Gaia Data Release 2

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Contents

Chapter 1

Datamodel description

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1.1 Main tables

1.1.1 GAIA_SOURCE

This table has an entry for every Gaia observed source as listed in the Main Database accumulating catalogue version from which the catalogue release has been generated. It contains the basic source parameters, that is only final data (no epoch data) and no spectra (neither final nor epoch).

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

DESIGNATION : Unique source designation (unique across all Data Releases) (string)

A source designation, unique across all Gaia Data Releases, that is constructed from the prefix “Gaia DRx ” followed by a string of digits corresponding to source_id (3 space–separated words in total). Note that the integer source identifier source_id is **not** guaranteed to be unique across Data Releases; moreover it is not guaranteed that the same astronomical source will always have the same source_id in different Data Releases. Hence the only safe way to compare source records between different Data Releases in general is to check the records of proximal source(s) in the same small part of the sky.

SOURCE_ID : Unique source identifier (unique within a particular Data Release) (long)

A unique numerical identifier of the source, encoding the approximate position of the source (roughly to the nearest arcmin), the provenance (data processing centre where it was created), a running number, and a component number.

The approximate equatorial (ICRS) position is encoded using the nested HEALPix scheme at level 12 (Nside = 4096), which divides the sky into $\simeq$ 200 million pixels of about 0.7 arcmin^2.

The source ID consists of a 64-bit integer, least significant bit = 1 and most significant bit = 64, comprising:

- a HEALPix index number (sky pixel) in bits 36 - 63; by definition the smallest HEALPix index number is zero.
- a 3-bit Data Processing Centre code in bits 33 - 35; for example `MOD(source_id / 4294967296, 8)` can be used to distinguish between sources initialised via the Initial Gaia Source List by the Torino DPC (code = 0) and sources otherwise detected and assigned by Gaia observations (code > 0)
- a 25-bit plus 7 bit sequence number within the HEALPix pixel in bits 1 - 32 split into:
  - a 25 bit running number in bits 8 - 32; the running numbers are defined to be positive, i.e. never zero
  - a 7-bit component number in bits 1 - 7

This means that the HEALpix index level 12 of a given source is contained in the most significant bits. HEALpix index of 12 and lower levels can thus be retrieved as follows:

- HEALpix level 12 = source_id / 34359738368
- HEALpix level 11 = source_id / 137438953472
- HEALpix level 10 = source_id / 549755813888
- HEALpix level n = source_id / $2^{35} \times 4^{(12-\text{level})}$

Additional details can be found in the Gaia DPAC public document *Source Identifiers — Assignment and Usage throughout DPAC* (document code GAIA–C3–TN–ARI–BAS–020) available from `https://www.cosmos.esa.int/web/gaia/public-dpac-documents`

RANDOM_INDEX : Random index used to select subsets (long)

Random index which can be used to select smaller subsets of the data that are still representative. The column contains a random permutation of the numbers from 0 to N-1, where N is the number of rows.

The random index can be useful for validation (testing on 10 different random subsets), visualization (displaying 1% of the data), and statistical exploration of the data, without the need to download all the data.

REF_EPOCH : Reference epoch (double, Time[Julian Years])

Reference epoch to which the astrometric source parameters are referred, expressed as a Julian Year in TCB.

At DR2 this reference epoch is always J2015.5 but in future releases this will be different and not necessarily the same for all sources.

RA : Right ascension (double, Angle[deg])

Barycentric right ascension α of the source in ICRS at the reference epoch `ref_epoch`

RA_ERROR : Standard error of right ascension (double, Angle[mas])

Standard error $\sigma_{\alpha*} \equiv \sigma_\alpha \cos\delta$ of the right ascension of the source in ICRS at the reference epoch `ref_epoch`.

DEC : Declination (double, Angle[deg])

Barycentric declination δ of the source in ICRS at the reference epoch `ref_epoch`

DEC_ERROR : Standard error of declination (double, Angle[mas])

Standard error σ_δ of the declination of the source in ICRS at the reference epoch `ref_epoch`

PARALLAX : Parallax (double, Angle[mas])

Absolute stellar parallax ϖ of the source at the reference epoch `ref_epoch`

PARALLAX_ERROR : Standard error of parallax (double, Angle[mas])

Standard error σ_ϖ of the stellar parallax at the reference epoch `ref_epoch`

PARALLAX_OVER_ERROR : Parallax divided by its error (float)

Parallax divided by its standard error

PMRA : Proper motion in right ascension direction (double, Angular Velocity[mas/year])

Proper motion in right ascension $\mu_{\alpha*} \equiv \mu_\alpha \cos\delta$ of the source in ICRS at the reference epoch `ref_epoch`. This is the tangent plane projection of the proper motion vector in the direction of increasing right ascension.

PMRA_ERROR : Standard error of proper motion in right ascension direction (double, Angular Velocity[mas/year])

Standard error $\sigma_{\mu\alpha*}$ of the proper motion component in right ascension at the reference epoch `ref_epoch`

PMDEC : Proper motion in declination direction (double, Angular Velocity[mas/year])

Proper motion in declination μ_δ of the source at the reference epoch `ref_epoch`. This is the tangent plane projection of the proper motion vector in the direction of increasing declination.

PMDEC_ERROR : Standard error of proper motion in declination direction (double, Angular Velocity[mas/year])

Standard error $\sigma_{\mu\delta}$ of the proper motion component in declination at the reference epoch `ref_epoch`

RA_DEC_CORR : Correlation between right ascension and declination (float, Dimensionless[see description])

Correlation coefficient $\rho(\alpha, \delta)$ between right ascension and declination, a dimensionless quantity in the range [-1,+1]

RA_PARALLAX_CORR : Correlation between right ascension and parallax (float, Dimensionless[see description])

Correlation coefficient $\rho(\alpha, \varpi)$ between right ascension and parallax, a dimensionless quantity in the range [-1,+1]

RA_PMRA_CORR : Correlation between right ascension and proper motion in right ascension (float, Dimensionless[see description])

Correlation coefficient $\rho(\alpha, \mu_{\alpha*})$ between right ascension and proper motion in right ascension, a dimensionless quantity in the range [-1,+1]

RA_PMDEC_CORR : Correlation between right ascension and proper motion in declination (float, Dimensionless[see description])

Correlation coefficient $\rho(\alpha, \mu_\delta)$ between right ascension and proper motion in declination, a dimensionless quantity in the range [-1,+1]

DEC_PARALLAX_CORR : Correlation between declination and parallax (float, Dimensionless[see description])

Correlation coefficient $\rho(\delta, \varpi)$ between declination and parallax, a dimensionless quantity in the range [-1,+1]

DEC_PMRA_CORR : Correlation between declination and proper motion in right ascension (float, Dimensionless[see description])

Correlation coefficient $\rho(\delta, \mu_{\alpha*})$ between declination and proper motion in right ascension, a dimensionless quantity in the range [-1,+1]

DEC_PMDEC_CORR : Correlation between declination and proper motion in declination (float, Dimensionless[see description])

Correlation coefficient $\rho(\delta, \mu_\delta)$ between declination and proper motion in declination, a dimensionless quantity in the range [-1,+1]

PARALLAX_PMRA_CORR : Correlation between parallax and proper motion in right ascension (float, Dimensionless[see description])

Correlation coefficient $\rho(\varpi, \mu_{\alpha*})$ between parallax and proper motion in right ascension, a dimensionless quantity in the range [-1,+1]

PARALLAX_PMDEC_CORR : Correlation between parallax and proper motion in declination (float, Dimensionless[see description])

Correlation coefficient $\rho(\varpi, \mu_\delta)$ between parallax and proper motion in declination, a dimensionless quantity in the range [-1,+1]

PMRA_PMDEC_CORR : Correlation between proper motion in right ascension and proper motion in declination (float, Dimensionless[see description])

Correlation coefficient $\rho(\mu_{\alpha*}, \mu_\delta)$ between proper motion in right ascension and proper motion in declination, a dimensionless quantity in the range [-1,+1]

ASTROMETRIC_N_OBS_AL : Total number of observations AL (int)

Total number of AL observations (= CCD transits) used in the astrometric solution of the source, independent of their weight. Note that some observations may be strongly downweighted (see `astrometric_n_bad_obs_al`).

ASTROMETRIC_N_OBS_AC : Total number of observations AC (int)

Total number of AC observations (= CCD transits) used in the astrometric solution of the source, independent of their weight. Note that some observations may be strongly downweighted (see `astrometric_n_bad_obs_ac`). Nearly all sources having G < 13 will have AC observations from 2d windows, while fainter than that limit only ~ 1% of transit observations (the so–called 'calibration faint stars') are assigned 2d windows resulting in AC observations.

ASTROMETRIC_N_GOOD_OBS_AL : Number of good observations AL (int)

Number of AL observations (= CCD transits) that were not strongly downweighted in the astrometric solution of the source. Strongly downweighted observations (with downweighting factor $w < 0.2$) are instead counted in `astrometric_n_bad_obs_al`. The sum of `astrometric_n_good_obs_al` and `astrometric_n_bad_obs_al` equals astrometric_n_obs_al, the total number of AL observations used in the astrometric solution of the source.

ASTROMETRIC_N_BAD_OBS_AL : Number of bad observations AL (int)

Number of AL observations (= CCD transits) that were strongly downweighted in the astrometric solution of the source, and therefore contributed little to the determination of the astrometric parameters. An observation is considered to be strongly downweighted if its downweighting factor $w < 0.2$, which means that the absolute value of the astrometric residual exceeds 4.83 times the total uncertainty of the observation, calculated as the quadratic sum of the centroiding uncertainty, excess source noise, and excess attitude noise.

ASTROMETRIC_GOF_AL : Goodness of fit statistic of model wrt along-scan observations (float)

Goodness-of-fit statistic of the astrometric solution for the source in the along-scan direction. This is the 'gaussianized chi-square', which for good fits should approximately follow a normal distribution with zero mean value and unit standard deviation. Values exceeding, say, +3 thus indicate a bad fit to the data.

This statistic is computed according to the formula

$\text{astrometric\_gof\_al} = (9\nu/2)^{1/2}[(\chi^2/\nu)^{1/3} + 2/(9\nu) - 1]$

where χ^2 = astrometric_chi2_al is the AL chi-square statistic and

ν = astrometric_n_good_obs_al $- N$

is the number of degrees of freedom for a source update. Here $N = 5$ is the number of astrometric parameters. Note that only 'good' (i.e. not strongly downweighted) observations are included in χ^2 and ν.

The above formula is the well-known cube-root transformation of the chi-square variable (E.B. Wilson & M.M. Hilferty 1931, Proc. National Academy of Science, 17, 684). It is usually quoted to be valid for $\nu > 30$, but is in fact useful for much smaller ν. This transformation of (χ^2, ν) eliminates the inconvenience of having the distribution (and hence the significance levels) depend on the additional variable ν, which is generally not the same for different sources.

An alternative indicator of bad fits is the astrometric_excess_noise. In AGIS the source update deals with bad fits by adding astrometric_excess_noise to the formal observation noise. This reduces the weight of the observations and inflates the covariance of the estimated astrometric parameters correspondingly. However, the chi-square values used to calculate astrometric_gof_al do not take into account the astrometric_excess_noise, and astrometric_gof_al can therefore always be used as a goodness-of-fit indicator of the source solution in AGIS.

ASTROMETRIC_CHI2_AL : AL chi-square value (float)

Astrometric goodness-of-fit (χ^2) in the AL direction.

χ^2 values were computed for the 'good' AL observations of the source, without taking into account the astrometric_excess_noise (if any) of the source. They do however take into account the attitude excess noise (if any) of each observation.

ASTROMETRIC_EXCESS_NOISE : Excess noise of the source (double, Angle[mas])

This is the excess noise ϵ_i of the source. It measures the disagreement, expressed as an angle, between the observations of a source and the best-fitting standard astrometric model (using five astrometric parameters). The assumed observational noise in each observation is quadratically increased by ϵ_i in order to statistically match the residuals in the astrometric solution. A value of 0 signifies that the source is astrometrically well-behaved, i.e. that the residuals of the fit statistically agree with the assumed observational noise. A positive value signifies that the residuals are statistically larger than expected.

The significance of ϵ_i is given by `astrometric_excess_noise_sig` (D). If $D \leq 2$ then ϵ_i is probably not significant, and the source may be astrometrically well-behaved even if ϵ_i is large.

The excess noise ϵ_i may absorb all kinds of modelling errors that are not accounted for by the observational noise (image centroiding error) or the excess attitude noise. Such modelling errors include LSF and PSF calibration errors, geometric instrument calibration errors, and part of the high-frequency attitude noise. These modelling errors are particularly important in the early data releases, but should decrease as the astrometric modelling of the instrument and attitude improves over the years.

Additionally, sources that deviate from the standard five-parameter astrometric model (e.g. unresolved binaries, exoplanet systems, etc.) may have positive ϵ_i. Given the many other possible contributions to the excess noise, the user must study the empirical distributions of ϵ_i and D to make sensible cutoffs before filtering out sources for their particular application.

The excess source noise is further explained in Sects. 3.6 and 5.1.2 of **?**.

ASTROMETRIC_EXCESS_NOISE_SIG : Significance of excess noise (double)

A dimensionless measure (D) of the significance of the calculated `astrometric_excess_noise` (ϵ_i). A value $D > 2$ indicates that the given ϵ_i is probably significant.

For good fits in the limit of a large number of observations, D should be zero in half of the cases and approximately follow the positive half of a normal distribution with zero mean and unit standard deviation for the other half. Consequently, D is expected to be greater than 2 for only a few percent of the sources with well-behaved astrometric solutions.

In the early data releases ϵ_i will however include instrument and attitude modelling errors that are statistically significant and could result in large values of ϵ_i and D. The user must study the empirical distributions of these statistics and make sensible cutoffs before filtering out sources for their particular application.

The excess noise significance is further explained in Sect. 5.1.2 of **?**.

ASTROMETRIC_PARAMS_SOLVED : Which parameters have been solved for? (byte)

This is a binary code indicating which astrometric parameters were estimated for the source. A set bit means the parameter was estimated. The least-significant bit represents α, the next bits δ, ϖ, $\mu_{\alpha*}$, and μ_δ. For Gaia DR2 the only relevant values are

- `astrometric_params_solved` = 31 (binary 11111): all five astrometric parameters were estimated
- `astrometric_params_solved` = 3 (binary 11): only position (α, δ) was estimated

ASTROMETRIC_PRIMARY_FLAG : Primary or seconday (boolean)

Flag indicating if this source was used as a primary source (`true`) or secondary source (`false`). Only primary sources contribute to the estimation of attitude, calibration, and global parameters. The estimation of source parameters is otherwise done in exactly the same way for primary and secondary sources.

ASTROMETRIC_WEIGHT_AL : Mean astrometric weight of the source (float, Angle[mas^{-2}])

Mean astrometric weight of the source in the AL direction.

The mean astrometric weight of the source is calculated as per Eq. (119) in **?**.

ASTROMETRIC_PSEUDO_COLOUR : Astrometrically determined pseudocolour of the source (double, Misc[μm^{-1}])

Colour of the source assumed in the final astrometric processing.

The `astrometric_pseudo_colour` is defined to be equivalent to the effective wavenumber of the photon flux distribution in the astrometric (G) band, and is measured in μm^{-1}. The value given in this field was astrometrically determined in a preliminary solution, using the chromatic displacement of image centroids calibrated by means of the effective wavenumbers (ν_{eff}) of primary sources calculated from BP and RP magnitudes. The field is empty when no such determination was possible, in which case a default value of 1.6 μm^{-1} was assumed.

ASTROMETRIC_PSEUDO_COLOUR_ERROR : Standard error of the pseudocolour of the source (double, Misc[μm^{-1}])

Standard error $\sigma_{pseudocolour}$ of the astrometrically determined pseudocolour of the source.

MEAN_VARPI_FACTOR_AL : Mean Parallax factor AL (float)

Mean parallax factor in the AL direction, computed from all the good observations of the source processed in the astrometry.

The AL parallax factor for an individual observation is defined as $\partial\eta/\partial\varpi$, where η is the AL field angle of the source and ϖ its parallax, and is constrained to $[-0.73, +0.73]$ by the scanning law. The value given in this field is typically in the range $[-0.23, +0.32]$ (1st and 99th percentiles). A value outside this range indicates a distribution of observations that is unfavourable for the determination of the parallax, and the calculated parallax could then be more vulnerable to errors, e.g. from the calibration model, not reflected in the formal uncertainties. See **?** for a discussion of other astrometric quality indicators.

ASTROMETRIC_MATCHED_OBSERVATIONS : Matched FOV transits used in the AGIS solution (short)

The number of FOV transits matched to this source, counting only the transits containing CCD observations actually used to compute the astrometric solution.

This number will always be equal to or smaller than the matched_observations, the difference being the FOV transits that were not used in the astrometric solution because of bad data or excluded time intervals.

VISIBILITY_PERIODS_USED : Number of visibility periods used in Astrometric solution (short)

Number of visibility periods used in the astrometric solution.

A visibility period is a group of observations separated from other groups by a gap of at least 4 days. A source may have from one to tens of FOV transits in a visibility period, but with a small spread in time, direction of scanning, and parallax factor. From one visibility period to the next these variables have usually changed significantly. A high number of visibility periods is therefore a better indicator of an astrometrically well-observed source than a large number of FOV transits (`matched_observations` or `astrometric_matched_observations`) or CCD transits (`astrometric_n_obs_al`). A small value (e.g. less than 10) indicates that the calculated parallax could be more vulnerable to errors, e.g. from the calibration model, not reflected in the formal uncertainties. See **?** for a discussion of this and other astrometric quality indicators.

ASTROMETRIC_SIGMA5D_MAX : The longest semi-major axis of the 5-d error ellipsoid (float, Angle[mas])

The longest principal axis in the 5-dimensional error ellipsoid.

This is a 5-dimensional equivalent to the semi-major axis of the position error ellipse and is therefore useful for filtering out cases where one of the five parameters, or some linear combination of several parameters, is particularly ill-determined. It is measured in mas and computed as the square root of the largest singular value of the scaled 5×5 covariance matrix of the astrometric parameters. The matrix is scaled so as to put the five parameters on a comparable scale, taking into account the maximum along-scan parallax factor for the parallax and the time coverage of the observations for the proper motion components. If C is the unscaled covariance matrix, the scaled matrix is SCS, where $S = \text{diag}(1, 1, \sin\xi, T/2, T/2)$, $\xi = 45^\circ$ is the solar aspect angle in the nominal scanning law, and T the time coverage of the data used in the solution. $T = 1.75115$ yr for Gaia DR2.

`astrometric_sigma5d_max` is given for both 5-parameter and 2-parameter solutions, as its size is one of the criteria for accepting or rejecting the 5-parameter solution. In case of a 2-parameter solution (`astrometric_params_solved` = 3) it gives the value for the rejected 5-parameter solution, and can then be arbitrarily large.

FRAME_ROTATOR_OBJECT_TYPE : The type of the source mainly used for frame rotation (int)

This field is non-zero if the source was used to define the reference frame of the positions and proper motions.

The values used are:

0: An ordinary source not used for the reference frame determination

2: The optical counterpart of an extragalactic radio source with accurately known VLBI position in ICRF. This is used to determine the orientation of the reference frame at the reference epoch, but also contributes to the determination of a non-rotating frame.

3: An extragalactic source (AGN or quasar) that was used to determine a kinematically non-rotating celestial frame.

MATCHED_OBSERVATIONS : Amount of observations matched to this source (short)

The total number of FOV transits matched to this source.

DUPLICATED_SOURCE : Source with duplicate sources (boolean)

During data processing, this source happened to be duplicated and only one source identifier has been kept. Observations assigned to the discarded source identifier(s) were not used. This may indicate observational, cross-matching or processing problems, or stellar multiplicity, and probable astrometric or photometric problems in all cases. In Gaia DR1 and DR2, for close doubles with separations below some 2 arcsec, truncated windows have not been processed, neither in astrometry nor photometry. The transmitted window is centred on the brighter part of the acquired window, so the brighter component has a better chance to be selected, even when processing the fainter transit. If more than two images are contained in a window, the result of the image parameter determination is unpredictable in the sense that it might refer to either (or neither) image, and no consistency is assured.

PHOT_G_N_OBS : Number of observations contributing to G photometry (int)

Number of observations (CCD transits) that contributed to the G mean flux and mean flux error.

PHOT_G_MEAN_FLUX : G-band mean flux (double, Flux[e-/s])

Mean flux in the G-band.

PHOT_G_MEAN_FLUX_ERROR : Error on G-band mean flux (double, Flux[e-/s])

Standard deviation of the G-band fluxes divided by sqrt(phot_g_n_obs)

PHOT_G_MEAN_FLUX_OVER_ERROR : G-band mean flux divided by its error (float)

Mean flux in the G-band divided by its error.

PHOT_G_MEAN_MAG : G-band mean magnitude (float, Magnitude[mag])

Mean magnitude in the G band. This is computed from the G-band mean flux applying the magnitude zero-point in the Vega scale.

No error is provided for this quantity as the error distribution is only symmetric in flux space. This converts to an asymmetric error distribution in magnitude space which cannot be represented by a single error value.

PHOT_BP_N_OBS : Number of observations contributing to BP photometry (int)

Number of observations (CCD transits) that contributed to the integrated BP mean flux and mean flux error.

PHOT_BP_MEAN_FLUX : Integrated BP mean flux (double, Flux[e-/s])

Mean flux in the integrated BP band.

PHOT_BP_MEAN_FLUX_ERROR : Error on the integrated BP mean flux (double, Flux[e-/s])

Error on the mean flux in the integrated BP band (errors are computed from the dispersion about the weighted mean of input calibrated photometry).

PHOT_BP_MEAN_FLUX_OVER_ERROR : Integrated BP mean flux divided by its error (float)

Integrated BP mean flux divided by its error.

PHOT_BP_MEAN_MAG : Integrated BP mean magnitude (float, Magnitude[mag])

Mean magnitude in the integrated BP band. This is computed from the BP-band mean flux applying the magnitude zero-point in the Vega scale.

No error is provided for this quantity as the error distribution is only symmetric in flux space. This converts to an asymmetric error distribution in magnitude space which cannot be represented by a single error value.

PHOT_RP_N_OBS : Number of observations contributing to RP photometry (int)

Number of observations (CCD transits) that contributed to the integrated RP mean flux and mean flux error.

PHOT_RP_MEAN_FLUX : Integrated RP mean flux (double, Flux[e-/s])

Mean flux in the integrated RP band.

PHOT_RP_MEAN_FLUX_ERROR : Error on the integrated RP mean flux (double, Flux[e-/s])

Error on the mean flux in the integrated RP band (errors are computed from the dispersion about the weighted mean of input calibrated photometry).

PHOT_RP_MEAN_FLUX_OVER_ERROR : Integrated RP mean flux divided by its error (float)

Integrated RP mean flux divided by its error.

PHOT_RP_MEAN_MAG : Integrated RP mean magnitude (float, Magnitude[mag])

Mean magnitude in the integrated RP band. This is computed from the RP-band mean flux applying the magnitude zero-point in the Vega scale.

No error is provided for this quantity as the error distribution is only symmetric in flux space. This converts to an asymmetric error distribution in magnitude space which cannot be represented by a single error value.

PHOT_BP_RP_EXCESS_FACTOR : BP/RP excess factor (float)

BP/RP excess factor estimated from the comparison of the sum of integrated BP and RP fluxes with respect to the flux in the G band. This measures the excess of flux in the BP and RP integrated photometry with respect to the G band. This excess is believed to be caused by background and contamination issues affecting the BP and RP data.

Therefore a large value of this factor for a given source indicates systematic errors in the BP and RP photometry.

For more details see **?**.

PHOT_PROC_MODE : Photometry processing mode (byte)

This flag indicates different calibration procedures in place. The following possible values are defined for Gaia DR2:

- 0: this corresponds to the procedure applied for the generation of the "gold" photometric dataset. Sources in this dataset have been used to establish the internal photometric system and to compute all calibrations.
- 1: this corresponds to the procedure applied for the generation of the "silver" photometric dataset. Sources in this dataset have no reference photometry. The processing of these sources is an iterative process, where calibrations computed using the "gold" dataset are applied initially to raw fluxes and at each iteration a new set of reference photometry is obtained from the accumulation of all calibrated epoch photometry.
- 2: this corresponds to the procedure applied for the generation of the "bronze" photometric dataset. Sources in this dataset lack complete colour information in the Gaia data. A default colour is therefore used to apply the calibrations computed using the "gold" dataset. For Gaia DR2 it is expected that all sources that were calibrated using a default colour will have only G band photometry available (no integrated BP or RP).

More details about the different calibration procedures are available in Chapter **??** of the Gaia DR2 on-line documentation and in **?**.

BP_RP : BP - RP colour (float, Magnitude[mag])

BP - RP colour: phot_bp_mean_mag - phot_rp_mean_mag

BP_G : BP - G colour (float, Magnitude[mag])

BP - G colour: phot_bp_mean_mag - phot_g_mean_mag

G_RP : G - RP colour (float, Magnitude[mag])

G - RP colour: phot_g_mean_mag - phot_rp_mean_mag

RADIAL_VELOCITY : Radial velocity (double, Velocity[km/s])

Spectroscopic radial velocity in the solar barycentric reference frame.

The radial velocity provided is the median value of the radial velocity measurements at all epochs.

RADIAL_VELOCITY_ERROR : Radial velocity error (double, Velocity[km/s])

The `radial_velocity_error` is the error on the median to which a constant noise floor of 0.11 km/s has been added in quadrature to take into account the calibration contribution.

In detail, `radial_velocity_error` = $\sqrt{\sigma^2_{V_{\rm rad}} + 0.11^2}$ where $\sigma_{V_{\rm rad}}$ is the error on the median:

$$\sigma_{V_{\rm rad}} = \sqrt{\frac{\pi}{2}} . \frac{\sigma(V^{\rm t}_{\rm rad})}{\sqrt{rv\_nb\_transits}}$$

where $\sigma(V^{\rm t}_{\rm rad})$ is the standard deviation of the epoch radial velocities and `rv_nb_transits` the number of transits for which a $V^{\rm t}_{\rm rad}$ has been obtained.

RV_NB_TRANSITS : Number of transits used to compute radial velocity (int)

number of transits (epochs) used to compute `radial_velocity`

RV_TEMPLATE_TEFF : Teff of the template used to compute radial velocity (float, Temperature[K])

Effective temperature of the synthetic spectrum template used to determine `radial_velocity`. The purpose of this parameter is to provide information on the synthetic spectrum used to determine `radial_velocity`, and not to provide an estimation of the star Teff.

RV_TEMPLATE_LOGG : logg of the template used to compute radial velocity (float, GravitySurface[log cgs])

$\log g$ of the synthetic spectrum template used to determine `radial_velocity`. The purpose of this parameter is to provide information on the synthetic spectrum used to determine `radial_velocity`, and not to provide an estimation of the star log g.

RV_TEMPLATE_FE_H : Fe/H of the template used to compute radial velocity (float, Abundances[dex])

Fe/H of the synthetic spectrum template used to determine `radial_velocity`. The purpose of this parameter is to provide information on the synthetic spectrum used to determine `radial_velocity`, and not to provide an estimation of the star Fe/H.

PHOT_VARIABLE_FLAG : Photometric variability flag (string, Dimensionless[see description])

Flag indicating if variability was identified in the photometric data:

- ”NOT_AVAILABLE”: source not processed and/or exported to catalogue
- ”CONSTANT”: Source not identified as variable
- ”VARIABLE”: source identified and processed as variable, see `Vari*` tables.

Note that for this data release only a subset of (variable) sources was processed and/or exported, so for many (known) variable sources this flag is set to ”NOT AVAILABLE”. No ”CONSTANT” sources were exported either.

L : Galactic longitude (double, Angle[deg])

Galactic Longitude of the object at reference epoch `ref_epoch`, see Section **??** of the release documentation for conversion details.

B : Galactic latitude (double, Angle[deg])

Galactic Latitude of the object at reference epoch `ref_epoch`, see Section **??** of the release documentation for conversion details.

ECL_LON : Ecliptic longitude (double, Angle[deg])

Ecliptic Longitude of the object at reference epoch `ref_epoch`, obtained from the equatorial coordinates using the transformation defined in Section 1.5.3 of 'The Hipparcos and Tycho Catalogues', ESA SP-1200, Volume 1 (ESA, 1997).

ECL_LAT : Ecliptic latitude (double, Angle[deg])

Ecliptic Latitude of the object at reference epoch `ref_epoch`, obtained from the equatorial coordinates using the transformation defined in Section 1.5.3 of 'The Hipparcos and Tycho Catalogues', ESA SP-1200, Volume 1 (ESA, 1997).

PRIAM_FLAGS : flags for the Apsis-Priam results (long, Dimensionless[see description])

Flags describing the status of the astrophysical parameters Teff, A_G and E[BP-RP] (i.e. those determined by Apsis-Priam). They are described in Chapter **??** of the release documentation.

TEFF_VAL : stellar effective temperature (float, Temperature[K])

Estimate of Teff from Apsis-Priam

TEFF_PERCENTILE_LOWER : teff_val lower uncertainty (float, Temperature[K])

Uncertainty (lower) on Teff estimate from Apsis-Priam. This is the 16th percentile of the PDF over Teff.

TEFF_PERCENTILE_UPPER : teff_val upper uncertainty (float, Temperature[K])

Uncertainty (upper) on Teff estimate from Apsis-Priam. This is the 84th percentile of the PDF over Teff.

A_G_VAL : line-of-sight extinction in the G band, A_G (float, Magnitude[mag])

Estimate of extinction in the G band from Apsis-Priam

A_G_PERCENTILE_LOWER : a_g_val lower uncertainty (float, Magnitude[mag])

Uncertainty (lower) on A_G estimate from Apsis-Priam. This is the 16th percentile of the PDF over A_G.

A_G_PERCENTILE_UPPER : a_g_val upper uncertainty (float, Magnitude[mag])

Uncertainty (upper) on A_G estimate from Apsis-Priam. This is the 84th percentile of the PDF over A_G.

E_BP_MIN_RP_VAL : line-of-sight reddening E(BP-RP) (float, Magnitude[mag])

Estimate of redenning E[BP-RP] from Apsis-Priam.

E_BP_MIN_RP_PERCENTILE_LOWER : e_bp_min_rp_val lower uncertainty (float, Magnitude[mag])

Uncertainty (lower) on E[BP-RP] estimate from Apsis-Priam. This is the 16th percentile of the PDF over E[BP-RP].

E_BP_MIN_RP_PERCENTILE_UPPER : e_bp_min_rp_val upper uncertainty (float, Magnitude[mag])

Uncertainty (upper) on E[BP-RP] estimate from Apsis-Priam. This is the 84th percentile of the PDF over E[BP-RP].

FLAME_FLAGS : Flags for the Apsis-FLAME results (long, Dimensionless[see description])

Flags describing the status of the astrophysical parameters radius and luminosity (i.e. those determined by Apsis-FLAME). They are described in Chapter **??** of the release documentation.

RADIUS_VAL : stellar radius (float, Length & Distance[Solar Radius])

Estimate of radius from Apsis-FLAME

RADIUS_PERCENTILE_LOWER : radius_val lower uncertainty (float, Length & Distance[Solar Radius])

Uncertainty (lower) on radius estimate from Apsis-FLAME. This is the 16th percentile of the PDF over radius.

RADIUS_PERCENTILE_UPPER : radius_val upper uncertainty (float, Length & Distance[Solar Radius])

Uncertainty (upper) on radius estimate from Apsis-FLAME. This is the 84th percentile of the PDF over radius.

LUM_VAL : stellar luminosity (float, Luminosity[Solar Luminosity])

Esimate of luminosity from Apsis-FLAME

LUM_PERCENTILE_LOWER : lum_val lower uncertainty (float, Luminosity[Solar Luminosity])

Uncertainty (lower) on luminosity estimate from Apsis-FLAME. This is the 16th percentile of the PDF over luminosity.

LUM_PERCENTILE_UPPER : lum_val upper uncertainty (float, Luminosity[Solar Luminosity])

Uncertainty (upper) on luminosity estimate from Apsis-FLAME. This is the 84th percentile of the PDF over luminosity.

1.2 SSO tables

1.2.1 SSO_OBSERVATION

Solar System object observations. Each table line contained data obtained during the transit of the source on a single CCD, during a single transit. The corresponding epoch is provided. Data not varying within the transit are repeated identically for all single observations of that transit.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`). Note in particular that these identifiers are by convention negative for SSOs.

OBSERVATION_ID : Observation Identifier (long)

Identifier at single CCD level of the observation of a Solar System object. It is unique, and obtained from a combination of transit_id and an integer number representing the CCD strip.

NUMBER_MP : minor planet number attributed by MPC (long)

Minor Planet number attributed by MPC

EPOCH : Gaia-centric epoch TCB(Gaia) (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Gaia-centric epoch TCB(Gaia) in JD corresponding to the time of crossing of the fiducial line of the CCD. This is the epoch to which the target coordinates and the position/velocity of Gaia are referred. To avoid loss of precision the reference time J2010.0 has been subtracted.

EPOCH_ERR : Error in Gaiacentric epoch (double, Time[day])

The error in the Gaiacentric epoch (for both epoch and epoch_utc).

EPOCH_UTC : Gaiacentric epoch UTC (double, Time[Julian Date (day)])

Gaiacentric epoch in UTC in JD-2455197.5 corresponding to right ascension and declination.

RA : Right ascension of the source (double, Angle[deg])

ICRS Right Ascension of the source as observed by Gaia at `epoch`.

DEC : Declination of the source (double, Angle[deg])

ICRS Declination of the source as observed by Gaia at `epoch`

RA_ERROR_SYSTEMATIC : Standard error of right ascension - systematic (double, Angle[mas])

Uncertainty on right ascension, systhematic component, multiplied by cos of declination.

DEC_ERROR_SYSTEMATIC : Standard error of declination - systematic (double, Angle[mas])

Standard error for declination, systhematic component.

RA_DEC_CORRELATION_SYSTEMATIC : Correlation of ra and dec errors - systematic (double)

Correlation of Ra and Dec errors, systhematic component.

RA_ERROR_RANDOM : Standard error of right ascension - random (double, Angle[mas])

Uncertainty on right ascension, random component, multiplied by cos of declination.

DEC_ERROR_RANDOM : Standard error of declination - random (double, Angle[mas])

Standard error for declination, random component.

RA_DEC_CORRELATION_RANDOM : Correlation of ra and dec errors - random (double)

Correlation of Ra and Dec errors, random component.

G_MAG : Calibrated G mag (double, Magnitude[mag])

Corrected G magnitude based on refined signal analysis. Produced by the same photometric calibration performed for stars.

G_FLUX : Average calibrated G flux for the transit (double, Flux[e-/s])

Average calibrated G flux for the transit.

G_FLUX_ERROR : Error on the G flux (double, Flux[e-/s])

Error on the average transit-level G flux derived in the Photometric Pipeline from the individual CCD-level flux measurements of the single transit.

X_GAIA : Barycentric x position of Gaia (double, Length & Distance[AU])

Barycentric equatorial J2000 (ICRS) x position of Gaia at the epoch of observation.

Y_GAIA : Barycentric y position of Gaia (double, Length & Distance[AU])

Barycentric equatorial J2000 (ICRS) y position of Gaia at the epoch of observation.

Z_GAIA : Barycentric z position of Gaia (double, Length & Distance[AU])

Barycentric equatorial J2000 (ICRS) z position of Gaia at the epoch of observation.

VX_GAIA : Barycentric x velocity of Gaia (double, Velocity[au/d])

Barycentric equatorial J2000 (ICRS) x velocity of Gaia at the epoch of observation.

VY_GAIA : Barycentric y velocity of Gaia (double, Velocity[au/d])

Barycentric equatorial J2000 (ICRS) y velocity of Gaia at the epoch of observation.

VZ_GAIA : Barycentric z velocity of Gaia (double, Velocity[au/d])

Barycentric equatorial J2000 (ICRS) z velocity of Gaia at the epoch of observation.

POSITION_ANGLE_SCAN : Position angle of the scanning direction (double, Angle[deg])

Position angle of the scan direction at the epoch of observation in the equatorial reference frame. 0 = North direction, pi/2 = increasing right ascension, pi = South, 3pi/2 = decreasing right ascension. It is defined as the angle between the AL direction and the direction to the North Pole, at the SSO position, after applying the correction for aberration. As a consequence of this correction for aberration, the AC direction is no longer strictly perpendicular to the AL direction.

LEVEL_OF_CONFIDENCE : Level of confidence of the identification (short, Dimensionless[percentage/100])

Level of confidence in the identification of the given SSO source_id with this observation: 0 stands for completely unambiguous identification, 100 stands for failed identification.

1.2.2 SSO_SOURCE

This table contains data related to Solar System objects observed by Gaia. The quantities in the table are derived from data reduction and are associated to single objects.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`). Note in particular that these identifiers are by convention negative for SSOs.

NUM_OF_OBS : number of observations (int)

Number of CCD-level observations of the asteroid that appear in the sso_observation table.

NUMBER_MP : Minor Planet number (long)

Minor planet number atrributed by MPC

DENOMINATION : standard MPC denomination of the asteroid (string)

Name of the object in the MPC data base

1.3 Variability tables

1.3.1 VARI_CEPHEID

This table describes the Cepheid stars.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

PF : Period corresponding to the fundamental pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

pf: for single-mode pulsators classified as fundamental mode pulsators, this parameter is filled with the periodicity found in the time-series. For double-mode RR Lyrae this parameter is filled with the period corresponding to the longer periodicity. For double-mode DCEPs this parameter is filled with the period corresponding to the longer periodicity if the DCEP is classified as “F/1O” or “F/2O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the longer periodicity if the DCEP is classified as “F/1O/2O” This value is obtained by modelling the *G* band time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

PF_ERROR : Uncertainty of the pf period (double, Time[day])

pf_error: this parameter is filled with the uncertainty of the *pf* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *pf_error* parameter. The value refers to the analysis performed on the *G* band time series.

P1_O : Period corresponding to the first overtone pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

p1_o: for single-mode pulsators classified as first-overtone pulsators, this parameter is filled with the periodicity found in the time-series. For double-mode RR Lyrae this parameter is filled with the period corresponding to the shortest periodicity. For double-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “F/1O”; otherwise it is filled with the longest one if the classification is “1O/2O” or “1O/3O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the intermediate periodicity if the DCEP is classified as “F/1O/2O”; it is filled with the longest periodicity if the classification is “1O/2O/3O”. This value is obtained by modelling the *G* time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

P1_O_ERROR : Uncertainty of the p1_o period (double, Time[day])

p1_o_error: this parameter is filled with the uncertainty of the *p1_o* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *p1_o_error* parameter.

P2_O : Period corresponding to the second overtone pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

p2_o: For single-mode DCEPs classified as second-overtone pulsators, this parameter is filled with the periodicity found in the time-series. For double-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “1O/2O” of “F/2O”; otherwise it is filled with the longest periodicity if the classification is “2O/3O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “F/1O/2O”; it is filled with the intermediate periodicity if the classification is “1O/2O/3O”. This value is obtained by modelling the *G* time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

P2_O_ERROR : Uncertainty of the p2_o period (double, Time[day])

p2_o_error: this parameter is filled with the uncertainty of the *p2_o* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *p2_o_error* parameter. The value refers to the analysis performed on the *G* band time-series.

P3_O : Period corresponding to the third overtone pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

p3_o: for double-mode DCEPs this parameter is filled with the periodicity found in the time-series corresponding to the shortest periodicity if the DCEP is classified as “1O/3O” of “2O/3O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “1O/2O/3O”. This value is obtained by modelling the *G* time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

The parameter is NULL for RR Lyrae.

P3_O_ERROR : Uncertainty of the p3_o period (double, Time[day])

this parameter is filled with the uncertainty value of the *p3_o* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *p3_o_error* parameter. The value refers to the analysis performed on the G band time-series.

The parameter is NULL for RR Lyrae.

EPOCH_G : Epoch of the maximum of the light curve in the G band (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Epoch of maximum light for the Gaia G band light curve. It corresponds to the Baricentric Julian day (BJD) of the maximum value of the light curve model which is closest to the BJD of the first observations -3 times the period of the source (first periodicity depending on the pulsation mode).

The mentioned BJD is offset by JD 2455197.5 (= J2010.0).

EPOCH_G_ERROR : Uncertainty on the epoch parameter epoch_g (double, Time[day])

Value of the uncertainty of the `epoch_g` parameter. It corresponds to three times the error on the period of the source (first periodicity depending on the pulsation mode).

EPOCH_BP : Epoch of the maximum of the light curve in the BP band (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Epoch of maximum light for the Gaia integrated G_{BP} band light curve. It corresponds to the Baricentric Julian day (BJD) of the maximum value of the light curve model which is closest to the BJD of the first observations -3 times the period of the source (first periodicity depending on the pulsation mode).

The mentioned BJD is offset by JD 2455197.5 (= J2010.0).

EPOCH_BP_ERROR : Uncertainty on the epoch parameter epoch_bp (double, Time[day])

Value of the uncertainty of the *epoch_bp* parameter. It corresponds to three times the error on the period of the source (first periodicity depending on the pulsation mode)

EPOCH_RP : Epoch of the maximum of the light curve in the RP band (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Epoch of maximum light for the Gaia integrated G_{RP} band light curve. It corresponds to the Baricentric Julian day (BJD) of the maximum value of the light curve model which is closest to the BJD of the first observations -3 times the period of the source (first periodicity depending on the pulsation mode).

The mentioned BJD is offset by JD 2455197.5 (= J2010.0).

EPOCH_RP_ERROR : Uncertainty on the epoch parameter epoch_rp (double, Time[day])

Value of the uncertainty of the *epoch_rp* parameter. It corresponds to three times the error on the period of the source (first periodicity depending on the pulsation mode)

INT_AVERAGE_G : Intensity-averaged magnitude in the G band (double, Magnitude[mag])

Value of the intensity-averaged magnitude in the *G*-band. The intensity-averaged magnitude is obtained by computing the average flux and then converting the average flux to magnitude.

INT_AVERAGE_G_ERROR : Uncertainty on int_average_g parameter (double, Magnitude[mag])

This parameter is filled with the uncertainty of the `int_average_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `int_average_g` is computed. The mean of all the magnitudes found and its standard deviation are then computed, and the latter value is kept to fill the `int_average_g_error` parameter.

INT_AVERAGE_BP : intensity-averaged magnitude in the BP band (double, Magnitude[mag])

Value of the intensity-averaged magnitude in the BP-band. The intensity-averaged magnitude is obtained by computing the average flux and then converting the average flux to magnitude.

INT_AVERAGE_BP_ERROR : Uncertainty on int_average_bp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty of the *int_average_bp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `int_average_bp` is computed. The mean of all the magnitudes found and its standard deviation are then computed, and the latter value is kept to fill the `int_average_bpError` parameter.

INT_AVERAGE_RP : intensity-averaged magnitude in the RP band (double, Magnitude[mag])

Value of the intensity-averaged magnitude in the RP-band. The intensity-averaged magnitude is obtained by computing the average flux and then converting the average flux to magnitude.

INT_AVERAGE_RP_ERROR : Uncertainty on int_average_rp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty of the *int_average_rp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `int_average_rp` is computed. The mean of all the magnitudes found and its standard deviation are then computed, and the latter value is kept to fill the `int_average_rp_error` parameter.

PEAK_TO_PEAK_G : Peak-to-peak amplitude of the G band light curve (double, Magnitude[mag])

This parameter is filled with the peak-to-peak amplitude value of the *G* band light curve. The peak-to-peak amplitude is calculated as the (maximum) - (minimum) of the modelled folded light curve in the *G* band. The light curve of the target star is modelled with a truncated Fourier series ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)]$). Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, for the *G*-band light curve are determined using the Levenberg-Marquardt non linear fitting algorithm.

PEAK_TO_PEAK_G_ERROR : Uncertainty on the peak_to_peak_g parameter (double, Magnitude[mag])

This parameter is filled with the uncertainty value of the `peak_to_peak_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `peak_to_peak_g` is computed. The mean of all the amplitudes found and its standard deviation are then computed, and the latter value is kept to fill the `peak_to_peak_gError` parameter.

PEAK_TO_PEAK_BP : Peak-to-peak amplitude of the BP band light curve (double, Magnitude[mag])

this parameter is filled with the peak-to-peak amplitude value of the *BP* light curve. The peak-to-peak amplitude is calculated as the (maximum) - (minimum) of the modelled folded light curve in the *BP* band. The light curve of the target star is modelled with a truncated Fourier series ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)]$). Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, for the *BP*-band light curve are determined using the Levenberg-Marquardt non linear fitting algorithm.

PEAK_TO_PEAK_BP_ERROR : Uncertainty on the peak_to_peak_bp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty value of the *peak_to_peak_bp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `peak_to_peak_bp` is computed. The mean of all the amplitudes found and its standard deviation are then computed, and the latter value is kept to fill the `peak_to_peak_bpError` parameter.

PEAK_TO_PEAK_RP : Peak-to-peak amplitude of the RP band light curve (double, Magnitude[mag])

this parameter is filled with the peak-to-peak amplitude value. The peak-to-peak amplitude is calculated as the (maximum) - (minimum) of the modelled folded light curve in the *RP* band. The light curve of the target star is modelled with a truncated Fourier series ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)]$). Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, for the *RP*-band light curve are determined using the Levenberg-Marquardt non linear fitting algorithm.

PEAK_TO_PEAK_RP_ERROR : Uncertainty on the peak_to_peak_rp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty value of the *peak_to_peak_rp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `peak_to_peak_rp` is computed. The mean of all the amplitudes found and its standard deviation are then computed, and the latter value is kept to fill the `peak_to_peak_rp_error` parameter.

METALLICITY : Metallicity of the star from the Fourier parameters of the light curve (double, Abundances[dex]) metallicity: this parameter is filled with the [Fe/H] metallicity derived for the source from the Fourier parameters of the G-band light curve.

METALLICITY_ERROR : Uncertainty of the metallicity parameter (double, Abundances[dex])

metallicity_error: this parameter is filled with the uncertainty of the *metallicity* derived from the Fourier parameters of the G-band light curve.

R21_G : Fourier decomposition parameter r21_g: A2/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the Fourier decomposition parameter $R_{21} = A_2/A_1$, where A_2 is the amplitude of the 2nd harmonic and A_1 is the amplitude of the fundamental harmonic of the truncated Fourier series defined as ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max}t_j + \phi_i)]$) used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

R21_G_ERROR : Uncertainty on the r21_g parameter: A2/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the uncertainty value on the `r21_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `r21_g` is computed. The mean of all the r21_g values found and its standard deviation are then computed, and the latter value is kept to fill the `r21_gError` parameter.

R31_G : Fourier decomposition parameter r31_g: A3/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the Fourier decomposition parameter $R_{21} = A_3/A_1$, where A_3 is the amplitude of the 3rd harmonic and A_1 is the amplitude of the fundamental harmonic of the truncated Fourier series defined as ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max}t_j + \phi_i)]$) used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

R31_G_ERROR : Uncertainty on the r31_g parameter: A3/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the uncertainty value of the *r31_g* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `r31_g` is computed. The mean of all the r31_g values found and its standard deviation are then computed, and the latter value is kept to fill the `r31_g_error` parameter.

PHI21_G : Fourier decomposition parameter phi21_g: phi2 - 2*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the Fourier decomposition parameter ϕ_{21}: $\phi_2 - 2\phi_1$ value, where ϕ_2 is the phase of the 2nd harmonic and ϕ_1 is the phase of the fundamental harmonic of the truncated Fourier series defined as

($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)]$) used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

PHI21_G_ERROR : Uncertainty on the phi21_g parameter: phi2 - 2*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the uncertainty of the `phi21_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `phi21_g` is computed. The mean of all the phi21_g values is found and its standard deviation are then computed, and the latter value is kept to fill the `phi21_g_error` parameter.

PHI31_G : Fourier decomposition parameter phi31_g: phi3 - 3*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the Fourier decomposition parameter ϕ_{31}: $\phi_3 - 3\phi_1$ value, where ϕ_3 is the phase of the 3rd harmonic and ϕ_1 is the phase of the fundamental harmonic of the truncated Fourier series defined as ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)]$) used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

PHI31_G_ERROR : Uncertainty on the phi31_g parameter: phi3 - 3*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the uncertainty of the *phi31_g*: $\phi_3 - 3\phi_1$ parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `phi31_g` is computed. The mean of all the phi31_g values is found and its standard deviation are then computed, and the latter value is kept to fill the `phi31_g_error` parameter.

NUM_CLEAN_EPOCHS_G : Number of G FoV epochs used in the fitting algorithm (int, Dimensionless[see description])

this parameter is filled with the number of epochs that remain in the G band light curve after the SOS Cep & RRLyrae outlier removal process.

NUM_CLEAN_EPOCHS_BP : Number of BP epochs used in the fitting algorithm (int, Dimensionless[see description])

this parameter is filled with the number of epochs that remain in the BP band light curve after the SOS Cep&RRLyrae outlier removal process.

NUM_CLEAN_EPOCHS_RP : Number of RP epochs used in the fitting algorithm (int, Dimensionless[see description])

this parameter is filled with the number of epochs that remain in the RP band light curve after the SOS Cep&RRLyrae outlier removal process.

G_ABSORPTION : Interstellar absorption in the G-band (double, Magnitude[mag])

This parameter is filled with values coming from the estimate of the interstellar extinction toward the investigated pulsators. For RR Lyrae stars the period-colour-amplitude relation was used, whereas the parameter is not available for Cepheids in DR2.

G_ABSORPTION_ERROR : Error on the interstellar absorption in the G-band (double, Magnitude[mag])

Error on the interstellar absorption in the G-band (**g_absorption_error**): This parameter is filled with the r.m.s. errors of the relations used to estimate the interstellar absorption.

TYPE_BEST_CLASSIFICATION : Best type classification estimate out of: ”DCEP”, ”T2CEP”, ”ACEP” (string, Dimensionless[see description])

Classification of a Cepheid into ”DCEP”, ”T2CEP” or ”ACEP” using the period-luminosity relations, which are different for the three different types of Cepheids.

TYPE2_BEST_SUB_CLASSIFICATION : Best subclassification estimate for type_best_classification=”T2CEP” out of: ”BL_HER”, ”W_VIR”, ”RV_TAU” (string, Dimensionless[see description])

Sub-classification of a T2CEP Cepheids into BL Herculis (”BL_HER”), W Virginis (”W_VIR”) or RV Tauris (”RV_TAU”) sub-types depending on the source periodicity.

MODE_BEST_CLASSIFICATION : Best mode classification estimate out of: ”FUNDAMENTAL”, ”FIRST_OVERTONE”, ”SECOND_OVERTONE”, ”MULTI”,”UNDEFINED”, ”NOT_APPLICABLE” (string, Dimensionless[see description])

Best mode classification estimate:

- ”FUNDAMENTAL”: fundamental mode for `type_best_classification="DCEP"` or `"ACEP"`
- ”FIRST_OVERTONE”: first overtone for `type_best_classification="DCEP"` or `"ACEP"`
- ”SECOND_OVERTONE”: second overtone for `type_best_classification="DCEP"`
- ”MULTI”: multi-mode pulsators for `type_best_classification="DCEP"`
- ”UNDEFINED”: if mode could not be clearly determined for `type_best_classification="DCEP"` or `"ACEP"`
- ”NOT_APPLICABLE”: when `type_best_classification="T2CEP"`

The Cepheid pulsation mode is assigned using the period-luminosity and period-Wesenheit relations, which are different for the various pulsation modes as well as analysing the Fourier parameters vs period plots. The type “MULTI” is assigned to stars pulsating in two or more modes simultaneously.

MULTI_MODE_BEST_CLASSIFICATION : Best multi mode DCEP classification out of: ”F/1O”, ”F/2O”, ”1O/2O”, ”1O/3O”,”2O/3O”,”F/1O/2O”,”1O/2O/3O” (string, Dimensionless[see description])

Sub-classification of multi mode DCEP variables according to their position in the "Petersen diagram" (see e.g. Fig. 1 in Soszyński et al. 2015, AcA, 65, 329). F,1O,2O and 3O mean fundamental, first, second and third overtone, respectively.

1.3.2 VARI_CLASSIFIER_CLASS_DEFINITION

Table with detailed descriptions of published classes for each classifier described in `vari_classifier_definition` and used in table `vari_classifier_result`.

In DR2 this table contains the details of a classifier with `classifier_name`='nTransits:2+'.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

CLASSIFIER_NAME : Name of the classifier that is detailed in this entry (string, Dimensionless[see description])

Name of the classifier that is detailed in this entry.

CLASS_NAME : Name of the published class from this classifier (string, Dimensionless[see description])

Name of the published class from this classifier.

CLASS_DESCRIPTION : Description of the published class from this classifier (string, Dimensionless[see description])

Descriptions of the published class from this classifier.

1.3.3 VARI_CLASSIFIER_DEFINITION

Table with detailed descriptions of all classifiers used in table `vari_classifier_result`.
Details of the published classes for each classifier can be found in `vari_classifier_class_definition`.

In DR2 this table contains the details of a classifier with `classifier_name`='nTransits:2+'.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

CLASSIFIER_NAME : Name of the classifier that is detailed in this entry (string, Dimensionless[see description])

Name of the classifier that is detailed in this entry.

CLASSIFIER_DESCRIPTION : Description of this classifier (string, Dimensionless[see description])

Human readable description of the classifier.

1.3.4 VARI_CLASSIFIER_RESULT

Table with variability classification results of all classifiers, identified by the `classifier_name` column. In DR2 it contains a classifier with `classifier_name`=‘nTransits:2+’, description of which can be found in `vari_classifier_definition` and classes in `vari_classifier_class_definition`.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

CLASSIFIER_NAME : Classifier name used to produce this result, use for lookup in vari_classifier_definition table (string, Dimensionless[see description])

Classifier name used to produce this result, use for lookup in table `vari_classifier_definition` (only `classifier_name`=‘nTran
is available in DR2).

BEST_CLASS_NAME : Name of best class, see table vari_classifier_definition for details of the class (string, Dimensionless[see description])

Best class name with corresponding classification score in `best_class_score`. For the ‘nTransits:2+’ classifier in DR2, the following classes are published: ‘ACEP’, ‘ARRD’, ‘CEP’, ‘DSCT_SXPHE’, ‘MIRA_SR’, ‘RRAB’, ‘RRC’, ‘RRD’, and ‘T2CEP’. See `vari_classifier_definition` for a detailed description of this classifier and its published classes.

BEST_CLASS_SCORE : Score of the best class (double, Dimensionless[see description])

It describes a quantity between 0 and 1 which is related to the confidence of the classifier in the identification of the best class (`classBestName`) by a monotonically increasing function (depending on class).

1.3.5 VARI_LONG_PERIOD_VARIABLE

This table describes the Long Period Variable stars.

Some entries can be NaN when absent.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ABS_MAG_BOL : Absolute bolometric magnitude of the star (double, Magnitude[mag])

This parameter gives the absolute bolometric magnitude for the case of LPVs.

ABS_MAG_BOL_ERROR : Error of absolute bolometric magnitude (double, Magnitude[mag])

This parameter gives the error of the absolute bolometric magnitude for the case of LPVs.

RSG_FLAG : Red supergiant flag (boolean, Dimensionless[see description])

This flag marks stars that are probably red supergiants.

BOLOMETRIC_CORR : Bolometric correction for LPVs (double, Magnitude[mag])

This parameter gives the bolometric correction for the case of LPVs; details of the calculation can be found in Chapter **??** of the release documentation. For DR2, the bolometric correction was fixed to a specific value in three cases. First for red supergiant LPVs, identified with `rsg_flag=True`, the value was set to −0.71 mag. Second, the value was set to −2.2 mag for LPVs with G amplitude variations > 3 mag, where the variability amplitude is computed as the 5-95% trimmed range using the LEGACY strategy of commons-math to compute the percentiles. Third, for all cases for which the uncertainty in BP or in RP was larger than 4 mag, the BP-RP color was assumed to be 3.25 mag, at which value the bolometric correction is −1.729 mag.

BOLOMETRIC_CORR_ERROR : Error of the bolometric correction (double, Magnitude[mag])

This parameter gives the error of the bolometric correction for the case of LPVs. For DR2, the bolometric correction was fixed to a specific value in three cases. First for red supergiant LPVs, identified with `rsg_flag=True`, the value was set to 0.3 mag. Second, the value was set to 0.005 mag for LPVs with G amplitude variations > 3 mag, where the variability amplitude is computed as the 5-95% trimmed range using the LEGACY strategy of commons-math to compute the percentiles. Third, for all cases for which the uncertainty in BP or in RP was larger than 4 mag, the BP-RP color was assumed to be 3.25 mag and the error on BP-RP assumed to be 2 mag, at which values the bolometric correction error is 1.892 mag.

FREQUENCY : Frequency of the LPV (double, Frequency[day^{-1}])

This field is the frequency found for the Long Period Variable star.

FREQUENCY_ERROR : Error on the frequency (double, Frequency[day^{-1}])

This field gives the error on the frequency for the Long Period Variable star.

1.3.6 VARI_ROTATION_MODULATION

This table describes the solar-like stars with rotational modulation.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

NUM_SEGMENTS : Number of segments (int, Dimensionless[see description])

This is the number of time intervals (segments) in which the magnitude and colour time-series are splitted. The segmentation of time-series is needed because the spots due to the stellar magnetic activity have a life-time shorter than the whole Gaia time-series. The rotational modulation induced by spots can therefore be detected only in segments whose duration is comparable with the spots life-time

SEGMENTS_START_TIME : Times at which segments start (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

an array filled with the starting times of segments

SEGMENTS_END_TIME : Times at which segments end (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

an array filled with the ending times of segments

SEGMENTS_COLOUR_MAG_INTERCEPT : Colour-Magnitude Intercept in segments (double, Misc[see description])

a robust linear regression is applied to the points (BP-RP, G) in each segment. This array is filled with the intercepts given by the fitting procedure in the different segments.

SEGMENTS_COLOUR_MAG_INTERCEPT_ERROR : Colour-Magnitude Intercept uncertainty in segments (double, Misc[see description])

This array is filled with the uncertainties associated with the intercepts given by the fitting procedure

SEGMENTS_COLOUR_MAG_SLOPE : Colour-Magnitude Slope in segments (double, Misc[see description])

a robust linear regression is applied to the points (BP-RP, G) in each segment. This array is filled with the slopes given by the fitting procedure in the different segments.

SEGMENTS_COLOUR_MAG_SLOPE_ERROR : Colour-Magnitude Slope uncertainty in segments (double, Misc[see description])

This array is filled with the uncertainties associated with the slopes given by the fitting procedure

SEGMENTS_CORRELATION_COEFFICIENT : Correlation coefficient in segments (double, Dimensionless[see description])

The Pearson correlation coefficient r between BP-RP and G is computed in each segment. The higher is the Pearson coefficient the higher is the probability that the stellar variability is due to rotational modulation. This array is filled with the Pearson coefficients obtained in the different segments

SEGMENTS_CORRELATION_SIGNIFICANCE : Correlation coefficient significance in segments (double, Dimensionless[see description])

this array is filled with the statistical significances associated with the Pearson coefficients computed in the different segments. The significance p associated with a given $r = r_0$ gives the probability $P(r \geq r_0)$ that two sets of uncorrelated measurements have a Pearson coefficient $\geq r_0$

NUM_OUTLIERS : Number of outliers (int, Dimensionless[see description])

the number of outliers detected by the robust linear regression procedure

OUTLIERS_TIME : Times at which outliers occurs (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

times at which the detected outliers occurred

SEGMENTS_ROTATION_PERIOD : Rotation period in segment (double, Time[day])

A period search algorithm is applied to the different time-series segments. If the star is a solar-like variable the detected period is a measure of the stellar rotation period. This array is filled with the periods detected in the different segments (for each segment the period with the highest statistical significance is stored).

SEGMENTS_ROTATION_PERIOD_ERROR : Rotation period uncertainty in segment (double, Time[day])

This array is filled with the errors associated with the periods found in the different segments

SEGMENTS_ROTATION_PERIOD_FAP : FAP on rotation period in segment (double, Dimensionless[percentage/100])

False Alarm Probability = Probability that that a white noise sequence produces a peak similar or higher than the computed one; i.e., small FAP = little probability of noise, high FAP = noise is an acceptable explanation for the peak.

SEGMENTS_COS_TERM : Coefficient of cosine term of linear fit in segment (double, Magnitude[mag])

if a significative period T_0 is detected in a time-series segment, then the points of the time-series segment are fitted with the function

$$mag(t) = mag_0 + Acos(\frac{2\pi}{T_0}t) + Bsin(\frac{2*\pi}{T_0}t) \tag{1.1}$$

This array stores the A terms obtained by the fitting procedure in the different segments.

SEGMENTS_COS_TERM_ERROR : Errors on cosin terms (double, Magnitude[mag])

This array is filled with the errors associated with the A terms obtained from the fitting procedure in the different segments

SEGMENTS_SIN_TERM : Coefficient of sin term of linear fit in segment (double, Magnitude[mag])

if a significative period T_0 is detected in a time-series segment, then the points of the time-series segment are fitted with the function

$$mag(t) = mag_0 + Acos(\frac{2\pi}{T_0}t) + Bsin(\frac{2*\pi}{T_0}t) \tag{1.2}$$

This array stores the B terms obtained by the fitting procedure in the different segments.

SEGMENTS_SIN_TERM_ERROR : Errors on sine terms (double, Magnitude[mag])

This array is filled with the errors associated with the B terms obtained from the fitting procedure in the different segments

SEGMENTS_A0_TERM : Constant term (A0) of linear fit in segment (double, Magnitude[mag])

if a significative period T_0 is detected in a time-series segment, then the points of the time-series segment are fitted with the function

$$mag(t) = A_0 + Acos(\frac{2\pi}{T_0}t) + Bsin(\frac{2*\pi}{T_0}t) \tag{1.3}$$

This array stores the A_0 terms obtained by the fitting procedure in the different segments.

SEGMENTS_A0_TERM_ERROR : Errors on constant terms (double, Magnitude[mag])

This array is filled with the errors associated with the A_0 terms obtained from the fitting procedure in the different segments

BEST_ROTATION_PERIOD : Best rotation period (double, Time[day]) this field is an estimate of the stellar rotation period and is obtained by averaging the periods obtained in the different segments

BEST_ROTATION_PERIOD_ERROR : Error on best rotation period (double, Time[day])

error on the best rotation period

SEGMENTS_ACTIVITY_INDEX : Activity Index in segment (double, Magnitude[mag])

this array stores the activity indexes measured in the different segments. In a given segment the amplitude of variability A is taken as an index of the magnetic activity level. The amplitude of variability is measured by means of the equation:

$$A = mag_{95} - mag_5 \tag{1.4}$$

where mag_{95} and mag_5 are the 95-th and the 5-th percentiles of the G-band magnitude values.

SEGMENTS_ACTIVITY_INDEX_ERROR : error on Activity index in segment (double, Magnitude[mag])

this array stores the errors associated with the activity indexes in the G band. In a given segment the error on the activity index A is computed by means of the equation:

$$\sigma_A = \sqrt{\sigma^2_{mag95} + \sigma^2_{mag5}} \tag{1.5}$$

where σ_{mag95} and σ_{mag5} are the uncertainties of the measurements associated with the 95th and 5th percentiles of the G-band magnitude values, respectively

MAX_ACTIVITY_INDEX : The maximum Activity Index (double, Magnitude[mag])

this field is the maximum of measured the activity indexes in the G band

MAX_ACTIVITY_INDEX_ERROR : Error on maximum activity index (double, Magnitude[mag])

this field stores the error associated with the maximum activity index in the G band

SEGMENTS_G_UNSPOTTED : The unspotted G mags in segment (double, Magnitude[mag])

in a given segment the G magnitude corresponding to the unspotted state is estimated by taking the minimum G value in the segment

SEGMENTS_G_UNSPOTTED_ERROR : The unspotted G mag uncertainties in segment (double, Magnitude[mag])

this array stores the errors associated to the unspotted G values registered in the different segments

SEGMENTS_BP_UNSPOTTED : The unspotted BP mag in segment (double, Magnitude[mag]) in a given segment the BP magnitude corresponding to the unspotted state is estimated by taking the BP magnitude occurring at the same time of the unspotted G

SEGMENTS_BP_UNSPOTTED_ERROR : The unspotted BP mag uncertainties in segment (double, Magnitude[mag])

this array stores the errors associated to the unspotted BP values registered in the different segments

SEGMENTS_RP_UNSPOTTED : The unspotted RP mag in segment (double, Magnitude[mag])

in a given segment the RP magnitude corresponding to the unspotted state is estimated by taking the RP magnitude occurring at the same time of the unspotted G

SEGMENTS_RP_UNSPOTTED_ERROR : The unspotted RP mag uncertainties in segment (double, Magnitude[mag])

this array stores the errors associated to the unspotted RP values registered in the different segments

G_UNSPOTTED : Unspotted G mag (double, Magnitude[mag])

final estimate of the G magnitude corresponding to the unspotted state. It is computed by taking the minimum G magnitude in the whole time-series

G_UNSPOTTED_ERROR : Unspotted G mag uncertainty (double, Magnitude[mag])

this field stores the photometric error associated with g_unspotted

BP_UNSPOTTED : Unspotted BP mag (double, Magnitude[mag])

final estimate of the BP magnitude corresponding to the unspotted state. It is estimated by taking the BP magnitude occurring at the same time in which the minim G magnitude has been measured.

BP_UNSPOTTED_ERROR : Unspotted BP mag uncertainty (double, Magnitude[mag])

error associated with the bp_unspotted value

RP_UNSPOTTED : Unspotted RP mag (double, Magnitude[mag])

final estimate of the RP magnitude corresponding to the unspotted state. It is estimated by taking the RP magnitude occurring at the same time in which the minim G magnitude has been measured.

RP_UNSPOTTED_ERROR : Unspotted RP mag uncertainty (double, Magnitude[mag])

error associated with the rp_unspotted value

1.3.7 VARI_RRLYRAE

This table describes the RR Lyrae stars.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

PF : Period corresponding to the fundamental pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

pf: for single-mode pulsators classified as fundamental mode pulsators, this parameter is filled with the periodicity found in the time-series. For double-mode RR Lyrae this parameter is filled with the period corresponding to the longer periodicity. For double-mode DCEPs this parameter is filled with the period corresponding to the longer periodicity if the DCEP is classified as “F/1O” or “F/2O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the longer periodicity if the DCEP is classified as “F/1O/2O” This value is obtained by modelling the *G* band time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

PF_ERROR : Uncertainty of the pf period (double, Time[day])

pf_error: this parameter is filled with the uncertainty of the *pf* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *pf_error* parameter. The value refers to the analysis performed on the *G* band time series.

P1_O : Period corresponding to the first overtone pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

p1_o: for single-mode pulsators classified as first-overtone pulsators, this parameter is filled with the periodicity found in the time-series. For double-mode RR Lyrae this parameter is filled with the period corresponding to the shortest periodicity. For double-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “F/1O”; otherwise it is filled with the longest one if the classification is “1O/2O” or “1O/3O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the intermediate periodicity if the DCEP is classified as “F/1O/2O”; it is filled with the longest periodicity if the classification is “1O/2O/3O”. This value is obtained by modelling the *G* time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

P1_O_ERROR : Uncertainty of the p1_o period (double, Time[day])

p1_o_error: this parameter is filled with the uncertainty of the *p1_o* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *p1_o_error* parameter.

P2_O : Period corresponding to the second overtone pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

p2_o: For single-mode DCEPs classified as second-overtone pulsators, this parameter is filled with the periodicity found in the time-series. For double-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “1O/2O” of “F/2O”; otherwise it is filled with the longest periodicity if the classification is “2O/3O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “F/1O/2O”; it is filled with the intermediate periodicity if the classification is “1O/2O/3O”. This value is obtained by modelling the *G* time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

P2_O_ERROR : Uncertainty of the p2_o period (double, Time[day])

p2_o_error: this parameter is filled with the uncertainty of the *p2_o* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *p2_o_error* parameter. The value refers to the analysis performed on the *G* band time-series.

P3_O : Period corresponding to the third overtone pulsation mode (for multi mode pulsators) in the G band time series (double, Time[day])

p3_o: for double-mode DCEPs this parameter is filled with the periodicity found in the time-series corresponding to the shortest periodicity if the DCEP is classified as “1O/3O” of “2O/3O”. For triple-mode DCEPs this parameter is filled with the period corresponding to the shortest periodicity if the DCEP is classified as “1O/2O/3O”. This value is obtained by modelling the *G* time series using the Levenberg-Marquardt non linear fitting algorithm (see Clementini et al. 2016, A&A, 595, A133).

The parameter is NULL for RR Lyrae.

P3_O_ERROR : Uncertainty of the p3_o period (double, Time[day])

this parameter is filled with the uncertainty value of the *p3_o* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the period is computed. The mean of all the periods and its standard deviation are then derived, and the latter value is used to fill the *p3_o_error* parameter. The value refers to the analysis performed on the *G* band time-series.

The parameter is NULL for RR Lyrae.

EPOCH_G : Epoch of the maximum of the light curve in the G band (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Epoch of maximum light for the Gaia *G* band light curve. It corresponds to the Baricentric Julian day (BJD) of the maximum value of the light curve model which is closest to the BJD of the first observations -3 times the period of the source (first periodicity depending on the pulsation mode).

The mentioned BJD is offset by JD 2455197.5 (= J2010.0).

EPOCH_G_ERROR : Uncertainty on the epoch parameter epoch_g (double, Time[day])

Value of the uncertainty of the `epoch_g` parameter. It corresponds to three times the error on the period of the source (first periodicity depending on the pulsation mode).

EPOCH_BP : Epoch of the maximum of the light curve in the BP band (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Epoch of maximum light for the Gaia integrated G_{BP} band light curve. It corresponds to the Baricentric Julian day (BJD) of the maximum value of the light curve model which is closest to the BJD of the first observations -3 times the period of the source (first periodicity depending on the pulsation mode).

The mentioned BJD is offset by JD 2455197.5 (= J2010.0).

EPOCH_BP_ERROR : Uncertainty on the epoch parameter epoch_bp (double, Time[day])

Value of the uncertainty of the *epoch_bp* parameter. It corresponds to three times the error on the period of the source (first periodicity depending on the pulsation mode)

EPOCH_RP : Epoch of the maximum of the light curve in the RP band (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Epoch of maximum light for the Gaia integrated G_{RP} band light curve. It corresponds to the Baricentric Julian day (BJD) of the maximum value of the light curve model which is closest to the BJD of the first observations -3 times the period of the source (first periodicity depending on the pulsation mode).

The mentioned BJD is offset by JD 2455197.5 (= J2010.0).

EPOCH_RP_ERROR : Uncertainty on the epoch parameter epoch_rp (double, Time[day])

Value of the uncertainty of the *epoch_rp* parameter. It corresponds to three times the error on the period of the source (first periodicity depending on the pulsation mode)

INT_AVERAGE_G : Intensity-averaged magnitude in the G band (double, Magnitude[mag])

Value of the intensity-averaged magnitude in the *G*-band. The intensity-averaged magnitude is obtained by computing the average flux and then converting the average flux to magnitude.

INT_AVERAGE_G_ERROR : Uncertainty on int_average_g parameter (double, Magnitude[mag])

This parameter is filled with the uncertainty of the `int_average_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `int_average_g` is computed. The mean of all the magnitudes found and its standard deviation are then computed, and the latter value is kept to fill the `int_average_g_error` parameter.

INT_AVERAGE_BP : intensity-averaged magnitude in the BP band (double, Magnitude[mag])

Value of the intensity-averaged magnitude in the BP-band. The intensity-averaged magnitude is obtained by computing the average flux and then converting the average flux to magnitude.

INT_AVERAGE_BP_ERROR : Uncertainty on int_average_bp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty of the *int_average_bp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `int_average_bp` is computed. The mean of all the magnitudes found and its standard deviation are then computed, and the latter value is kept to fill the `int_average_bpError` parameter.

INT_AVERAGE_RP : intensity-averaged magnitude in the RP band (double, Magnitude[mag])

Value of the intensity-averaged magnitude in the RP-band. The intensity-averaged magnitude is obtained by computing the average flux and then converting the average flux to magnitude.

INT_AVERAGE_RP_ERROR : Uncertainty on int_average_rp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty of the *int_average_rp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `int_average_rp` is computed. The mean of all the magnitudes found and its standard deviation are then computed, and the latter value is kept to fill the `int_average_rp_error` parameter.

PEAK_TO_PEAK_G : Peak-to-peak amplitude of the G band light curve (double, Magnitude[mag])

This parameter is filled with the peak-to-peak amplitude value of the *G* band light curve. The peak-to-peak amplitude is calculated as the (maximum) - (minimum) of the modelled folded light curve in the *G* band. The light curve of the target star is modelled with a truncated Fourier series ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)]$). Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, for the *G*-band light curve are determined using the Levenberg-Marquardt non linear fitting algorithm.

PEAK_TO_PEAK_G_ERROR : Uncertainty on the peak_to_peak_g parameter (double, Magnitude[mag])

This parameter is filled with the uncertainty value of the `peak_to_peak_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `peak_to_peak_g` is computed. The mean of all the amplitudes found and its standard deviation are then computed, and the latter value is kept to fill the `peak_to_peak_gError` parameter.

PEAK_TO_PEAK_BP : Peak-to-peak amplitude of the BP band light curve (double, Magnitude[mag])

this parameter is filled with the peak-to-peak amplitude value of the *BP* light curve. The peak-to-peak amplitude is calculated as the (maximum) - (minimum) of the modelled folded light curve in the *BP* band. The light curve of the target star is modelled with a truncated Fourier series ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max}t_j + \phi_i)]$). Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, for the *BP*-band light curve are determined using the Levenberg-Marquardt non linear fitting algorithm.

PEAK_TO_PEAK_BP_ERROR : Uncertainty on the peak_to_peak_bp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty value of the *peak_to_peak_bp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `peak_to_peak_bp` is computed. The mean of all the amplitudes found and its standard deviation are then computed, and the latter value is kept to fill the `peak_to_peak_bpError` parameter.

PEAK_TO_PEAK_RP : Peak-to-peak amplitude of the RP band light curve (double, Magnitude[mag])

this parameter is filled with the peak-to-peak amplitude value. The peak-to-peak amplitude is calculated as the (maximum) - (minimum) of the modelled folded light curve in the *RP* band. The light curve of the target star is modelled with a truncated Fourier series ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max}t_j + \phi_i)]$). Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, for the *RP*-band light curve are determined using the Levenberg-Marquardt non linear fitting algorithm.

PEAK_TO_PEAK_RP_ERROR : Uncertainty on the peak_to_peak_rp parameter (double, Magnitude[mag])

this parameter is filled with the uncertainty value of the *peak_to_peak_rp* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `peak_to_peak_rp` is computed. The mean of all the amplitudes found and its standard deviation are then computed, and the latter value is kept to fill the `peak_to_peak_rp_error` parameter.

METALLICITY : Metallicity of the star from the Fourier parameters of the light curve (double, Abundances[dex])

metallicity: this parameter is filled with the [Fe/H] metallicity derived for the source from the Fourier parameters of the G-band light curve.

METALLICITY_ERROR : Uncertainty of the metallicity parameter (double, Abundances[dex])

metallicity_error: this parameter is filled with the uncertainty of the *metallicity* derived from the Fourier parameters of the G-band light curve.

R21_G : Fourier decomposition parameter r21_g: A2/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the Fourier decomposition parameter $R_{21} = A_2/A_1$, where A_2 is the amplitude of the 2nd harmonic and A_1 is the amplitude of the fundamental harmonic of the truncated Fourier series defined as $(mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)])$ used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

R21_G_ERROR : Uncertainty on the r21_g parameter: A2/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the uncertainty value on the `r21_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `r21_g` is computed. The mean of all the r21_g values found and its standard deviation are then computed, and the latter value is kept to fill the `r21_gError` parameter.

R31_G : Fourier decomposition parameter r31_g: A3/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the Fourier decomposition parameter $R_{21} = A_3/A_1$, where A_3 is the amplitude of the 3rd harmonic and A_1 is the amplitude of the fundamental harmonic of the truncated Fourier series defined as $(mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)])$ used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

R31_G_ERROR : Uncertainty on the r31_g parameter: A3/A1 (for G band) (double, Dimensionless[see description])

this parameter is filled with the uncertainty value of the *r31_g* parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `r31_g` is computed. The mean of all the r31_g values found and its standard deviation are then computed, and the latter value is kept to fill the `r31_g_error` parameter.

PHI21_G : Fourier decomposition parameter phi21_g: phi2 - 2*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the Fourier decomposition parameter ϕ_{21}: $\phi_2 - 2\phi_1$ value, where ϕ_2 is the phase of the 2nd harmonic and ϕ_1 is the phase of the fundamental harmonic of the truncated Fourier series defined as $(mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)])$ used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

PHI21_G_ERROR : Uncertainty on the phi21_g parameter: phi2 - 2*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the uncertainty of the `phi21_g` parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `phi21_g` is computed. The mean of all the phi21_g values is found and its standard deviation are then computed, and the latter value is kept to fill the `phi21_g_error` parameter.

PHI31_G : Fourier decomposition parameter phi31_g: phi3 - 3*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the Fourier decomposition parameter ϕ_{31}: $\phi_3 - 3\phi_1$ value, where ϕ_3 is the phase of the 3rd harmonic and ϕ_1 is the phase of the fundamental harmonic of the truncated Fourier series defined as ($mag(t_j) = zp + \sum[A_i sin(i \times 2\pi\nu_{max} t_j + \phi_i)]$) used to model the G-band light curve. Zero-point (zp), period ($1/\nu_{max}$), number of harmonics (i), amplitudes (A_i), and phases (ϕ_i) of the harmonics, are determined using the Levenberg-Marquardt non linear fitting algorithm.

PHI31_G_ERROR : Uncertainty on the phi31_g parameter: phi3 - 3*phi1 (for G band) (double, Angle[rad])

this parameter is filled with the uncertainty of the *phi31_g*: $\phi_3 - 3\phi_1$ parameter. Its value is derived from Monte Carlo simulations that generate several (100) time series with the same time path as the data points but with magnitudes generated randomly around the corresponding data values. For each of these time series the `phi31_g` is computed. The mean of all the phi31_g values is found and its standard deviation are then computed, and the latter value is kept to fill the `phi31_g_error` parameter.

NUM_CLEAN_EPOCHS_G : Number of G FoV epochs used in the fitting algorithm (int, Dimensionless[see description])

this parameter is filled with the number of epochs that remain in the G band light curve after the SOS Cep & RRLyrae outlier removal process.

NUM_CLEAN_EPOCHS_BP : Number of BP epochs used in the fitting algorithm (int, Dimensionless[see description])

this parameter is filled with the number of epochs that remain in the BP band light curve after the SOS Cep&RRLyrae outlier removal process.

NUM_CLEAN_EPOCHS_RP : Number of RP epochs used in the fitting algorithm (int, Dimensionless[see description])

this parameter is filled with the number of epochs that remain in the RP band light curve after the SOS Cep&RRLyrae outlier removal process.

G_ABSORPTION : Interstellar absorption in the G-band (double, Magnitude[mag])

This parameter is filled with values coming from the estimate of the interstellar extinction toward the investigated pulsators. For RR Lyrae stars the period-colour-amplitude relation was used, whereas the parameter is not available for Cepheids in DR2.

G_ABSORPTION_ERROR : Error on the interstellar absorption in the G-band (double, Magnitude[mag])

Error on the interstellar absorption in the G-band (**g_absorption_error**): This parameter is filled with the r.m.s. errors of the relations used to estimate the interstellar absorption.

BEST_CLASSIFICATION : Best RR Lyrae classification estimate out of: ”RRC”, ”RRAB”, ”RRD” (string, Dimensionless[see description])

Classification of an RR Lyrae star according to the pulsation mode: RRc (”RRC”) for first overtone, RRab (”RRAB”) for fundamental mode, and RRd (”RRD”) for double modes, obtained using the period-amplitude diagram in the G-band; the plots of the Fourier parameters R21 and Phi2 vs period and the Petersen diagram.

1.3.8 VARI_SHORT_TIMESCALE

This table describes the short-timescale sources. For DR2, all sources in this table were selected according to their variogram analysis.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

AMPLITUDE_ESTIMATE : Amplitude estimate of all per CCD G-band photometry (quantile(95%)-quantile(5%)) (double, Magnitude[mag])

This parameter is filled with the amplitude estimate from per-CCD G-band photometry. This amplitude estimate is calculated as the quantile differ- ence (95th quantile - 5th quantile) of all per-CCD G-band measurements.

NUMBER_OF_FOV_TRANSITS : Number of FoV transits with more than 7 CCD measurements after time series cleaning (int, Dimensionless[see description])

Number of FoV transits that have more than 7 CCD measurements after time series cleaning (i.e. not necessarly the number of FoV transits available for the source).

MEAN_OF_FOV_ABBE_VALUES : Mean of per-FOV Abbe values derived from CCD G-band photometry (double, Dimensionless[see description])

This parameter is filled by the mean of per-FoV Abbe values derived from per-CCD G-band photometry. Considering a given source, for each of its FoV transits containing more than one per-CCD measurement, the associated Abbe value from per-CCD G-band photometry is derived as $abbe = \frac{\sum(mag(t_{i+1})-mag(t_i))^2}{2\sum(mag(t_i)-<mag(t_i)>)^2}$ where $< mag(t_i) >$ is the mean of the per-CCD measurements of the transit. The value of `mean_of_fov_abbe_values` is calculated as the mean of these per-FoV Abbe values.

VARIOGRAM_NUM_POINTS : Number of points in the variogram (int, Dimensionless[see description])

This parameter is filled by the number of characteristic points in the variogram and associated time scales. For DR2, it is only 1.

VARIOGRAM_CHAR_TIMESCALES : Characteristic time scales of variability (double, Time[day])

This parameter is filled by the variogram characteristic timescale(s) derived from the variogram analysis of the source, if it has been flagged as a short timescale variable candidate.

VARIOGRAM_VALUES : Variogram values associated with the variogram_char_timescales (double, Misc[mag**2])

This parameter is filled by the variogram value(s) associated with the variogram characteristic timescales `variogram_char_timesca`

FREQUENCY : Frequency search result for either G CCD, G FoV, BP or RP photometry (Null if no periodicity detected) (double, Frequency[day^{-1}])

The parameter is filled by the frequency value resulting from the period search (method LOMB_SCARGLE for DR2) performed either on the per-CCD G-band photometry, per-FoV G-band photometry, BP photometry or RP photometry, if periodicity has been detected. Otherwise it is set to NULL.

1.3.9 VARI_TIME_SERIES_STATISTICS

Statistical parameters of time series, using only transits not rejected, see `rejected_by_variability` column in the VO Table `epoch_photometry_url` in `gaia_source`.

Note that NaN will be reported when the parameter value is missing or cannot be calculated.

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

SOURCE_ID : Unique source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

NUM_SELECTED_G_FOV : Total number of G FOV transits selected for variability analysis (int, Dimensionless[see description])

The number of processed observations for variability analyses of this source, using only transits not rejected, see `rejected_by_variability` column in the VO Table `epoch_photometry_url` in `gaia_source`.

MEAN_OBS_TIME_G_FOV : Mean observation time for G FoV transits (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Name: The mean observation time

Control parameters: None

Output: Let y_i be a time series of size N at times t_i. The mean $\bar{t}$ is defined as

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} t_i. \tag{1.6}$$

TIME_DURATION_G_FOV : Time duration of the time series for G FoV transits (double, Time[day])

Name: The time duration of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The time duration of the time series is equal to $t_N - t_1$.

MIN_MAG_G_FOV : Minimum G FoV magnitude (double, Magnitude[mag])

Name: The minimum value of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The minimum value of the time series is defined as:

$$min(y_i)\ \forall i \in (1, N) \tag{1.7}$$

MAX_MAG_G_FOV : Maximum G FoV magnitude (double, Magnitude[mag])

Name: The maximum value of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The maximum value of the time series is defined as:

$$max(y_i)\ \forall i \in (1, N) \tag{1.8}$$

MEAN_MAG_G_FOV : Mean G FoV magnitude (double, Magnitude[mag])

Name: The mean of the time series

Control parameters: None

Output: Let y_i be a time series of size N. The mean $\overline{y}$ is defined as

$$\overline{y} = \frac{1}{N} \sum_{i=1}^{N} y_i. \tag{1.9}$$

MEDIAN_MAG_G_FOV : Median G FoV magnitude (double, Magnitude[mag])

Name: The median of the time series

Control parameters: None

Output: The 50th percentile unweighted value.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < p_1 \\ y_{(i)} + \frac{m-p_i}{p_{i+1}-p_i}\,(y_{(i+1)} - y_{(i)}) & \text{if } p_i \leq m \leq p_{i+1} \\ y_{(N)} & \text{if } p_N < m \leq 100 \end{cases}$$

where $p_i = 100\, i/(N+1)$.

RANGE_MAG_G_FOV : Difference between the highest and lowest G FoV magnitudes (double, Magnitude[mag])

Name: The range of the time series

Control parameters: None

Output: Let y_i be a time series, $y_{\max}$ its largest element, and $y_{\min}$ its smallest element, then the range is defined as

$$R = y_{\max} - y_{\min} \tag{1.10}$$

STD_DEV_MAG_G_FOV : Square root of the unweighted G FoV magnitude variance (double, Magnitude[mag])

Name: The square root of the unbiased unweighted variance.

Output: Let y_i be a time series of size N. The unweighted standard deviation $\hat{\sigma}$ is defined as the square root of the sample-size unbiased unweighted variance:

$$\hat{\sigma} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(y_i - \overline{y})^2}.$$

SKEWNESS_MAG_G_FOV : Standardized unweighted G FoV magnitude skewness (double, Dimensionless[see description])

Name: The standardised unbiased unweighted skewness.

Output: Let y_i be a time series of size $N > 2$. The sample-size unbiased unweighted skewness moment $\mathcal{E}$ is defined as:

$$\mathcal{E} = \frac{N}{(N-1)(N-2)}\sum_{i=1}^{N}(y_i - \overline{y})^3.$$

The standardized unbiased skewness E is defined as:

$$E = \frac{\mathcal{E}}{\hat{\sigma}^3}$$

where $\hat{\sigma}$ is the square root of the unbiased unweighted variance around the unweighted mean. While $\mathcal{E}$ is an unbiased estimate of the population value, E becomes unbiased in the limit of large N.

KURTOSIS_MAG_G_FOV : Standardized unweighted G FoV magnitude kurtosis (double, Dimensionless[see description])

Name: The standardised unbiased unweighted kurtosis.

Output: Let y_i be a time series of size $N > 3$. The sample-size unbiased unweighted kurtosis cumulant $\mathcal{K}$ is defined as:

$$\mathcal{K} = \frac{N(N+1)}{(N-1)(N-2)(N-3)}\sum_{i=1}^{N}(y_i - \overline{y})^4 - \frac{3}{(N-2)(N-3)}\left[\sum_{i=1}^{N}(y_i - \overline{y})^2\right]^2.$$

The standardized unbiased kurtosis K is defined as:

$$K = \frac{\mathcal{K}}{\hat{\sigma}^4}$$

where $\hat{\sigma}^2$ is the unbiased unweighted variance around the unweighted mean. While $\mathcal{K}$ is an unbiased estimate of the population value, K becomes unbiased in the limit of large N.

MAD_MAG_G_FOV : Median Absolute Deviation (MAD) for G FoV transits (double, Magnitude[mag])

Name: The Median Absolute Deviation (MAD)

Control parameters: None

Output: Let y_i be a time series of size N. The MAD is defined as the median of the absolute deviations from the median of the data:

$$\mathrm{MAD} = \mathrm{median}\{|y_i - \mathrm{median}\{y_j, \forall j \in (1, N)\}|, \forall i \in (1, N)\}. \tag{1.11}$$

ABBE_MAG_G_FOV : Abbe value for G FoV transits (double, Dimensionless[see description])

Name: The Abbe value

Control parameters: None

Output: Let $\{t_i, y_i\}$ be a time-sorted time series of size N, such that $t_i < t_{i+1}$ for all $i < N$. The Abbe value $\mathcal{A}$ is defined as

$$\mathcal{A} = \frac{N}{2(N-1)} \frac{\sum_{i=1}^{N-1} (y_{i+1} - y_i)^2}{\sum_{i=1}^{N} (y_i - \bar{y})} \tag{1.12}$$

where $\bar{y}$ is the unweighted mean.

IQR_MAG_G_FOV : Interquartile range for G FoV transits (double, Magnitude[mag])

Name: The Interquartile Range (IQR)

Control parameters: None

Output: The difference between the (unweighted) 75th and 25th percentile values: IQR= $P_{75} - P_{25}$.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < p_1 \\ y_{(i)} + \frac{m - p_i}{p_{i+1} - p_i} \left(y_{(i+1)} - y_{(i)} \right) & \text{if } p_i \leq m \leq p_{i+1} \\ y_{(N)} & \text{if } p_N < m \leq 100 \end{cases}$$

where $p_i = 100\, i/(N+1)$.

NUM_SELECTED_BP : Total number of BP observations selected for variability analysis (int, Dimensionless[see description])

The number of processed observations for variability analyses of this source, using only transits not rejected, see `rejected_by_variability` column in the VO Table `epoch_photometry_url` in `gaia_source`.

MEAN_OBS_TIME_BP : Mean observation time for BP observations (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Name: The mean observation time

Control parameters: None

Output: Let y_i be a time series of size N at times t_i. The mean $\bar{t}$ is defined as

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} t_i. \tag{1.13}$$

TIME_DURATION_BP : Time duration of the BP time series (double, Time[day])

Name: The time duration of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The time duration of the time series is equal to $t_N - t_1$.

MIN_MAG_BP : Minimum BP magnitude (double, Magnitude[mag])

Name: The minimum value of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The minimum value of the time series is defined as:

$$min(y_i) \ \forall i \in (1, N) \tag{1.14}$$

MAX_MAG_BP : Maximum BP magnitude (double, Magnitude[mag])

Name: The maximum value of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The maximum value of the time series is defined as:

$$max(y_i) \ \forall i \in (1, N) \tag{1.15}$$

MEAN_MAG_BP : Mean BP magnitude (double, Magnitude[mag])

Name: The mean of the time series

Control parameters: None

Output: Let y_i be a time series of size N. The mean $\overline{y}$ is defined as

$$\overline{y} = \frac{1}{N} \sum_{i=1}^{N} y_i. \tag{1.16}$$

MEDIAN_MAG_BP : Median BP magnitude (double, Magnitude[mag])

Name: The median of the time series

Control parameters: None

Output: The 50th unweighted percentile value.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < p_1 \\ y_{(i)} + \frac{m-p_i}{p_{i+1}-p_i} \left(y_{(i+1)} - y_{(i)}\right) & \text{if } p_i \leq m \leq p_{i+1} \\ y_{(N)} & \text{if } p_N < m \leq 100 \end{cases}$$

where $p_i = 100\, i/(N+1)$.

RANGE_MAG_BP : Difference between the highest and lowest BP magnitudes (double, Magnitude[mag])

Name: The range of the time series

Control parameters: None

Output: Let y_i be a time series, $y_{\max}$ its largest element, and $y_{\min}$ its smallest element, then the range is defined as

$$R = y_{\max} - y_{\min} \tag{1.17}$$

STD_DEV_MAG_BP : Square root of the unweighted BP magnitude variance (double, Magnitude[mag])

Name: The square root of the unbiased unweighted variance.

Output: Let y_i be a time series of size N. The unweighted standard deviation $\hat{\sigma}$ is defined as the square root of the sample-size unbiased unweighted variance:

$$\hat{\sigma} = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} (y_i - \overline{y})^2}.$$

SKEWNESS_MAG_BP : Standardized unweighted BP magnitude skewness (double, Dimensionless[see description])

Name: The standardised unbiased unweighted skewness.

Output: Let y_i be a time series of size $N > 2$. The sample-size unbiased unweighted skewness moment $\mathcal{E}$ is defined as:

$$\mathcal{E} = \frac{N}{(N-1)(N-2)} \sum_{i=1}^{N} (y_i - \overline{y})^3.$$

The standardized unbiased skewness E is defined as:

$$E = \frac{\mathcal{E}}{\hat{\sigma}^3}$$

where $\hat{\sigma}$ is the square root of the unbiased unweighted variance around the unweighted mean. While $\mathcal{E}$ is an unbiased estimate of the population value, E becomes unbiased in the limit of large N.

KURTOSIS_MAG_BP : Standardized unweighted BP magnitude kurtosis (double, Dimensionless[see description])

Name: The standardised unbiased unweighted kurtosis.

Output: Let y_i be a time series of size $N > 3$. The sample-size unbiased unweighted kurtosis cumulant $\mathcal{K}$ is defined as:

$$\mathcal{K} = \frac{N(N+1)}{(N-1)(N-2)(N-3)} \sum_{i=1}^{N} (y_i - \overline{y})^4 - \frac{3}{(N-2)(N-3)} \left[\sum_{i=1}^{N} (y_i - \overline{y})^2 \right]^2 .$$

The standardized unbiased kurtosis K is defined as:

$$K = \frac{\mathcal{K}}{\hat{\sigma}^4}$$

where $\hat{\sigma}^2$ is the unbiased unweighted variance around the unweighted mean. While $\mathcal{K}$ is an unbiased estimate of the population value, K becomes unbiased in the limit of large N.

MAD_MAG_BP : Median Absolute Deviation (MAD) for BP observations (double, Magnitude[mag])

Name: The Median Absolute Deviation (MAD)

Control parameters: None

Output: Let y_i be a time series of size N. The MAD is defined as the median of the absolute deviations from the median of the data:

$$\text{MAD} = \text{median}\{|y_i - \text{median}\{y_j, \forall j \in (1, N)\}|, \forall i \in (1, N)\}. \tag{1.18}$$

ABBE_MAG_BP : Abbe value for BP observations (double, Dimensionless[see description])

Name: The Abbe value

Control parameters: None

Output: Let $\{t_i, y_i\}$ be a time-sorted time series of size N, such that $t_i < t_{i+1}$ for all $i < N$. The Abbe value $\mathcal{A}$ is defined as

$$\mathcal{A} = \frac{N}{2(N-1)} \frac{\sum_{i=1}^{N-1} (y_{i+1} - y_i)^2}{\sum_{i=1}^{N} (y_i - \bar{y})} \tag{1.19}$$

where $\bar{y}$ is the unweighted mean.

IQR_MAG_BP : Interquartile BP magnitude range (double, Magnitude[mag])

Name: The Interquartile Range (IQR)

Control parameters: None

Output: The difference between the (unweighted) 75th and 25th percentile values: IQR= $P_{75} - P_{25}$.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < p_1 \\ y_{(i)} + \frac{m-p_i}{p_{i+1}-p_i}\left(y_{(i+1)} - y_{(i)}\right) & \text{if } p_i \leq m \leq p_{i+1} \\ y_{(N)} & \text{if } p_N < m \leq 100 \end{cases}$$

where $p_i = 100\,i/(N+1)$.

NUM_SELECTED_RP : Total number of RP observations selected for variability analysis (int, Dimensionless[see description])

The number of processed observations for variability analyses of this source, using only transits not rejected, see `rejected_by_variability` column in the VO Table `epoch_photometry_url` in `gaia_source`.

MEAN_OBS_TIME_RP : Mean observation time for RP observations (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Name: The mean observation time

Control parameters: None

Output: Let y_i be a time series of size N at times t_i. The mean $\bar{t}$ is defined as

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_i. \tag{1.20}$$

TIME_DURATION_RP : Time duration of the RP time series (double, Time[day])

Name: The time duration of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The time duration of the time series is equal to $t_N - t_1$.

MIN_MAG_RP : Minimum RP magnitude (double, Magnitude[mag])

Name: The minimum value of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The minimum value of the time series is defined as:

$$min(y_i)\ \forall i \in (1, N) \tag{1.21}$$

MAX_MAG_RP : Maximum RP magnitude (double, Magnitude[mag])

Name: The maximum value of the time series

Control parameters: None

Output: Let y_i be a time series of size N at times t_i, with $i = 1$ to N. The maximum value of the time series is defined as:

$$max(y_i)\ \forall i \in (1, N) \tag{1.22}$$

MEAN_MAG_RP : Mean RP magnitude (double, Magnitude[mag])

Name: The mean of the time series

Control parameters: None

Output: Let y_i be a time series of size N. The mean $\bar{y}$ is defined as

$$\bar{y} = \frac{1}{N} \sum_{i=1}^{N} y_i. \tag{1.23}$$

MEDIAN_MAG_RP : Median RP magnitude (double, Magnitude[mag])

Name: The median of the time series

Control parameters: None

Output: The 50th unweighted percentile value.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < p_1 \\ y_{(i)} + \frac{m-p_i}{p_{i+1}-p_i} \left(y_{(i+1)} - y_{(i)}\right) & \text{if } p_i \leq m \leq p_{i+1} \\ y_{(N)} & \text{if } p_N < m \leq 100 \end{cases}$$

where $p_i = 100\, i/(N + 1)$.

RANGE_MAG_RP : Difference between the highest and lowest RP magnitudes (double, Magnitude[mag])

Name: The range of the time series

Control parameters: None

Output: Let y_i be a time series, $y_{\max}$ its largest element, and $y_{\min}$ its smallest element, then the range is defined as

$$R = y_{\max} - y_{\min} \tag{1.24}$$

STD_DEV_MAG_RP : Square root of the unweighted RP magnitude variance (double, Magnitude[mag])

Name: The square root of the unbiased unweighted variance.

Output: Let y_i be a time series of size N. The unweighted standard deviation $\hat{\sigma}$ is defined as the square root of the sample-size unbiased unweighted variance:

$$\hat{\sigma} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(y_i - \overline{y})^2}.$$

SKEWNESS_MAG_RP : Standardized unweighted RP magnitude skewness (double, Dimensionless[see description])

Name: The standardised unbiased unweighted skewness.

Output: Let y_i be a time series of size $N > 2$. The sample-size unbiased unweighted skewness moment $\mathcal{E}$ is defined as:

$$\mathcal{E} = \frac{N}{(N-1)(N-2)}\sum_{i=1}^{N}(y_i - \overline{y})^3.$$

The standardized unbiased skewness E is defined as:

$$E = \frac{\mathcal{E}}{\hat{\sigma}^3}$$

where $\hat{\sigma}$ is the square root of the unbiased unweighted variance around the unweighted mean. While $\mathcal{E}$ is an unbiased estimate of the population value, E becomes unbiased in the limit of large N.

KURTOSIS_MAG_RP : Standardized unweighted RP magnitude kurtosis (double, Dimensionless[see description])

Name: The standardised unbiased unweighted kurtosis.

Output: Let y_i be a time series of size $N > 3$. The sample-size unbiased unweighted kurtosis cumulant $\mathcal{K}$ is defined as:

$$\mathcal{K} = \frac{N(N+1)}{(N-1)(N-2)(N-3)}\sum_{i=1}^{N}(y_i - \overline{y})^4 - \frac{3}{(N-2)(N-3)}\left[\sum_{i=1}^{N}(y_i - \overline{y})^2\right]^2.$$

The standardized unbiased kurtosis K is defined as:

$$K = \frac{\mathcal{K}}{\hat{\sigma}^4}$$

where $\hat{\sigma}^2$ is the unbiased unweighted variance around the unweighted mean. While $\mathcal{K}$ is an unbiased estimate of the population value, K becomes unbiased in the limit of large N.

MAD_MAG_RP : Median Absolute Deviation (MAD) for RP observations (double, Magnitude[mag])

Name: The Median Absolute Deviation (MAD)

Control parameters: None

Output: Let y_i be a time series of size N. The MAD is defined as the median of the absolute deviations from the median of the data:

$$\mathrm{MAD} = \mathrm{median}\{|y_i - \mathrm{median}\{y_j, \forall j \in (1,N)\}|, \forall i \in (1,N)\}. \quad (1.25)$$

ABBE_MAG_RP : Abbe value for RP observations (double, Dimensionless[see description])

Name: The Abbe value

Control parameters: None

Output: Let $\{t_i, y_i\}$ be a time-sorted time series of size N, such that $t_i < t_{i+1}$ for all $i < N$. The Abbe value $\mathcal{A}$ is defined as

$$\mathcal{A} = \frac{N}{2(N-1)} \frac{\sum_{i=1}^{N-1}(y_{i+1} - y_i)^2}{\sum_{i=1}^{N}(y_i - \bar{y})} \tag{1.26}$$

where $\bar{y}$ is the unweighted mean.

IQR_MAG_RP : Interquartile RP magnitude range (double, Magnitude[mag])

Name: The Interquartile Range (IQR)

Control parameters: None

Output: The difference between the (unweighted) 75th and 25th percentile values: IQR= $P_{75} - P_{25}$.

Let y_i be a time series of size N ordered such as $y_{(1)} \leq y_{(2)} \leq \cdots \leq y_{(N)}$. The m-th (per cent) percentile P_m is defined for $0 < m \leq 100$ as follows:

$$P_m = \begin{cases} y_{(1)} & \text{if } 0 < m < p_1 \\ y_{(i)} + \frac{m-p_i}{p_{i+1}-p_i}\left(y_{(i+1)} - y_{(i)}\right) & \text{if } p_i \leq m \leq p_{i+1} \\ y_{(N)} & \text{if } p_N < m \leq 100 \end{cases}$$

where $p_i = 100\, i/(N+1)$.

1.4 External catalogues

1.4.1 ALLWISE_ORIGINAL_VALID

AllWISE source catalogue
Reference paper:
Wright et al. 2010, AJ, 140, 1868
Mainzer et al. 2011, ApJ, 731, 53
Original catalogue:
`http://irsadist.ipac.caltech.edu/wise-allwise/`
`http://wise2.ipac.caltech.edu/docs/release/allwise/expsup/index.html`

Columns description:

ALLWISE_OID : Unique Numeric Identifier (long)

Incremental unique numeric identifier (increasing with declination). This is the only field which was not in the original allWISE catalogue, but was added for cross-match purposes.

DESIGNATION : source Id in original catalog (string)

Sexagesimal, equatorial position-based source name in the form: hhmmss.ss+ddmmss.s.
The full naming convention for AllWISE Source Catalog sources has the form
"WISEA Jhhmmss.ss+ddmmss.s," where "WISEA" indicates the source is from the AllWISE Source Catalog, and "J" indicates the position is J2000. The "WISEA" acronym is not listed explicitly in the designation column.

RA : RA, ICRS (double, Angle[deg])

J2000 right ascension with respect to the 2MASS PSC reference frame from the non-moving source extraction.
The sky coverage depth for sources in the AllWISE Catalog is approximately twice as large in W1 and W2 as it is in W3 and W4. AllWISE combined W1 and W2 Single-exposure images from the WISE 4-Band Cryo, 3-Band Cryo and NEOWISE Post-Cryo survey phases, and W3 and W4 images from the 4-Band Cryo phase only. The additional epoch of W1 and W2 coverage accenuates the weight of those two bands in determining source properties such as position and motion.

DEC : DEC, ICRS (double, Angle[deg])

J2000 declination with respect to the 2MASS PSC reference frame from the non-moving source extraction.
The sky coverage depth for sources in the AllWISE Catalog is approximately twice as large in W1 and W2 as it is in W3 and W4. AllWISE combined W1 and W2 Single-exposure images from the WISE 4-Band Cryo, 3-Band Cryo and NEOWISE Post-Cryo survey phases, and W3 and W4 images from the 4-Band Cryo phase only. The additional epoch of W1 and W2 coverage accenuates the weight of those two bands in determining source properties such as position and motion.

RA_ERROR : Error in RAcosDEC (double, Angle[arcsec])

One-sigma uncertainty in right ascension coordinate from the non-moving source extraction.

DEC_ERROR : Error in DEC (double, Angle[arcsec])

One-sigma uncertainty in declination coordinate from the non-moving source extraction.

RADEC_CO_ERROR : Co-sigma between position errors (double, Angle[arcsec])

The co-sigma (radec_co_error) of the equatorial position uncertainties (ra_error and dec_error). Unit arcsec.
The covariance between the position errors, $C_{\alpha\delta}$ can be derived from the co-sigma by the formula:
$C_{\alpha\delta} = radec\_co\_error * |radec\_co\_error|$.

W1MPRO : W1 profile-fitting magnitude (double, Magnitude[mag])

W1 magnitude measured with profile-fitting photometry, or the magnitude of the 95% confidence brightness upper limit if the W1 flux measurement has SNR<2. This column is null if the source is nominally detected in W1, but no useful brightness estimate could be made. The corresponding error column is null if the W1 profile-fit magnitude is a 95% confidence upper limit.
CAUTION: WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

W1MPRO_ERROR : Error on W1 profile-fitting magnitude (double, Magnitude[mag])

W1 profile-fit photometric measurement uncertainty in mag units. This column is null if the W1 profile-fit magnitude is a 95% confidence upper limit or if the source is not measurable.

W2MPRO : W2 profile-fitting magnitude (double, Magnitude[mag])

W2 magnitude measured with profile-fitting photometry, or the magnitude of the 95% confidence brightness upper limit if the W2 flux measurement has SNR<2. This column is null if the source is nominally detected in W2, but no useful brightness estimate could be made. The corresponding error column is null if the W2 profile-fit magnitude is a 95% confidence upper limit.
CAUTION: WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

W2MPRO_ERROR : Error on W2 profile-fitting magnitude (double, Magnitude[mag])

W2 profile-fit photometric measurement uncertainty in mag units. This column is null if the W2 profile-fit magnitude is a 95% confidence upper limit or if the source is not measurable.

W3MPRO : W3 profile-fitting magnitude (double, Magnitude[mag])

W3 magnitude measured with profile-fitting photometry, or the magnitude of the 95% confidence brightness upper

limit if the W3 flux measurement has SNR<2. This column is null if the source is nominally detected in W3, but no useful brightness estimate could be made. The corresponding error column is null if the W3 profile-fit magnitude is a 95% confidence upper limit.
CAUTION: WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

W3MPRO_ERROR : Error on W3 profile-fitting magnitude (double, Magnitude[mag])

W3 profile-fit photometric measurement uncertainty in mag units. This column is null if the W3 profile-fit magnitude is a 95% confidence upper limit or if the source is not measurable.

W4MPRO : W4 profile-fitting magnitude (double, Magnitude[mag])

W4 magnitude measured with profile-fitting photometry, or the magnitude of the 95% confidence brightness upper limit if the W4 flux measurement has SNR<2. This column is null if the source is nominally detected in W4, but no useful brightness estimate could be made. The corresponding error column is null if the W1 profile-fit magnitude is a 95% confidence upper limit.
CAUTION: WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

W4MPRO_ERROR : Error on W4 profile-fitting magnitude (double, Magnitude[mag])

W4 profile-fit photometric measurement uncertainty in mag units. This column is null if the W4 profile-fit magnitude is a 95% confidence upper limit or if the source is not measurable.

CC_FLAGS : Contamination and confusion flag (string)

Contamination and confusion flag.
Four character string, one character per band [W1/W2/W3/W4], that indicates that the photometry and/or position measurements of a source may be contaminated or biased due to proximity to an image artifact.
The type of artifact that may contaminate the measurements is denoted by the following codes. Lower-case letters correspond to instances in which the source detection in a band is believed to be real but the measurement may be contaminated by the artifact. Upper-case letters are instances in which the source detection in a band may be a spurious detection of an artifact.

- D,d - Diffraction spike. Source may be a spurious detection of (D) or contaminated by (d) a diffraction spike from a nearby bright star on the same image, or
- P,p - Persistence. Source may be a spurious detection of (P) or contaminated by (p) a short-term latent image left by a bright source, or
- H,h - Halo. Source may be a spurious detection of (H) or contaminated by (h) the scattered light halo surrounding a nearby bright source, or
- O,o (letter "o") - Optical ghost. Source may be a spurious detection of (O) or contaminated by (o) an optical ghost image caused by a nearby bright source, or

- 0 (number zero) - Source is unaffected by known artifacts.

A source extraction may be affected by more than one type of artifact or condition. In this event, the cc_flags value in each band is set in the following priority order: D,P,H,O,d,p,h,o,0.
A source can appear in the AllWISE Source Catalog even if it is flagged as a spurious artifact detection in a band if there is a reliable detection in another band that is not flagged as a spurious artifact detection.
CAUTION: Non-zero cc_flags values in any band indicate the the measurement in that band may be contaminated and the photometry should be used with caution.

EXT_FLAG : Extended source flag (short)

Extended source flag.
This is an integer flag, the value of which indicates whether or not the morphology of a source is consistent with the WISE point spread function in any band, or whether the source is associated with or superimposed on a previously known extended object from the 2MASS Extended Source Catalog (XSC).
The values of the ext_flag indicate the following conditions:

- 0 - The source shape is consistent with a point-source and the source is not associated with or superimposed on a 2MASS XSC source
- 1 - The profile-fit photometry goodness-of-fit is >3.0 in one or more bands.
- 2 - The source falls within the extrapolated isophotal footprint of a 2MASS XSC source.
- 3 - The profile-fit photometry goodness-of-fit is >3.0 in one or more bands, and the source falls within the extrapolated isophotal footprint of a 2MASS XSC source.
- 4 - The source position falls within 5 arcsec of a 2MASS XSC source.
- 5 - The profile-fit photometry goodness-of-fit is >3.0 in one or more bands, and the source position falls within 5 arcsec of a 2MASS XSC source.

CAUTION: WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

VAR_FLAG : Variability flag (string)

Variability flag.
The variability flag is a four-character string, one character per band, in which the value for each band is related to the probability that the source flux measured on the individual WISE exposures was not constant with time.
The probability is computed for a band only when there are at least six single-exposure measurements available that satisfy minimum quality criteria.
A value of "n" in a band indicates insufficient or inadequate data to make a determination of possible variability.
Values of "0" through "9" indicate increasing probabilities of variation. Values of "0" through "5" are most likely not variables.
Sources with values of "6" and "7" are likely flux variables, but are the most susceptible to false-positive variability.
VarFlag values greater than "7" have the highest probability of being true flux variables in a band.

CAUTION: Estimation of flux variability is unreliable for sources that are extended (ext_flag>0), and sources whose measurements are contaminated by image artifacts in a band (cc_flags[band] $! =' 0'$).

PH_QUAL : Photometric quality flag (string)

Photometric quality flag.
Four character flag, one character per band [W1/W2/W3/W4], that provides a shorthand summary of the quality of the profile-fit photometry measurement in each band, as derived from the measurement signal-to-noise ratio.

- A - Source is detected in this band with a flux signal-to-noise ratio >10.
- B - Source is detected in this band with a flux signal-to-noise ratio $3< snr <10$.
- C - Source is detected in this band with a flux signal-to-noise ratio $2< snr <3$.
- U - Upper limit on magnitude. Source measurement has w?snr<2. The profile-fit magnitude w?mpro is a 95% confidence upper limit.
- X - A profile-fit measurement was not possible at this location in this band. The value of w?mpro and w?sigmpro will be "null" in this band.
- Z - A profile-fit source flux measurement was made at this location, but the flux uncertainty could not be measured. The value of w?sigmpro will be "null" in this band. The value of w?mpro will be "null" if the measured flux, w?flux, is negative, but will not be "null" if the flux is positive. If a non-null magnitude is present, it corresponds to the true flux, and not the 95% confidence upper limit. This occurs for a small number of sources found in a narrow range of ecliptic longitude which were covered by a large number of saturated pixels from 3-Band Cryo single-exposures.

W1MJD_MEAN : Average mJD of W1 observation (double, Time[Julian Date (day)])

The average modified Julian Date (mJD) of the W1 single-exposures covering the source.

W2MJD_MEAN : Average mJD of W2 observation (double, Time[Julian Date (day)])

The average modified Julian Date (mJD) of the W2 single-exposures covering the source.

W3MJD_MEAN : Average mJD of W3 observation (double, Time[Julian Date (day)])

The average modified Julian Date (mJD) of the W3 single-exposures covering the source.

W4MJD_MEAN : Average mJD of W4 observation (double, Time[Julian Date (day)])

The average modified Julian Date (mJD) of the W4 single-exposures covering the source.

W1GMAG : W1 elliptical aperture magnitude (double, Magnitude[mag])

W1 magnitude of source measured in the elliptical aperture.
WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate

the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

w1gmag_error : Error on W1 elliptical aperture magnitude (double, Magnitude[mag])

Uncertainty in the W1 magnitude of source measured in elliptical aperture.
CAUTION: A w1gerr value of 9.999 indicates that the measurement uncertainty is very large, or the uncertainty could not be computed. In either case, the w1gmag measurement should be considered highly suspect.

w2gmag : W2 elliptical aperture magnitude (double, Magnitude[mag])

W2 magnitude of source measured in the elliptical aperture.
WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

w2gmag_error : Error on W2 elliptical aperture magnitude (double, Magnitude[mag])

Uncertainty in the W2 magnitude of source measured in elliptical aperture.

CAUTION: A w2gerr value of 9.999 indicates that the measurement uncertainty is very large, or the uncertainty could not be computed. In either case, the w2gmag measurement should be considered highly suspect.

w3gmag : W3 elliptical aperture magnitude (double, Magnitude[mag])

W3 magnitude of source measured in the elliptical aperture.
WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

w3gmag_error : Error on W3 elliptical aperture magnitude (double, Magnitude[mag])

Uncertainty in the W3 magnitude of source measured in elliptical aperture.

CAUTION: A w3gerr value of 9.999 indicates that the measurement uncertainty is very large, or the uncertainty could not be computed. In either case, the w3gmag measurement should be considered highly suspect.

w4gmag : W4 elliptical aperture magnitude (double, Magnitude[mag])

W4 magnitude of source measured in the elliptical aperture.
WISE profile-fit (w?mpro) measurements are optimized for point sources and will systematically underestimate the true flux of resolved objects. If a source entry has ext_flag>0, you may wish to examine the elliptical aperture photometry which are measured using areas that are scaled from 2MASS XSC morphologies.

w4gmag_error : Error on W4 elliptical aperture magnitude (double, Magnitude[mag])

Uncertainty in the W4 magnitude of source measured in elliptical aperture.

CAUTION: A w4gError value of 9.999 indicates that the measurement uncertainty is very large, or the uncertainty could not be computed. In either case, the w4gmag measurement should be considered highly suspect.

TMASS_KEY : 2MASS PSC association (long)

2MASS PSC association.
Unique identifier of the closest source in the 2MASS Point Source Catalog (PSC) that falls within 3 arcsec of the non-motion fit position of this WISE source. This is equivalent to the pts_key in the 2MASS PSC entry.
This column is "null" if there is no 2MASS PSC source within 3 arcsec of the WISE source position.

1.4.2 GSC23_ORIGINAL_VALID

GSC 2.3 Catalogue
Reference paper: Lasker et al. 2008, AJ 136,735
Original catalogue: R. Smart private communication

Columns description:

GSC23_OID : Unique Numeric Identifier (long)

Incremental unique numeric identifier (increasing with declination). This is the only field which was not in the original GSC2.3 catalogue, but was added for cross-match purposes.

GSC23_IDENTIFIER : source Id in original catalog (string)

The GSC2.3 identification is made of 10 characters, the first four representing the level-6 HTM (Hierarchical Triangular Mesh) coded in base 36 (0..9 and A..Z), and the last 6 represent a zero-filled sequence number assigned to each source upon initial detection.

RA : RA, ICRS (double, Angle[deg])

J2000 right ascension with respect to the ICRS.

DEC : DEC, ICRS (double, Angle[deg])

J2000 declination with respect to the ICRS.

POSITION_EPOCH : Position Epoch (double, Time[Julian Years])

Plate epoch for GSC-II objects. For Tycho-2 objects, for which RA epoch and DEC epoch are different, the RA epoch is given.

RA_ERROR : Reference error in RAcosDEC (double, Angle[arcsec])

Reference error in RA*cos(DEC) at position epoch (position_epoch). These astrometric errors are not formal statistical uncertainties but raw and conservative estimates to be used for telescope operations.

DEC_ERROR : Reference error in DEC (double, Angle[arcsec])

Reference error in DEC at position epoch (position_epoch). These astrometric errors are not formal statistical uncertainties but raw and conservative estimates to be used for telescope operations.

FPG_MAG : Rf photographic magnitude (double, Magnitude[mag])

Magnitude in Rf photographic band (red).

FPG_MAG_ERROR : Reference error on Rf (double, Magnitude[mag])

Reference error in Rf photographic band (red).
These photometric errors are not formal statistical uncertainties but raw and conservative estimates to be used for telescope operations.

FPG_MAG_CODE : Rf filter Code (short)

coded emulsion / bandpass / filter:

---

bcode Name Emulsion/Filter

---

35 Fpg IIIaF+RG610 (POSS-II Red)
36 Fpg IIIaF+OG590 (SERC-ER/SR, AAO-R/GR)

JPG_MAG : Bj photographic magnitude (double, Magnitude[mag])

Magnitude in Bj photographic band (blue).

JPG_MAG_ERROR : Reference error on Bj (double, Magnitude[mag])

Reference error in Bj photographic band (blue).
These photometric errors are not formal statistical uncertainties but raw and conservative estimates to be used for telescope operations.

JPG_MAG_CODE : Bj filter Code (short)

coded emulsion / bandpass / filter:

---

bcode Name Emulsion/Filter

---

0 Jpg IIIaJ+GG395 (SERC-J/EJ)
18 Jpg IIIaJ+GG385 (POSS-II Blue)

V_MAG : V (photographic) magnitude (double, Magnitude[mag])

Magnitude in V band.
This magnitude may include:

- photographic $\mathrm{V}_1$2 or $\mathrm{V}_4$85 from IIaD plates,
- V_T of Tycho-2 stars, or
- Johnson V from SKY2000

V_MAG_ERROR : Reference error on V (double, Magnitude[mag])

Reference error in V band.
These photometric errors are not formal statistical uncertainties but raw and conservative estimates to be used for telescope operations.

V_MAG_CODE : V filter Code (short)

coded emulsion / bandpass / filter:

bcode	Name	Emulsion/Filter
1	V	IIaD+W12 (Pal Quick-V)
4	V	(Johnson)
6	V495	IIaD+GG495 (Pal QV/AAO XV)
42	VT	TYCHO-V

NPG_MAG : In photographic magnitude (double, Magnitude[mag])

Magnitude in In photographic band.

NPG_MAG_ERROR : Reference error on In (double, Magnitude[mag])

Reference error in In photographic band.
These photometric errors are not formal statistical uncertainties but raw and conservative estimates to be used for telescope operations.

NPG_MAG_CODE : In filter Code (short)

coded emulsion / bandpass / filter:

bcode	Name	Emulsion/Filter
37	Npg	IVN+RG9 (POSS-II IR)
38	Npg	IVN+RG715 (SERC-IR)

B_MAG : B magnitude (double, Magnitude[mag])

Magnitude in B band.
This filter may include:

- B_T of Tycho-2 stars,
- Johnson B from SKY2000, or
- photographic O from pOSS-I.

B_MAG_ERROR : Reference error on B (double, Magnitude[mag])

Reference error in B band.
These photometric errors are not formal statistical uncertainties but raw and conservative estimates to be used for telescope operations.

B_MAG_CODE : B filter Code (short)

coded emulsion / bandpass / filter:

bcode Name Emulsion/Filter

3 B (Johnson)
7 O 103aO+no filter (POSS-I Blue)
41 BT TYCHO-B

CLASSIFICATION : Morphological classification (short)

Image classification:
0 = ”star”, i.e. point-like object
3 = ”nonstar”, i.e. extended object

STATUS : Object processing status flag (string)

The status code is a 10-digit field encoding the properties of the catalog object.
This flag is 99999900 for a Tycho object and 88888800 for SKY2000 object.

digit	explanation	values
........xx	Number of plates on which the object appeared	
.......x..	Centroid type associated with the exported position	0 = barycenter 1 = circular gaussian
		2 = elliptical gaussian
		3 = FPA-applied barycenter
		4 = multicircular
		5 = multielliptical
		6 = FPA + circular
		7 = FPA + elliptical
......x...	Quality of exported J magnitude	0 = not present
		1 = fit
		2 = extrapolated
.....x....	Quality of exported F magnitude	0 = not present
		1 = fit
		2 = extrapolated
....x.....	Quality of exported V magnitude	0 = not present
		1 = fit
		2 = extrapolated
...x......	Classification unanimity	0 = mixed vote
		1 = unanimous vote
		2 = unanimous defect
..x.......	Classification voters	0 = several 15um scan
		1 = one 15um scan
		2 = several 25um scan
		3 = one 25um scan
.x........	Processing status	0 = complete processing on all plates
		1 = object too big (>2562 pix) on at least one plate
x.........	Deblending	0 = single object on all plates
		1 = child (deblended) object on at least one plate.

FPA = Fractional Pixel Allocation

MULT_FLAG : Multiple object flag (short)

This flag concerns only the Tycho stars (Status=99999900).

1.4.3 HIPPARCOS_NEWREDUCTION

Hipparcos New Reduction: The Astrometric Catalogue

Hipparcos, the new Reduction of the Raw data van Leeuwen F. Astron. Astrophys. 474, 653 (2007) http://dx.doi.org/10.1051/0004-6361:20078357

A new reduction of the astrometric data as produced by the Hipparcos mission has been published, claiming accuracies for nearly all stars brighter than magnitude Hp=8 to be better, by up to a factor 4, than in the original catalogue. The new Hipparcos astrometric catalogue is checked for the quality of the data and the consistency of the formal errors as well as the possible presence of error correlations. The differences with the earlier publication are explained. Methods. The internal errors are followed through the reduction process, and the external errors are investigated on the basis of a comparison with radio observations of a small selection of stars, and the distribution of negative parallaxes. Error correlation levels are investigated and the reduction by more than a factor 10 as obtained in the new catalogue is explained. Results. The formal errors on the parallaxes for the new catalogue are confirmed. The presence of a small amount of additional noise, though unlikely, cannot be ruled out. Conclusions. The new reduction of the Hipparcos astrometric data provides an improvement by a factor 2.2 in the total weight compared to the catalogue published in 1997, and provides much improved data for a wide range of studies on stellar luminosities and local galactic kinematics.

Note that the covariance matrix is stored in a rather obscure form in this catalogue. The way to reconstruct it from the existing fields is described in Appendix B of https://ui.adsabs.harvard.edu/#abs/2014A&A...571A..85M/abstract

Columns description:

HIP : Hipparcos identifier (int)

Hipparcos identifier

IC : Entry in one of the supplementary catalogues (int)

Entry in one of the supplementary catalogues

RA : Right Ascension in ICRS, Ep=1991.25 (double, Angle[deg])

Right Ascension in ICRS, Ep=1991.25

DEC : Declination in ICRS, Ep=1991.25 (double, Angle[deg])

Declination in ICRS, Ep=1991.25

RA_RAD : Right Ascension in ICRS, Ep=1991.25 (double, Angle[rad])

Right Ascension in ICRS, Ep=1991.25

DE_RAD : Declination in ICRS, Ep=1991.25 (double, Angle[rad])

Declination in ICRS, Ep=1991.25

PLX : Parallax (double, Angle[mas])

Parallax

PM_RA : Proper motion in Right Ascension (double, Angular Velocity[mas/year])

Proper motion in Right Ascension

PM_DE : Proper motion in Declination (double, Angular Velocity[mas/year])

Proper motion in Declination

E_RA_RAD : Formal error on ra_rad (double, Angle[mas])

Formal error on ra_rad

E_DE_RAD : Formal error on de_rad (double, Angle[mas])

Formal error on de_rad

E_PLX : Formal error on parallax (double, Angle[mas])

Formal error on parallax

E_PM_RA : Formal error on pm_ra (double, Angular Velocity[mas/year])

Formal error on pm_ra

E_PM_DE : Formal error on pm_de (double, Angular Velocity[mas/year])

Formal error on pm_de

F1 : Percentage rejected data (int, Dimensionless[percentage/100])

Percentage rejected data

F2 : Goodness of fit (double)

Goodness of fit

NC : Number of components (int)

Number of components

NTR : Number of field transits used (int)

Number of field transits used

U3 : Upper-triangular weight matrix element 3 (double)

Upper-triangular weight matrix element 3; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

U4 : Upper-triangular weight matrix element 4 (double)

Upper-triangular weight matrix element 4; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u5 : Upper-triangular weight matrix element 5 (double)

Upper-triangular weight matrix element 5; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u6 : Upper-triangular weight matrix element 6 (double)

Upper-triangular weight matrix element 6; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u7 : Upper-triangular weight matrix element 7 (double)

Upper-triangular weight matrix element 7; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

U8 : Upper-triangular weight matrix element 8 (double)

Upper-triangular weight matrix element 8; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

U9 : Upper-triangular weight matrix element 9 (double)

Upper-triangular weight matrix element 9; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

SN : [0,159] Solution type new reduction (int)

[0,159] Solution type new reduction

The solution type is a number 10xd+s consisting of two parts d and s:

s describes the type of solution adopted:
1 = stochastic solution (dispersion is given in the 'var' column)
3 = VIM solution (additional parameters in file hipvim.dat)
5 = 5-parameter solution (this file)
7 = 7-parameter solution (additional parameters in hip7p.dat)
9 = 9-parameter solution (additional parameters in hip9p.dat)

d describes peculiarities, as a combination of values:
0 = single star
1 = double star
2 = variable in the system with amplitude > 0.2mag
4 = astrometry refers to the photocenter
8 = measurements concern the secondary (fainter) in the double system

SO : [0,5] Solution type old reduction (int)

[0,5] Solution type old reduction

as follows: 0 = standard 5-parameter solution 1 = 7- or 9-parameter solution 2 = stochastic solution 3 = double and multiple stars 4 = orbital binary as resolved in the published catalog 5 = VIM (variability-induced mover) solution

VAR : Cosmic dispersion added (stochastic solution) (double)

Cosmic dispersion added (stochastic solution)

U1 : Upper-triangular weight matrix element 1 (double)

Upper-triangular weight matrix element 1; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$\mathrm{C}^{-1} = \mathrm{U}^T\mathrm{U}$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u2 : Upper-triangular weight matrix element 2 (double)

Upper-triangular weight matrix element 2; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$\mathrm{C}^{-1} = \mathrm{U}^T\mathrm{U}$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u10 : Upper-triangular weight matrix element 10 (double)

Upper-triangular weight matrix element 10; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$\mathrm{C}^{-1} = \mathrm{U}^T\mathrm{U}$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u11 : Upper-triangular weight matrix element 11 (double)

Upper-triangular weight matrix element 11; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u12 : Upper-triangular weight matrix element 12 (double)

Upper-triangular weight matrix element 12; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u13 : Upper-triangular weight matrix element 13 (double)

Upper-triangular weight matrix element 13; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$\mathrm{C}^{-1} = \mathrm{U}^T\mathrm{U}$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u14 : Upper-triangular weight matrix element 14 (double)

Upper-triangular weight matrix element 14; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$\mathrm{C}^{-1} = \mathrm{U}^T\mathrm{U}$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

u15 : Upper-triangular weight matrix element 15 (double)

Upper-triangular weight matrix element 15; see *Hipparcos, the New Reduction of the Raw data*, Appendix C (van Leeuwen, 2007).

The upper-triangular weight matrix U is related to the covariance matrix C by

$$C^{-1} = U^T U$$

and the elements U_i forming the upper triangular matrix are indexed as

$$\begin{pmatrix} U_1 & U_2 & U_4 & U_7 & U_{11} \\ 0 & U_3 & U_5 & U_8 & U_{12} \\ 0 & 0 & U_6 & U_9 & U_{13} \\ 0 & 0 & 0 & U_{10} & U_{14} \\ 0 & 0 & 0 & 0 & U_{15} \end{pmatrix}$$

on the astrometric parameters RA, Dec, parallax, proper motion in RA, proper motion in Dec (in the case of 5-parameter solutions as above) and derivatives of those proper motion components (in the case of 7- and 9-parameter solutions).

HP_MAG : Hipparcos magnitude (double, Magnitude[mag])

Hipparcos magnitude

B_V : Colour index (double, Magnitude[mag])

Colour index

V_I : V-I colour index (double, Magnitude[mag])

V-I colour index

E_HP_MAG : Error on mean Hpmag (double, Magnitude[mag])

Error on mean Hpmag

E_B_V : Formal error on colour index (double, Magnitude[mag])

Formal error on colour index

S_HP : Scatter of Hpmag (double, Magnitude[mag])

Scatter of Hpmag

VA : [0,2] Reference to variability annex (int)

[0,2] Reference to variability annex

1.4.4 PANSTARRS1_ORIGINAL_VALID

The Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) is a system for wide-field astronomical imaging developed and operated by the Institute for Astronomy at the University of Hawaii. Pan-STARRS1 (PS1) is the first part of Pan-STARRS to be completed and is the basis for Data Release 1 (DR1). The PS1 survey used a 1.8 meter telescope and its 1.4 Gigapixel camera to image the sky in five broadband filters (g, r, i, z, y).

The current table contains a filtered subsample of the 10 723 304 629 entries listed in the original ObjectThin table.
We used only ObjectThin and MeanObject tables to extract `panstarrs1OriginalValid` table, this means that objects detected only in stack images are not included here. The main reason for us to avoid the use of objects detected in stack images is that their astrometry is not as good as the mean objects astrometry: "The stack positions (raStack, decStack) have considerably larger systematic astrometric errors than the mean epoch positions (raMean, decMean)." The astrometry for the MeanObject positions uses Gaia DR1 as a reference catalog, while the stack positions use 2MASS as a reference catalog.

In details, we filtered out all objects where:

- `n_detections` = 1
- no good quality data in Pan-STARRS, `obj_info_flag` 33554432 not set
- mean astrometry could not be measured, `obj_info_flag` 524288 set
- stack position used for mean astrometry, `obj_info_flag` 1048576 set
- error on all magnitudes equal to 0 or to -999;
- all magnitudes set to -999;
- error on RA or DEC greater than 1 arcsec.

The number of objects in `panstarrs1OriginalValid` is 2 264 263 282.

The `panstarrs1OriginalValid` table contains only a subset of the columns available in the combined ObjectThin and MeanObject tables. A description of the original ObjectThin and MeanObjects tables can be found at: `https://outerspace.stsci.edu/display/PANSTARRS/PS1+Database+object+and+detection+tables`

Download:
`http://mastweb.stsci.edu/ps1casjobs/home.aspx`
Documentation:
`https://outerspace.stsci.edu/display/PANSTARRS`
`http://pswww.ifa.hawaii.edu/pswww/`
References:
The Pan-STARRS1 Surveys, Chambers, K.C., et al. 2016, arXiv:1612.05560
Pan-STARRS Data Processing System, Magnier, E. A., et al. 2016, arXiv:1612.05240
Pan-STARRS Pixel Processing: Detrending, Warping, Stacking, Waters, C. Z., et al. 2016, arXiv:1612.05245
Pan-STARRS Pixel Analysis: Source Detection and Characterization, Magnier, E. A., et al. 2016, arXiv:1612.05244
Pan-STARRS Photometric and Astrometric Calibration, Magnier, E. A., et al. 2016, arXiv:1612.05242
The Pan-STARRS1 Database and Data Products, Flewelling, H. A., et al. 2016, arXiv:1612.05243

Columns description:

OBJ_NAME : IAU name (string)

IAU name for this object (from original table ObjectThin).

OBJ_ID : Unique Object Identifier (long)

Unique object identifier (from original tables ObjectThin and MeanObject).

RA : RA Mean (float, Angle[deg])

Right Ascention from single epoch detections (weighted mean) in Equinox J2000.0 at the mean epoch given by `epoch_mean` and calibrated against Gaia DR1 (from original table ObjectThin).

DEC : DEC Mean (float, Angle[deg])

Declination from single epoch detections (weighted mean) in Equinox J2000.0 at the mean epoch given by `epoch_mean` and calibrated against Gaia DR1 (from original table ObjectThin).

RA_ERROR : RA Mean standard deviation (double, Angle[arcsec])

Right Ascension standard deviation from single epoch detections (from original table ObjectThin).

DEC_ERROR : DEC Mean standard deviation (double, Angle[arcsec])

Declination standard deviation from single epoch detections (from original table ObjectThin).

EPOCH_MEAN : Epoch Mean (float, Time[day])

Modified Julian Date of the mean epoch corresponding to raMean, decMean (equinox J2000). From original table ObjectThin.

G_MEAN_PSF_MAG : Mean magnitude in g filter (double)

Mean PSF magnitude (AB magnitude) from g filter detections (from original table MeanObject).

G_MEAN_PSF_MAG_ERROR : Error in Mean magnitude in g filter (double, Magnitude[mag])

Error in mean PSF magnitude (AB magnitude) from g filter detections (from original table MeanObject).

G_FLAGS : g filter flags (int, Magnitude[mag])

Information flag bitmask for mean object from g filter detections (from original table MeanObject).
Flag values and descriptions are:

- 1 = Used within relphot (FEW): skip star.
- 2 = Used within relphot (POOR): skip star.
- 4 = Synthetic photometry used in average measurement.
- 8 = Ubercal photometry used in average measurement.
- 16 = PS1 photometry used in average measurement.
- 32 = PS1 stack photometry exists.
- 64 = Tycho photometry used for synthetic magnitudes.
- 128 = Synthetic magnitudes repaired with zeropoint map.
- 256 = Average magnitude calculated in 0th pass.
- 512 = Average magnitude calculated in 1th pass.
- 1024 = Average magnitude calculated in 2th pass.
- 2048 = Average magnitude calculated in 3th pass.
- 4096 = Average magnitude calculated in 4th pass.
- 8192 = Extended in this band (PSPS only).
- 16384 = PS1 stack photometry comes from primary skycell.

R_MEAN_PSF_MAG : Mean magnitude in r filter (double, Magnitude[mag])

Mean PSF magnitude (AB magnitude) from r filter detections (from original table MeanObject).

R_MEAN_PSF_MAG_ERROR : Error in Mean magnitude in r filter (double, Magnitude[mag])

Error in mean PSF magnitude (AB magnitude) from r filter detections (from original table MeanObject).

R_FLAGS : r filter flags (int)

Information flag bitmask for mean object from r filter detections (from original table MeanObject).
Flag values and descriptions are:

- 1 = Used within relphot (FEW): skip star.
- 2 = Used within relphot (POOR): skip star.
- 4 = Synthetic photometry used in average measurement.
- 8 = Ubercal photometry used in average measurement.
- 16 = PS1 photometry used in average measurement.

- 32 = PS1 stack photometry exists.
- 64 = Tycho photometry used for synthetic magnitudes.
- 128 = Synthetic magnitudes repaired with zeropoint map.
- 256 = Average magnitude calculated in 0th pass.
- 512 = Average magnitude calculated in 1th pass.
- 1024 = Average magnitude calculated in 2th pass.
- 2048 = Average magnitude calculated in 3th pass.
- 4096 = Average magnitude calculated in 4th pass.
- 8192 = Extended in this band (PSPS only).
- 16384 = PS1 stack photometry comes from primary skycell.

I_MEAN_PSF_MAG : Mean magnitude in i filter (double, Magnitude[mag])

Mean PSF magnitude (AB magnitude) from i filter detections (from original table MeanObject).

I_MEAN_PSF_MAG_ERROR : Error in Mean magnitude in i filter (double, Magnitude[mag])

Error in mean PSF magnitude (AB magnitude) from i filter detections (from original table MeanObject).

I_FLAGS : i filter flags (int)

Information flag bitmask for mean object from i filter detections (from original table MeanObject).
Flag values and descriptions are:

- 1 = Used within relphot (FEW): skip star.
- 2 = Used within relphot (POOR): skip star.
- 4 = Synthetic photometry used in average measurement.
- 8 = Ubercal photometry used in average measurement.
- 16 = PS1 photometry used in average measurement.
- 32 = PS1 stack photometry exists.
- 64 = Tycho photometry used for synthetic magnitudes.
- 128 = Synthetic magnitudes repaired with zeropoint map.
- 256 = Average magnitude calculated in 0th pass.
- 512 = Average magnitude calculated in 1th pass.
- 1024 = Average magnitude calculated in 2th pass.
- 2048 = Average magnitude calculated in 3th pass.

- 4096 = Average magnitude calculated in 4th pass.
- 8192 = Extended in this band (PSPS only).
- 16384 = PS1 stack photometry comes from primary skycell.

Z_MEAN_PSF_MAG : Mean magnitude in z filter (double, Magnitude[mag])

Mean PSF magnitude (AB magnitude) from z filter detections (from original table MeanObject).

Z_MEAN_PSF_MAG_ERROR : Error in Mean magnitude in z filter (double, Magnitude[mag])

Error in mean PSF magnitude (AB magnitude) from z filter detections (from original table MeanObject).

Z_FLAGS : z filter flags (int)

Information flag bitmask for mean object from z filter detections (from original table MeanObject).
Flag values and descriptions are:

- 1 = Used within relphot (FEW): skip star.
- 2 = Used within relphot (POOR): skip star.
- 4 = Synthetic photometry used in average measurement.
- 8 = Ubercal photometry used in average measurement.
- 16 = PS1 photometry used in average measurement.
- 32 = PS1 stack photometry exists.
- 64 = Tycho photometry used for synthetic magnitudes.
- 128 = Synthetic magnitudes repaired with zeropoint map.
- 256 = Average magnitude calculated in 0th pass.
- 512 = Average magnitude calculated in 1th pass.
- 1024 = Average magnitude calculated in 2th pass.
- 2048 = Average magnitude calculated in 3th pass.
- 4096 = Average magnitude calculated in 4th pass.
- 8192 = Extended in this band (PSPS only).
- 16384 = PS1 stack photometry comes from primary skycell.

Y_MEAN_PSF_MAG : Mean magnitude in y filter (double, Magnitude[mag])

Mean PSF magnitude (AB magnitude) from y filter detections (from original table MeanObject).

Y_MEAN_PSF_MAG_ERROR : Error in Mean magnitude in y filter (double, Magnitude[mag])

Error in mean PSF magnitude (AB magnitude) from y filter detections (from original table MeanObject).

Y_FLAGS : y filter flags (int)

Information flag bitmask for mean object from z filter detections (from original table MeanObject).
Flag values and descriptions are:

- 1 = Used within relphot (FEW): skip star.
- 2 = Used within relphot (POOR): skip star.
- 4 = Synthetic photometry used in average measurement.
- 8 = Ubercal photometry used in average measurement.
- 16 = PS1 photometry used in average measurement.
- 32 = PS1 stack photometry exists.
- 64 = Tycho photometry used for synthetic magnitudes.
- 128 = Synthetic magnitudes repaired with zeropoint map.
- 256 = Average magnitude calculated in 0th pass.
- 512 = Average magnitude calculated in 1th pass.
- 1024 = Average magnitude calculated in 2th pass.
- 2048 = Average magnitude calculated in 3th pass.
- 4096 = Average magnitude calculated in 4th pass.
- 8192 = Extended in this band (PSPS only).
- 16384 = PS1 stack photometry comes from primary skycell.

N_DETECTIONS : Number of detections (short)

Number of single epoch detections summed over all filters (from original table ObjectThin).

ZONE_ID : Local zone index (int)

Local zone index, found by dividing the sky into bands of declination 1/2 arcminute in height: zoneID = floor((90 + declination)/0.0083333). From original table ObjectThin.

OBJ_INFO_FLAG : Object information flags (int)

Information flag bitmask indicating details of the photometry (from original table ObjectThin).
Flag values and descriptions are:

- 0 = Initial value; resets all bits.
- 1 = Used within relphot (FEW); skip star.
- 2 = Used within relphot (POOR); skip star.
- 4 = object IDed with known ICRF quasar (may have ICRF position measurement).
- 8 = identified as likely QSO (Hernitschek et al 2015), $P_{QSO} \geq 0.60$.
- 16 = identified as possible QSO (Hernitschek et al 2015), $P_{QSO} \geq 0.05$.
- 32 = identified as likely RR Lyra (Hernitschek et al 2015), $P_{RRLyra} \geq 0.60$.
- 64 = identified as possible RR Lyra (Hernitschek et al 2015), $P_{RRLyra} \geq 0.05$.
- 128 = identified as a variable based on ChiSq (Hernitschek et al 2015).
- 256 = identified as a non-periodic (stationary) transient.
- 512 = at least one detection identified with a known solar-system object (asteroid or other).
- 1024 = most detections identified with a known solar-system object (asteroid or other).
- 2048 = star with large proper motion.
- 4096 = simple weighted average position was used (no IRLS fitting).
- 8192 = average position was fitted.
- 16384 = proper motion model was fitted.
- 32768 = parallax model was fitted.
- 65536 = average position used (not PM or PAR).
- 131072 = proper motion used (not AVE or PAR).
- 262144 = parallax used (not AVE or PM).
- 524288 = mean astrometry could not be measured.
- 1048576 = stack position used for mean astrometry.
- 2097152 = mean astrometry used for stack position.
- 4194304 = failure to measure proper-motion model.
- 8388608 = extended in our data (eg, PS).
- 16777216 = extended in external data (eg, 2MASS).
- 33554432 = good-quality measurement in our data (eg,PS).
- 67108864 = good-quality measurement in external data (eg, 2MASS).
- 134217728 = good-quality object in the stack (> 1 good stack measurement).
- 268435456 = the primary stack measurements are the best measurements.
- 536870912 = suspect object in the stack (no more than 1 good measurement, 2 or more suspect or good stack measurement).

- 1073741824 = poor-quality stack object (no more than 1 good or suspect measurement).

QUALITY_FLAG : Object quality flags (short)

Subset of obj_info_flag denoting whether this object is real or a likely false positive (from original table ObjectThin).
Flag values and descriptions are:

- 0 = Initial value; resets all bits.
- 1 = Extended in our data (eg, PS).
- 2 = Extended in external data (eg, 2MASS).
- 4 = Good-quality measurement in our data (eg,PS).
- 8 = Good-quality measurement in external data (eg, 2MASS).
- 16 = good-quality object in the stack (> 1 good stack measurement).
- 32 = the primary stack measurements are the best measurements.
- 64 = suspect object in the stack (no more than 1 good measurement, 2 or more suspect or good stack measurement).
- 128 = poor-quality stack object (no more than 1 good or suspect measurement).

1.4.5 PPMXL_ORIGINAL_VALID

PPMXL Catalogue
Reference papers:
PPMXL: Roeser et al. 2010, AJ 139, 2440
PPMX: Roeser et al. 2008,A&A 488, 401
Original Catalogue:
VO access: `http://vo.uni-hd.de/ppmxl`

Columns description:

PPMXL_OID : Unique Numeric Identifier (long)

Incremental unique numeric identifier (increasing with declination). This field was not in the original PPMXL catalogue, but was added for cross-match purposes.

IPIX : source Id in original catalog (long)

Identifier (Q3C ipix of the USNO-B 1.0 object)

RA : RA, ICRS, epoch J2000.0 (double, Angle[deg])

J2000 right ascension with respect to the ICRS, epoch 2000.0

DEC : DEC, ICRS, epoch J2000.0 (double, Angle[deg])

J2000 declination with respect to the ICRS, epoch 2000.0.

RA_ERROR_EPRA : mean error at mean epoch in RAcosDEC (double, Angle[mas])

Mean error in RA*cos(DEC) at mean epoch.

DEC_ERROR_EPDE : mean error at mean epoch in DEC (double, Angle[mas])

Mean error in DEC at mean epoch.

PMRA : proper motion in RAcosDEC (double, Angular Velocity[mas/year])

Proper motion in RA*cos(DEC).

PMDE : proper motion in DEC (double, Angular Velocity[mas/year])

Proper motion in Declination.

PMRA_ERROR : mean error in proper motion in RAcosDEC (double, Angular Velocity[mas/year])

Mean error in proper motion in RA*cos(DEC).

PMDE_ERROR : mean error in proper motion in DEC (double, Angular Velocity[mas/year])

Mean error in proper motion in DEC.

N_EPOCHS : number of epochs used for proper motions (short)

Number of catalogs (epoch) used for proper motions.
May be blank (null) for stars coming from ARIHIP or Tycho-2 via PPMX (i.e. bit#1 is set in "fl").

EPRA : Mean RA Epoch (double, Time[Julian Years])

Mean Epoch for RA.

EPDE : Mean DEC Epoch (double, Time[Julian Years])

Mean Epoch for DEC.

B1MAG : USNO B mag first epoch (double, Magnitude[mag])

B mag from USNO-B, first epoch.

Magnitudes from USNO-B should be used with care, photometric calibration may be severely off for some plates.
For objects from PPMX (bit#1 set in "fl"), these magnitudes have a special meaning:

Column	[PPMX]	Content
b1mag	[Cmag]	Catalogue magnitude from source
b2mag	[Bmag]	Johnson B magnitude
r1mag	[Rmag]	calculated Ru (UCAC) magnitude from source
r2mag	—	(always empty)
imag	[Vmag]	Johnson V magnitude

B2MAG : USNO B mag second epoch (double, Magnitude[mag])

B mag from USNO-B, second epoch.

Magnitudes from USNO-B should be used with care, photometric calibration may be severely off for some plates. For objects from PPMX (bit#1 set in ”fl”), these magnitudes have a special meaning:

Column	[PPMX]	Content
b1mag	[Cmag]	Catalogue magnitude from source
b2mag	[Bmag]	Johnson B magnitude
r1mag	[Rmag]	calculated Ru (UCAC) magnitude from source
r2mag	—	(always empty)
imag	[Vmag]	Johnson V magnitude

R1MAG : USNO R mag first epoch (double, Magnitude[mag])

R mag from USNO-B, first epoch.

Magnitudes from USNO-B should be used with care, photometric calibration may be severely off for some plates. For objects from PPMX (bit#1 set in ”fl”), these magnitudes have a special meaning:

Column	[PPMX]	Content
b1mag	[Cmag]	Catalogue magnitude from source
b2mag	[Bmag]	Johnson B magnitude
r1mag	[Rmag]	calculated Ru (UCAC) magnitude from source
r2mag	—	(always empty)
imag	[Vmag]	Johnson V magnitude

R2MAG : USNO R mag second epoch (double, Magnitude[mag])

R mag from USNO-B, second epoch.

Magnitudes from USNO-B should be used with care, photometric calibration may be severely off for some plates. For objects from PPMX (bit#1 set in ”fl”), these magnitudes have a special meaning:

Column	[PPMX]	Content
b1mag	[Cmag]	Catalogue magnitude from source
b2mag	[Bmag]	Johnson B magnitude
r1mag	[Rmag]	calculated Ru (UCAC) magnitude from source
r2mag	—	(always empty)
imag	[Vmag]	Johnson V magnitude

IMAG : USNO I mag (double, Magnitude[mag])

I mag from USNO-B.

Magnitudes from USNO-B should be used with care, photometric calibration may be severely off for some plates. For objects from PPMX (bit#1 set in ”fl”), these magnitudes have a special meaning:

Column	[PPMX]	Content
b1mag	[Cmag]	Catalogue magnitude from source
b2mag	[Bmag]	Johnson B magnitude
r1mag	[Rmag]	calculated Ru (UCAC) magnitude from source
r2mag	—	(always empty)
imag	[Vmag]	Johnson V magnitude

FLAGS : flags (short)

The flag is a bitwise or number ($\Sigma 2^i$) where each bit number (i) has the meaning:
#0 (1) = if set, one of the coordinates had an excessively large chi square.
#1 (2) = Row is from PPMX. These objects are mostly Tycho stars that were masked out of USNO-B. When this bit is set, the USNO magnitudes (b1mag through imag) have special meanings.
#2 (4) = Row is from PPMX and replaces a single row from USNO-B. This is done when the astrometry from PPMX was better (in terms of error estimates) than the astrometry of the corresponding PPMXL object.
#3 (8) = Row replaces multiple USNO-B1.0 objects. When PPMX contains an object that has more than one counterpart in PPMXL, all such counterparts are discarded on the assumption that they should have been matched in USNO-B1.0 or result from erroneous matches. For these rows, bit#1 is always 1.

1.4.6 SDSSDR9_ORIGINAL_VALID

SDSS DR9 Catalogue, primary object only, extracted from photoObj fits files.
Reference paper: Ahn et al. 2012, ApJS 203,21
Original catalogue: `http://data.sdss3.org/sas/dr9/boss/photoObj/`

Columns description:

SDSSDR9_OID : Unique Numeric Identifier (long)

Incremental unique numeric identifier (increasing with declination). This is the only field which was not in the original SDSS DR9 catalogue, but was added for cross-match purposes.

OBJ_ID : Unique SDSS identifier (string)

A number identifying an object in the image catalog for DR9. It is a bit-encoded integer of run, rerun, camcol, field, object.
The bits are assigned in objid as follows:

- **63** 0, unassigned
- **59−62** skyVersion resolved sky version
- **48−58** rerun, number of pipeline rerun
- **32−47** run, run number
- **29−31** camcol, camera column (1-6)
- **28** 0, unassigned
- **16−27** field, field number within run
- **0−15** id, object number within field

THING_ID : Unique identifier from global resolve (long)

Each unique source in the SDSS catalog is identified by the **thing_id**. Each source may have been observed more than once in multiple runs, and might therefore have multiple detections listed in the catalog. Only one detection is considered primary.

RA : RA (double, Angle[deg])

J2000 Right Ascension (from r-band, or best other band if r-band if too faint or saturated in r).

DEC : DEC (double, Angle[deg])

J2000 Declination (from r-band, or best other band if r-band if too faint or saturated in r).

RA_ERROR : Reference error in RAcosDEC (double, Angle[arcsec])

Error in RA*cos(DEC)

DEC_ERROR : Reference error in DEC (double, Angle[arcsec])

Error in DEC.

MJD : Date of observation (double, Time[day])

Modified Julian Date, used to indicate the date that a given piece of SDSS data (image or spectrum) was taken.

U_MAG : PSF magnitude in the u band (double, Magnitude[mag])

For isolated stars, which are well-described by the point spread function (PSF), the optimal measure of the total flux is determined by fitting a PSF model to the object.

U_MAG_ERROR : error on PSF magnitude in the u band (double, Magnitude[mag])

PSF magnitude error.

G_MAG : PSF magnitude in the g band (double, Magnitude[mag])

For isolated stars, which are well-described by the point spread function (PSF), the optimal measure of the total flux is determined by fitting a PSF model to the object.

G_MAG_ERROR : error on PSF magnitude in the g band (double, Magnitude[mag])

PSF magnitude error.

R_MAG : PSF magnitude in the r band (double, Magnitude[mag])

For isolated stars, which are well-described by the point spread function (PSF), the optimal measure of the total flux is determined by fitting a PSF model to the object.

R_MAG_ERROR : error on PSF magnitude in the r band (double, Magnitude[mag])

PSF magnitude error.

I_MAG : PSF magnitude in the i band (double, Magnitude[mag])

For isolated stars, which are well-described by the point spread function (PSF), the optimal measure of the total flux is determined by fitting a PSF model to the object.

I_MAG_ERROR : error on PSF magnitude in the i band (double, Magnitude[mag])

PSF magnitude error.

Z_MAG : PSF magnitude in the z band (double, Magnitude[mag])

For isolated stars, which are well-described by the point spread function (PSF), the optimal measure of the total flux is determined by fitting a PSF model to the object.

Z_MAG_ERROR : error on PSF magnitude in the z band (double, Magnitude[mag])

PSF magnitude error.

OBJC_TYPE : type classification of the object (int)

Distinguishes stars (type=6) and galaxies (type=3) based on their morphology. It is quantified on the basis of the difference between the PSF and model magnitudes.

CLEAN_FLAG : clean photometry flag for point sources (int)

Clean photometry flag for point sources (1=clean, 0=unclean).

1.4.7 TMASS_ORIGINAL_VALID

2MASS PSC Catalogue

Reference paper: Skrutskie et al. 2006, AJ 131, 1163

Documentation: `http://www.ipac.caltech.edu/2mass/releases/allsky/doc/explsup.html`

Original catalogue: `ftp://ftp.ipac.caltech.edu/pub/2mass/allsky`

Columns description:

TMASS_OID : Unique Numeric Identifier (long)

Incremental unique numeric identifier (increasing with declination). This is the only field which was not in the original 2MASS catalogue, but was added for cross-match purposes.

DESIGNATION : source Id in original catalog (string)

Sexagesimal, equatorial position-based source name in the form: hmmssss+ddmmsss[ABC...] The prefix "2MASS J" in not explicitely listed in the designation.

RA : RA, ICRS (double, Angle[deg])

J2000 right ascension with respect to the ICRS

DEC : DEC, ICRS (double, Angle[deg])

J2000 declination with respect to the ICRS

ERR_MAJ : semi-major axis pos uncertainty (float, Angle[arcsec])

Semi-major axis length of the one sigma position uncertainty ellipse

ERR_MIN : semi-minor axis pos uncertainty (float, Angle[arcsec])

Semi-minor axis length of the one sigma position uncertainty ellipse

ERR_ANG : position angle (int, Angle[deg])

Position angle on the sky of the semi-major axis of the position uncertainty ellipse (East of North)

J_M : Band J magnitude (float, Magnitude[mag])

Default J-band magnitude.
In case of a source not detected in the J-band, it is an upper limit and the corresponding total photometric uncer-

tainty is NULL.
In case of a source detected in the J-band and with no useful brightness estimate, it is set to NULL.

J_MSIGCOM : J magnitude uncertainty (float, Magnitude[mag])

Total photometric uncertainty for the default J-band magnitude. This column is NULL if the default magnitude is a 95% confidence upper limit (i.e. the source is not detected, or inconsistently deblended in the J-band).

H_M : Band H magnitude (float, Magnitude[mag])

Default H-band magnitude.
In case of a source not detected in the H-band, it is an upper limit and the corresponding total photometric uncertainty is NULL.
In case of a source detected in the H-band and with no useful brightness estimate, it is set to NULL.

H_MSIGCOM : H magnitude uncertainty (float, Magnitude[mag])

Total photometric uncertainty for the default H-band magnitude. This column is NULL if the default magnitude is a 95% confidence upper limit (i.e. the source is not detected, or inconsistently deblended in the H-band).

KS_M : Band Ks magnitude (float, Magnitude[mag])

Default Ks-band magnitude.
In case of a source not detected in the Ks-band, it is an upper limit and the corresponding total photometric uncertainty is NULL.
In case of a source detected in the Ks-band and with no useful brightness estimate, it is set to NULL.

KS_MSIGCOM : Ks magnitude uncertainty (float, Magnitude[mag])

Total photometric uncertainty for the default Ks-band magnitude. This column is NULL if the default magnitude is a 95% confidence upper limit (i.e. the source is not detected, or inconsistently deblended in the Ks-band.

EXT_KEY : UID of the record in the XSC (long)

Unique identification number of the record in the XSC (2MASS Extended Source Catalogue) that corresponds to this point source. Can be NULL if no corresponding extended source is present in the XSC.

J_DATE : Julian Date of source measurement (double, Time[Julian Date (day)])

The Julian Date of the source measurement accurate to +30 seconds. This value is extrapolated from the start time of the Survey scan using the difference between the declinations of the source and the first row in the Tile divided by the scanning rate of the telescope (approximately 5sec). The scanning rate of the two 2MASS telescopes was slightly different because of the need to optimize the dithering of images on the arrays.

PH_QUAL : JHKs Photometric quality flag (string)

Photometric quality flag. Three character flag, one character per band [JHKs], that provides a summary of the net quality of the default photometry in each band.
The value for ph_qual is set for a band according to the precedence of the table below. For example, a source that is tested and meets the conditions for category "X" is not tested for subsequent qualities.

- "X" - There is a detection at this location, but no valid brightness estimate can be extracted using any algorithm. Default magnitude is null.
- "U" - Upper limit on magnitude. Source is not detected in this band, or it is detected, but not resolved in a consistent fashion with other bands. A value of ph_qual="U" does not necessarily mean that there is no flux detected in this band at the location.
- "F" - This category includes sources where a reliable estimate of the photometric error could not be determined. The uncertainties reported for these sources in [jhk]_msigcom are flags and have numeric values >8.0.
- "E" - This category includes detections where the goodness-of-fit quality of the profile-fit photometry was very poor, or detections where psf fit photometry did not converge and an aperture magnitude is reported, or detections where the number of frames was too small in relation to the number of frames in which a detection was geometrically possible.
- "A" - Detections in any brightness regime where valid measurements were made with [jhk]_snr>10 AND [jhk]_cmsig<0.10857.
- "B" - Detections in any brightness regime where valid measurements were made with [jhk]_snr>7 AND [jhk]_cmsig<0.15510.
- "C" - Detections in any brightness regime where valid measurements were made with [jhk]_snr>5 AND [jhk]_cmsig<0.21714.
- "D" - Detections in any brightness regime where valid measurements were made with no [jhk]_snr or [jhk]_cmsig requirement.

1.4.8 TYCHO2

The Tycho-2 Catalogue is an astrometric reference catalogue containing positions and proper motions as well as two-colour photometric data for the 2.5 million brightest stars in the sky. The Tycho-2 positions and magnitudes are based on precisely the same observations as the original Tycho Catalogue (hereafter Tycho-1; see Cat. I/239)) collected by the star mapper of the ESA Hipparcos satellite, but Tycho-2 is much bigger and slightly more precise, owing to a more advanced reduction technique. Components of double stars with separations down to 0.8 arcsec are included. Proper motions precise to about 2.5 mas/yr are given as derived from a comparison with the Astrographic Catalogue and 143 other ground-based astrometric catalogues, all reduced to the Hipparcos celestial coordinate system. Tycho-2 supersedes in most applications Tycho-1, as well as the ACT (Cat. I/246) and TRC (Cat. I/250) catalogues based on Tycho-1. Supplement-1 lists stars from the Hipparcos and Tycho-1 Catalogues which are not in Tycho-2. Supplement-2 lists 1146 Tycho-1 stars which are probably either false or heavily disturbed. For more information, please consult the Tycho-2 home page: `http://www.astro.ku.dk/~erik/Tycho-2`

Columns description:

ID : Tycho 2 identifier. The TYC identifier is constructed from the GSC region number (string)

Tycho 2 identifier. The TYC identifier is constructed from the GSC region number (TYC1), the running number within the region (TYC2) and a component identifier (TYC3) which is normally 1. Some non-GSC running numbers were constructed for the first Tycho Catalogue and for Tycho-2. The recommended star designation contains a hyphen between the TYC numbers, e.g. TYC 1-13-1.

HIP : [1,120404] Hipparcos number (int)

[1,120404]? Hipparcos number

TYC1 : [1,9537]+= TYC1 from TYC or GSC (string)

[1,9537]+= TYC1 from TYC or GSC

The TYC identifier is constructed from the GSC region number (TYC1), the running number within the region (TYC2) and a component identifier (TYC3) which is normally 1. Some non-GSC running numbers were constructed for the first Tycho Catalogue and for Tycho-2. The recommended star designation contains a hyphen between the TYC numbers, e.g. TYC 1-13-1.

TYC2 : [1,12121] TYC2 from TYC or GSC (string)

[1,12121] TYC2 from TYC or GSC

The TYC identifier is constructed from the GSC region number (TYC1), the running number within the region (TYC2) and a component identifier (TYC3) which is normally 1. Some non-GSC running numbers were constructed for the first Tycho Catalogue and for Tycho-2. The recommended star designation contains a hyphen between the TYC numbers, e.g. TYC 1-13-1.

TYC3 : [1,3] TYC3 from TYC (string)

[1,3] TYC3 from TYC

The TYC identifier is constructed from the GSC region number (TYC1), the running number within the region (TYC2) and a component identifier (TYC3) which is normally 1. Some non-GSC running numbers were constructed for the first Tycho Catalogue and for Tycho-2. The recommended star designation contains a hyphen between the TYC numbers, e.g. TYC 1-13-1.

ID_TYCHO : Numeric tycho2 identifier (long)

These are the IDs as published in tycho2. In TYCHO-2 objects were identified by 3 numbers (TYC1,TYC2 and TYC3) and we have combined these into one complete number given by (TYC1*1000000.0d0)+(TYC2*10.0d0)+(TYC3*1.0d0)

TYC : [T] Tycho-1 star (string)

[T] Tycho-1 star

' ' = no Tycho-1 star was found within 0.8 arcsec (quality 1-8) or 2.4 arcsec (quality 9). 'T' = this is a Tycho-1 star. The Tycho-1 identifier is given in the beginning of the record. For Tycho-1 stars, resolved in Tycho-2 as a close pair, both components are flagged as a Tycho-1 star and the Tycho-1 TYC3 is assigned to the brightest (VT) component. The HIP-only stars given in Tycho-1 are not flagged as Tycho-1 stars.

RA : Observed Tycho-2 Right Ascension, ICRS (double, Angle[deg])

Observed Tycho-2 Right Ascension, ICRS

DEC : Observed Tycho-2 Declination, ICRS (double, Angle[deg])

Observed Tycho-2 Declination, ICRS

RA_DEG : Observed Tycho-2 Right Ascension, ICRS (double, Angle[deg])

Observed Tycho-2 Right Ascension, ICRS

DE_DEG : Observed Tycho-2 Declination, ICRS (double, Angle[deg])

Observed Tycho-2 Declination, ICRS

RA_MDEG : Mean Right Asc, ICRS, epoch=J2000 (double, Angle[deg])

Mean Right Asc, ICRS, epoch=J2000

The mean position is a weighted mean for the catalogues contributing to the proper motion determination. This mean has then been brought to epoch 2000.0 by the computed proper motion. See Note(2) above for details. Tycho-2 is one of the several catalogues used to determine the mean position and proper motion. The observed Tycho-2 position is given in the fields RAdeg and DEdeg.

DE_MDEG : Mean Decl, ICRS, at epoch=J2000 (double, Angle[deg])

Mean Decl, ICRS, at epoch=J2000

The mean position is a weighted mean for the catalogues contributing to the proper motion determination. This mean has then been brought to epoch 2000.0 by the computed proper motion. See Note(2) above for details. Tycho-2 is one of the several catalogues used to determine the mean position and proper motion. The observed Tycho-2 position is given in the fields RAdeg and DEdeg.

PM_RA : Proper motion in RA*cos(dec) (float, Angular Velocity[mas/year])

Proper motion in RA*cos(dec)

Some Hipparcos stars (having a positive number in the HIP column) have no proper motions; these are virtually all in multiple systems.

PM_DE : Proper motion in Dec (float, Angular Velocity[mas/year])

Proper motion in Dec

Some Hipparcos stars (having a positive number in the HIP column) have no proper motions; these are virtually all in multiple systems.

EP_RA1990 : [0.81,2.13] epoch-1990 of RAdeg (float, Time[year])

Epoch-1990 of RAdeg

EP_DE1990 : [0.72,2.36] epoch-1990 of DEdeg (float, Time[year])

Epoch-1990 of de_deg

EP_RA_M : [1915.95,1992.53] mean epoch of RA. The mean epochs are given in Julian years. (float, Time[year])

Mean epoch of RA. The mean epochs are given in Julian years.

EP_DE_M : [1911.94,1992.01] mean epoch of Dec. The mean epochs are given in Julian years. (float, Time[year])

Mean epoch of Dec. The mean epochs are given in Julian years.

NUM : [2,36] Number of positions used (short)

Number of positions used

E_RA_DEG : s.e.RA*cos(dec), of observed Tycho-2 RA. The errors are based on error models. (double, Angle[mas])

s.e.RA*cos(dec), of observed Tycho-2 RA. The errors are based on error models.

E_DE_DEG : s.e. of observed Tycho-2 Dec. The errors are based on error models. (double, Angle[mas])

s.e. of observed Tycho-2 Dec. The errors are based on error models.

CORR : [-1,1] correlation (RAdeg,DEdeg) (double)

Correlation (ra_deg, de_deg)

E_RA_MDEG : [3,183] s.e. RA*cos(dec),at mean epoch. The errors are based on error models. (double, Angle[mas])

s.e. RA*cos(dec),at mean epoch. The errors are based on error models.

E_DE_MDEG : [1,184] s.e. of Dec at mean epoch. The errors are based on error models. (double, Angle[mas])

s.e. of Dec at mean epoch. The errors are based on error models.

E_PM_RA : [0.2,11.5] s.e. prop mot in RA*cos(dec).The errors are based on error models. (float, Angular Velocity[mas/year])

s.e. prop mot in RA*cos(dec). The errors are based on error models.

E_PM_DE : [0.2,10.3] s.e. of proper motion in Dec. The errors are based on error models. (float, Angular Velocity[mas/year])

s.e. of proper motion in Dec. The errors are based on error models.

Q_RA_MDEG : [0.0,9.9] Goodness of fit for mean RA (float)

Goodness of fit for mean RA

This goodness of fit is the ratio of the scatter-based and the model-based error. It is only defined when Num > 2. Values exceeding 9.9 are truncated to 9.9.

Q_DE_MDEG : [0.0,9.9] Goodness of fit for mean Dec (float)

Goodness of fit for mean Dec

This goodness of fit is the ratio of the scatter-based and the model-based error. It is only defined when Num > 2. Values exceeding 9.9 are truncated to 9.9.

Q_PM_DE : [0.0,9.9] Goodness of fit for pmDE (float)

Goodness of fit for pmDE

This goodness of fit is the ratio of the scatter-based and the model-based error. It is only defined when Num > 2. Values exceeding 9.9 are truncated to 9.9.

Q_PM_RA : [0.0,9.9] Goodness of fit for pmRA (float)

Goodness of fit for pmRA

This goodness of fit is the ratio of the scatter-based and the model-based error. It is only defined when Num > 2. Values exceeding 9.9 are truncated to 9.9.

PFLAG : [PX] mean position flag (string)

[PX] mean position flag

' ' = normal mean position and proper motion. 'P' = the mean position, proper motion, etc., refer to the photocentre of two Tycho-2 entries, where the BT magnitudes were used in weighting the positions. 'X' = no mean position, no proper motion.

POSFLG : [DP] type of Tycho-2 solution (string)

[DP] type of Tycho-2 solution

' ' = normal treatment, close stars were subtracted when possible. 'D' = double star treatment. Two stars were found. The companion is normally included as a separate Tycho-2 entry, but may have been rejected. 'P' = photocentre treatment, close stars were not subtracted. This special treatment was applied to known or suspected doubles which were not successfully (or reliably) resolved in the Tycho-2 double star processing.

CCDM : CCDM component identifier for HIP stars (string)

CCDM component identifier for HIP stars

The CCDM component identifiers for double or multiple Hipparcos stars contributing to this Tycho-2 entry. For photocentre solutions, all components within 0.8 arcsec contribute. For double star solutions any unresolved component within 0.8 arcsec contributes. For single star solutions, the predicted signal from close stars were normally subtracted in the analysis of the photon counts and such stars therefore do not contribute to the solution. The components are given in lexical order.

PROX : [3,999] proximity indicator (short, Angle[100mas])

Proximity indicator

Distance in units of 100 mas to the nearest entry in the Tycho-2 main catalogue or supplement. The distance is computed for the epoch 1991.25. A value of 999 (i.e. 99.9 arcsec) is given if the distance exceeds 99.9 arcsec.

BT_MAG : [2.183,16.581] Tycho-2 BT magnitude (float, Magnitude[mag])

Tycho-2 BT magnitude

Blank when no magnitude is available. Either BTmag or VTmag is always given. Approximate Johnson photometry may be obtained as: V = VT -0.090*(BT-VT) B-V = 0.850*(BT-VT) Consult Sect 1.3 of Vol 1 of ”The Hipparcos and Tycho Catalogues”, ESA SP-1200, 1997, for details.

VT_MAG : [1.905,15.193] Tycho-2 VT magnitude (float, Magnitude[mag])

Tycho-2 VT magnitude

Blank when no magnitude is available. Either BTmag or VTmag is always given. Approximate Johnson photometry may be obtained as: V = VT -0.090*(BT-VT) B-V = 0.850*(BT-VT) Consult Sect 1.3 of Vol 1 of ”The Hipparcos and Tycho Catalogues”, ESA SP-1200, 1997, for details.

E_BT_MAG : [0.014,1.977] s.e. of BT (float, Magnitude[mag])

s.e. of BT

Blank when no magnitude is available. Either BTmag or VTmag is always given. Approximate Johnson photometry may be obtained as: V = VT -0.090*(BT-VT) B-V = 0.850*(BT-VT) Consult Sect 1.3 of Vol 1 of ”The Hipparcos and Tycho Catalogues”, ESA SP-1200, 1997, for details.

E_VT_MAG : [0.009,1.468] s.e. of VT (float, Magnitude[mag])

s.e. of VT

Blank when no magnitude is available. Either BTmag or VTmag is always given. Approximate Johnson photometry may be obtained as: V = VT -0.090*(BT-VT) B-V = 0.850*(BT-VT) Consult Sect 1.3 of Vol 1 of ”The Hipparcos and Tycho Catalogues”, ESA SP-1200, 1997, for details.

1.4.9 URAT1_ORIGINAL_VALID

URAT-1 Catalogue
Reference paper:
A URAT-1 release paper for the Astronomical Journal is in preparation.
The first U.S. Naval Observatory Astrometric Robotic Telescope Catalog (URAT1) Zacharias N., Finch C., Subasavage J., Bredthauer G., Crockett C., Divittorio M., Furguson E., Harris F., Harris H., Henden A., Kilian C., Munn J., Rafferty T., Rhodes A., Schultheiss M., Tilleman T., Wieder G. =2015yCat.1329....0Z
Original catalogue:
CDS

Columns description:

URAT1_OID : Unique Numeric Identifier (long)

Incremental unique numeric identifier (increasing with declination).
This is the only field which was not in the original URAT1 catalogue, but was added for cross-match purposes.

URAT1_IDENTIFIER : source Id in original catalog (string)

Official URAT1 star ID numbers consist of 2 parts, the 3-digit zone number (zzz) and the 6-digit running record number (nnnnnn) along a zone.
Thus a URAT1 star number is given by:
URAT1-zzznnnnnn
The main catalog data are arranged in declination zones of 0.2 degree width. Zones are numbered from 1 starting at the South Pole and increasing toward north. The first zone with data in URAT1 is 326 for -25.0 to -24.8 deg Dec. There is a separate file for each zone up to zone 900 near the north celestial pole.

RA : RA, ICRS at mean epoch (double, Angle[deg])

Positions are on the International Celestial Reference System (ICRS) as represented by the UCAC4 catalog.
Mean observed positions are given at mean epoch of URAT observations (epoch). Thus the epoch is slightly different from star to star, but it is always in the range between 2012.311 and 2014.679.

DEC : DEC, ICRS at mean epoch (double, Angle[deg])

Positions are on the International Celestial Reference System (ICRS) as represented by the UCAC4 catalog.
Mean observed positions are given at mean epoch of URAT observations (epoch). Thus the epoch is slightly different from star to star, but it is always in the range between 2012.311 and 2014.679.

RA_ERROR : Position error from model (double, Angle[arcsec])

ra_error = posError
posError gives an estimate of the error of the mean position components (ra and dec).
A mean was taken over RA and DEC component errors because they are very similar for most stars.

Here a model is used which include image profile fit (x,y data) errors, atmospheric turbulence, and astrometric reduction error propagations. A systematic error floor of 5 mas was added RMS. The model error is likely a better estimate of the true positional errors than the scatter error, at least for small numbers of observations.

DEC_ERROR : Position error from model (double, Angle[arcsec])

dec_error = posError
posError gives an estimate of the error of the mean position components (ra and dec).
A mean was taken over RA and DEC component errors because they are very similar for most stars.
Here a model is used which include image profile fit (x,y data) errors, atmospheric turbulence, and astrometric reduction error propagations. A systematic error floor of 5 mas was added RMS. The model error is likely a better estimate of the true positional errors than the scatter error, at least for small numbers of observations.

EPOCH : Epoch for mean URAT1 observation (double, Time[Julian Years])

epoch = mean epoch of URAT observations.

F_MAG : mean observerd magnitude in URAT bandpass (double, Magnitude[mag])

This is the mean, observed magnitude in the 680-762 nm URAT bandpass, calibrated by APASS photometry. This bandpass is between R and I, thus further into the red than UCAC. Observations in non-photometric nights *are* included thus the URAT magnitudes need to be taken with caution. Unknown or unrealistic magnitudes are set to NULL. The faintest maybe real celestial object magnitude is about 19.0, while the URAT1 catalog should be complete to about magnitude 18.0.

F_MAG_ERROR : URAT photometry error (double, Magnitude[mag])

The photometric error of URAT bandpass observations is derived from the scatter of individual observations. A systematic error floor of 0.01 mag has been RMS added. Unknown errors are indicated by NULL.

B_MAG : APASS B magnitude (double, Magnitude[mag])

APASS B magnitude.
A custom set of APASS (The AAVSO Photometric All-Sky Survey) data was kindly provided to us by Arne Henden to include the DR8 data plus single photometric observations.
For a total of 71614 stars with no DR8 data the DR6 data was used.

V_MAG : APASS V magnitude (double, Magnitude[mag])

APASS V magnitude.
A custom set of APASS (The AAVSO Photometric All-Sky Survey) data was kindly provided to us by Arne Henden to include the DR8 data plus single photometric observations.
For a total of 71614 stars with no DR8 data the DR6 data was used.

G_MAG : APASS g magnitude (double, Magnitude[mag])

APASS g magnitude.
A custom set of APASS (The AAVSO Photometric All-Sky Survey) data was kindly provided to us by Arne Henden to include the DR8 data plus single photometric observations.
For a total of 71614 stars with no DR8 data the DR6 data was used.

R_MAG : APASS r magnitude (double, Magnitude[mag])

APASS r magnitude.
A custom set of APASS (The AAVSO Photometric All-Sky Survey) data was kindly provided to us by Arne Henden to include the DR8 data plus single photometric observations.
For a total of 71614 stars with no DR8 data the DR6 data was used.

I_MAG : APASS i magnitude (double, Magnitude[mag])

APASS i magnitude.
A custom set of APASS (The AAVSO Photometric All-Sky Survey) data was kindly provided to us by Arne Henden to include the DR8 data plus single photometric observations.
For a total of 71614 stars with no DR8 data the DR6 data was used.

B_MAG_ERROR : Error on APASS B magnitude (double, Magnitude[mag])

Error on APASS B magnitude.

V_MAG_ERROR : Error on APASS V magnitude (double, Magnitude[mag])

Error on APASS V magnitude.

G_MAG_ERROR : Error on APASS g magnitude (double, Magnitude[mag])

Error on APASS g magnitude.

R_MAG_ERROR : Error on APASS r magnitude (double, Magnitude[mag])

Error on APASS r magnitude.

I_MAG_ERROR : Error on APASS i magnitude (double, Magnitude[mag])

Error on APASS i magnitude.

1.5 Crossmatches

1.5.1 ALLWISE_BEST_NEIGHBOUR

AllWISE BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

ALLWISE_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

NUMBER_OF_MATES : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.

Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more "best" neighbours. Those neighbours can be found in the Neighbourhood table.

1.5.2 ALLWISE_NEIGHBOURHOOD

AllWISE Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

ALLWISE_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.3 APASSDR9_BEST_NEIGHBOUR

APASS DR9 BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

APASSDR9_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

NUMBER_OF_MATES : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.
Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more ”best” neighbours. Those neighbours can be found in the Neighbourhood table.

1.5.4 APASSDR9_NEIGHBOURHOOD

APASS DR9 Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

APASSDR9_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.5 gsc23_best_neighbour

GSC2.3 BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.

Columns description:

source_id : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

original_ext_source_id : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

angular_distance : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

gaia_astrometric_params : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

gsc23_oid : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

number_of_neighbours : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

number_of_mates : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.
Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more "best" neighbours. Those neighbours can be found in the Neighbourhood table.

1.5.6 GSC23_NEIGHBOURHOOD

GSC2.3 Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

GSC23_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.7 HIPPARCOS2_BEST_NEIGHBOUR

Hipparcos-2 BestNeighbour table lists each matched external catalogue object with its best neighbour in Gaia.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

Unique identifier of the Gaia source, the attribute corresponds to gaia_source.source_id

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (long)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

NUMBER_OF_NEIGHBOURS : Number of neighbours in Gaia Catalogue (int)

Number of sources in the Gaia Catalogue which match the External Catalogue source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

1.5.8 HIPPARCOS2_NEIGHBOURHOOD

Hipparcos-2 Neighbourhood table includes all good neighbours for each matched external catalogue object. A good neighbour for a given external catalogue object is a nearby object in Gaia whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

Unique identifier of the Gaia source, the attribute corresponds to gaia_source.source_id

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (long)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

1.5.9 PANSTARRS1_BEST_NEIGHBOUR

Pan-STARRS1 BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.
There are 1 327 157 objects in the filtered version of Pan-STARRS1 used to compute this cross-match that have too early `epoch_mean`.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

Unique identifier of the Gaia source, the attribute corresponds to gaia_source.source_id

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (long)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

NUMBER_OF_NEIGHBOURS : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

NUMBER_OF_MATES : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.
Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more "best" neighbours. Those neighbours can be found in the Neighbourhood table.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

1.5.10 PANSTARRS1_NEIGHBOURHOOD

Pan-STARRS1 Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

Unique identifier of the Gaia source, the attribute corresponds to gaia_source.source_id

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (long)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

1.5.11 PPMXL_BEST_NEIGHBOUR

PPMXL BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

PPMXL_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

NUMBER_OF_MATES : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.
Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more ”best” neighbours. Those neighbours can be found in the Neighbourhood table.

1.5.12 PPMXL_NEIGHBOURHOOD

PPMXL Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

PPMXL_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.13 RAVEDR5_BEST_NEIGHBOUR

RAVE DR5 table lists each matched external catalogue object with its best neighbour in Gaia.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

RAVEDR5_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in Gaia Catalogue (int)

Number of sources in the Gaia Catalogue which match the External Catalogue source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

1.5.14 RAVEDR5_NEIGHBOURHOOD

RAVE DR5 Neighbourhood table includes all good neighbours for each matched external catalogue object. A good neighbour for a given external catalogue object is a nearby object in Gaia whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

RAVEDR5_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.15 SDSSDR9_BEST_NEIGHBOUR

SDSS DR9 BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

SDSSDR9_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

NUMBER_OF_MATES : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.
Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more "best" neighbours. Those neighbours can be found in the Neighbourhood table.

1.5.16 SDSSDR9_NEIGHBOURHOOD

SDSS DR9 Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

SDSSDR9_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.17 TMASS_BEST_NEIGHBOUR

2MASS BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

TMASS_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

NUMBER_OF_MATES : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.
Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more "best" neighbours. Those neighbours can be found in the Neighbourhood table.

1.5.18 TMASS_NEIGHBOURHOOD

2MASS Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

TMASS_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.19 TYCHO2_BEST_NEIGHBOUR

Tycho-2 table lists each matched external catalogue object with its best neighbour in Gaia.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

TYCHO2_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in Gaia Catalogue (int)

Number of sources in the Gaia Catalogue which match the External Catalogue source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

1.5.20 TYCHO2_NEIGHBOURHOOD

Tycho-2 Neighbourhood table includes all good neighbours for each matched external catalogue object. A good neighbour for a given external catalogue object is a nearby object in Gaia whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

TYCHO2_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.5.21 URAT1_BEST_NEIGHBOUR

URAT-1 BestNeighbour table lists each matched Gaia object with its best neighbour in the external catalogue.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

URAT1_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

NUMBER_OF_NEIGHBOURS : Number of neighbours in External Catalogue (int)

Number of sources in the External Catalogue which match the Gaia source within position errors.
The identifiers of all the neighbours can be found in the Neighbourhood table.

NUMBER_OF_MATES : Number of mates in Gaia Catalogue (short)

Number of other Gaia sources that have as best-neighbour the same External Catalogue source.
In case there are no other Gaia sources with the same best-neighbour in the external catalogue, the number of mates is equal to zero.
Given the Gaia high angular resolution, it will happen that what appears as a single object in an external catalogue will be resolved by Gaia and as such will be the best-match of more than one Gaia object.

BEST_NEIGHBOUR_MULTIPLICITY : Number of neighbours with same probability as best neighbour (short)

The best-match to a Gaia source in an external catalogue is the source in the external catalogue that has the highest probability to be the best-match.
As the probability is based on positional and density properties, it could happen that there is more than one source in the external catalogue with the same probability.
Even if a single best-match is always chosen, this field tells the user if there were more ”best” neighbours. Those neighbours can be found in the Neighbourhood table.

1.5.22 URAT1_NEIGHBOURHOOD

URAT-1 Neighbourhood table includes all good neighbours for each matched Gaia object. A good neighbour for a given Gaia object is a nearby object in the external catalogue whose position is compatible (within position errors) with the target.

Columns description:

SOURCE_ID : Unique Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`)

ORIGINAL_EXT_SOURCE_ID : Original External Catalogue source identifier (string)

The unique source identifier in the original External catalogue.

ANGULAR_DISTANCE : Angular Distance between the two sources (double, Angle[arcsec])

Angular distance between a Gaia source and its nearest neighbour in the External Catalogue

SCORE : Score of neighbours (double)

Score of a given neighbour.
The score is a figure of merit based on geometric distance and local density of the external catalogue: the higher the score, the more probable the match is.

GAIA_ASTROMETRIC_PARAMS : Number of Gaia astrometric params used (short)

This field indicates the number of Gaia astrometric parameters which were available in Gaia.
The field is set to 2 when only RA and DEC where available, while is set to 5 when RA, DEC, PMRA, PMDEC and PARALLAX are available and thus used to propagate a Gaia source position to the External Catalogue source coordinates epoch.

URAT1_OID : External Catalogue source identifier (long)

The additional numeric unique source identifier of the External catalogue, increasing with Declination.

1.6 Auxiliary tables

1.6.1 AUX_ALLWISE_AGN_GDR2_CROSS_ID

Tables `aux_iers_gdr2_cross_id` and `aux_allwise_agn_gdr2_cross_id` list sources whose positions in Gaia DR2 define the celestial reference frame of Gaia DR2 (GaiaCRF2).

`aux_iers_gdr2_cross_id` lists 2820 sources in Gaia DR2 identified as the optical counterparts of VLBI sources with accurate VLBI positions in the ICRF. The first column is the IERS name of the VLBI source, the second column is the source identifier in Gaia DR2 of the optical counterpart.

`aux_allwise_agn_gdr2_cross_id` lists 555934 sources in Gaia DR2 cross-matched to sources in the AllWISE AGN catalogue (**?**). The first column is the AllWISE identifier, the second column is the source identifier in Gaia DR2.

1885 of the Gaia DR2 source identifiers in table `aux_iers_gdr2_cross_id` appear also in table `aux_allwise_agn_gdr2_cross_id`

The selection of sources is described in **?**. Based on these sources, the quality of the GaiaCRF2 is discussed in **?**.

Columns description:

ALLWISE_NAME : Identifier in the ALLWISE AGN catalogue (string)

WISE All-Sky Release Catalog name, based on J2000 position.

SOURCE_ID : Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`).

1.6.2 aux_iers_gdr2_cross_id

Tables aux_iers_gdr2_cross_id and aux_allwise_agn_gdr2_cross_id list sources whose positions in Gaia DR2 define the celestial reference frame of Gaia DR2 (GaiaCRF2).

aux_iers_gdr2_cross_id lists 2820 sources in Gaia DR2 identified as the optical counterparts of VLBI sources with accurate VLBI positions in the ICRF. The first column is the IERS name of the VLBI source, the second column is the source identifier in Gaia DR2 of the optical counterpart.

aux_allwise_agn_gdr2_cross_id lists 555934 sources in Gaia DR2 cross-matched to sources in the AllWISE AGN catalogue (**?**). The first column is the AllWISE identifier, the second column is the source identifier in Gaia DR2.

1885 of the Gaia DR2 source identifiers in table aux_iers_gdr2_cross_id appear also in table aux_allwise_agn_gdr2_cross_id

The selection of sources is described in **?**. Based on these sources, the quality of the GaiaCRF2 is discussed in **?**.

Columns description:

IERS_NAME : IERS name (string)

International Earth Rotation and Reference Systems Service name (HHMM+DDd, B1950 equinox).

For further details, please consult IERS Techical Note No. 35

SOURCE_ID : Gaia source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see gaia_source.source_id).

1.6.3 AUX_SSO_ORBIT_RESIDUALS

Residuals with respect to an orbital fit considering only the Gaia observations. Each entry has a corresponding record in the table sso_observation. A flag is given, indicating if the observation has been rejected by the fit procedure.

Columns description:

SOURCE_ID : Source identifier (long)

A unique single numerical identifier of the source obtained from gaia_source (for a detailed description see `gaia_source.source_id`). Note in particular that these identifiers are by convention negative for SSOs.

TRANSIT_ID : Transit Identifier (long)

The TransitId is a number obtained from the combination of data fields from the telemetry. More specifically, from AF1 ref_acquisition_time, AF1 ac, FOV and CCD Row. It uniquely identifies the transit of a source on the focal plane.

OBSERVATION_ID : Observation Identifier (long)

Identifier at single CCD level of the observation of a Solar System object. It is unique, and obtained from a combination of transit_id and an integer number representing the CCD strip.

NUMBER_MP : minor planet number attributed by MPC (long, Dimensionless[see description])

Minor Planet number attributed by MPC

EPOCH : Gaiacentric epoch TCB(Gaia) (double, Time[Barycentric JD in TCB - 2455197.5 (day)])

Gaiacentric epoch TCB(Gaia) in JD corresponding to the time of crossing of the fiducial line of the CCD. This is the epoch to which the target coordinates and the position/velocity of Gaia are referred to. To avoid loss of precision the reference time J2010.0 is subtracted.

RESIDUAL_RA : post-orbital fit residual in RA*cos(Dec) (double, Angle[mas])

An orbital fit to whole set of Gaia observations (only) for a given object is performed. Post-fit residuals are then computed. This field contains the component in the direction of RA (*cos(dec)).

RESIDUAL_DEC : post-orbital fit residual in Dec (double, Angle[mas])

An orbital fit to whole set of Gaia observations (only) for a given object is performed. Post-fit residuals are then computed. This field contains the component in the direction of Dec.

RESIDUAL_AL : post-orbital fit residual AL (double, Angle[mas])

An orbital fit to a whole set of Gaia observations (only) for a given object is performed. Post-fit residuals are then computed. This field contains the component in the Along Scan (AL) direction.

RESIDUAL_AC : post-orbital fit residual AC (double, Angle[mas])

An orbital fit to a whole set of Gaia observations (only) for a given object is performed. Post-fit residuals are then computed. This field contains the component in the Across Scan (AC) direction.

SELECTED : observation not rejected by orbital fit (boolean, Dimensionless[see description])

An orbital fit to a whole set of Gaia observations (only) for a given object is performed. Post-fit residuals are then computed. Rejection of single observations may occur in this process. This flag is 1 when no observation is rejected.

1.6.4 AUX_SSO_ORBITS

Auxiliary information on asteroid orbits and basic photometric parameters from the astorb data base: ftp://cdsarc.u-strasbg.fr/pub/cats/B/astorb/astorb.html

Columns description:

SOLUTION_ID : Solution Identifier (long)

All Gaia data processed by the Data Processing and Analysis Consortium comes tagged with a solution identifier. This is a numeric field attached to each table row that can be used to unequivocally identify the version of all the subsystems that where used in the generation of the data as well as the input data used. It is mainly for internal DPAC use but is included in the published data releases to enable end users to examine the provenance of processed data products. To decode a given solution ID visit `https://gaia.esac.esa.int/decoder/solnDecoder.jsp`

NUMBER_MP : Asteroid MPC number (long)

Asteroid number assigned by MPC. Blank if unnumbered

DESIGNATION : MPC name (string)

MPC name or preliminary designation

MAG_H : absolute magnitude (double, Magnitude[mag])

Absolute magnitude H for the asteroid. Number of decimal places depending on accuracy (zero to 2), except for unnumbered asteroids (2 decimals even if H is poorly known)

SLOPE_G : slope parameter (double)

Slope parameter of the magnitude-phase law.

CODE : object specific flags (int)

See ftp://cdsarc.u-strasbg.fr/pub/cats/B/astorb/astorb.html for a full description

OBS_ARC : arc spanned by the observations (long, Time[day])

Time interval of the observations used to compute the orbit

OBS_NUM : number of observations used (long)

number of observations used to compute the orbit

OSC_EPOCH : epoch of osculation (string, Time[yyyymmdd])

Epoch of osculation, yyyymmdd (TDT). The epoch is the Julian date ending in 00.5 nearest the date the orbit data set was compiled.

ORB_M : mean anomaly (double, Angle[deg])

Orbital element: Mean anomaly

OMEGA : argument of perihelion (double, Angle[deg])

The argument of perihelion at equinox J2000.0 (note this is not ICRS because these orbits are heliocentric and all angles are referred to the nodal point defined at equinox J2000.0).

NODE_OMEGA : longitude of ascending node (double, Angle[deg])

Longitude of the ascending node at equinox J2000.0 (note this is not ICRS because these orbits are heliocentric and all angles are referred to the nodal point defined at equinox J2000.0).

INCLINATION : orbit inclination (double, Angle[deg])

Orbit inclination (J2000.0)

ECCENTRICITY : orbit eccentricity (double)

orbit eccentricity

A : semimajor axis (double, Length & Distance[AU])

Semimajor axis of the orbit

ORB_DATE : date of orbit computation (string, Time[yyyymmdd])

Date of orbit computation, yymmdd (MST, = UTC - 7 hr).

CEU : current orbit uncertainty (double, Angle[arcsec])

Absolute value of the current 1-sigma ephemeris uncertainty (CEU), arcsec.

CEU_RATE : rate of change of the orbit uncertainty (double, Angular Velocity[mas/s])

rate of change of the orbit uncertainty. Note that in astorb it is given in arcsec/day.

CEU_EPOCH : date of the CEU (string, Time[yyyymmdd])

Date of CEU, yyyymmdd (0 hr UT).

1.6.5 DR1_NEIGHBOURHOOD

Users wishing to look up the DR2 record for an astrophysical source identified in DR1 must **NOT** simply extract the record from DR2 having the same source identifier.

As described in the detailed description of attribute `designation` in gaia_source it is not guaranteed that the same astronomical source will always have the same source identifier in different Data Releases. Hence the only safe way to compare source records between different Data Releases in general is to check the records of proximal source(s) in the same small part of the sky. This table provides the means to do this via a precomputed crossmatch of such sources, taking into account the proper motions available at DR2.

Within the neighbourhood of a given DR2 source there may be none, one or (rarely) several possible counterparts in DR1 indicated by rows in this table. This occasional source confusion was introduced during the DR1 processing which used an earlier version of the software for matching of transit observations to unique astrophysical sources. The subsequent merging, splitting and deletion of identifiers introduced at DR1 during the DR2 processing means there is no guaranteed one–to–one correspondence in source identifiers between the releases.

For more details of the procedure used to create this crossmatch, see Chapter **??** in the online documentation.

Columns description:

DR1_SOURCE_ID : Source identifier in Gaia DR1 (long)

Source identifier assigned during DR1 processing for an astrophysical object in close proximity to (possibly) the same object in DR2.

DR2_SOURCE_ID : Source identifier in Gaia DR2 (long)

Source identifier assigned during DR2 processing for an astrophysical object in close proximity to (possibly) the same object in DR1.

ANGULAR_DISTANCE : Angular distance between the two sources (float, Angle[arcsec])

Angular (great–circle) distance on sky between the source pairing between DRs 1 and 2.

MAGNITUDE_DIFFERENCE : G band magnitude difference between the sources (float, Magnitude[mag])

G band magnitude difference between the sources based on the individual magnitudes materialised in gaia_source at the time of the respective data releases. The sense of the difference is DR2 minus DR1.

RANK : Rank metric indicating relative probability of a good match (float)

Probability figure–of–merit giving some indication of how probable is the association between these two sources in terms of the typical distribution of the position and magnitude differences for the crossmatch as a whole. For more details see Chapter **??** in the online documentation.