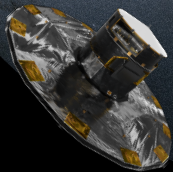


Gaia DR2 Overview

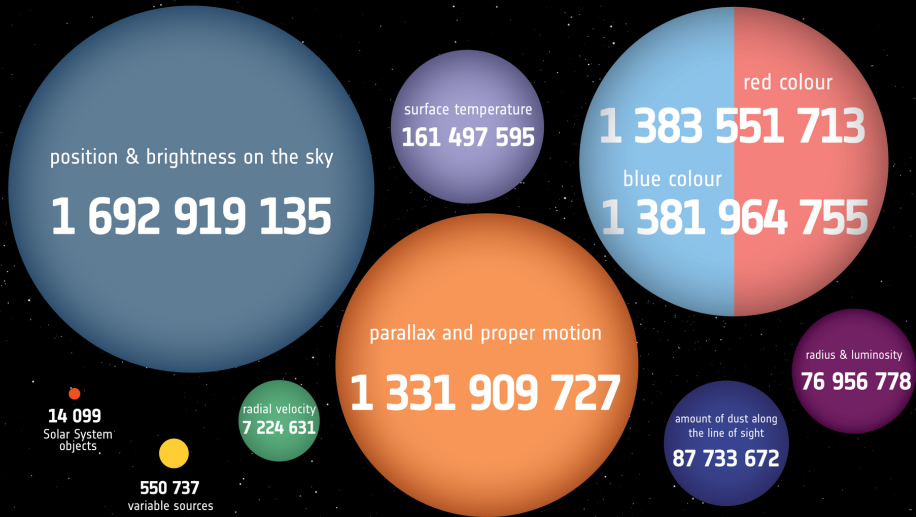
Anthony Brown

Leiden Observatory, Leiden University

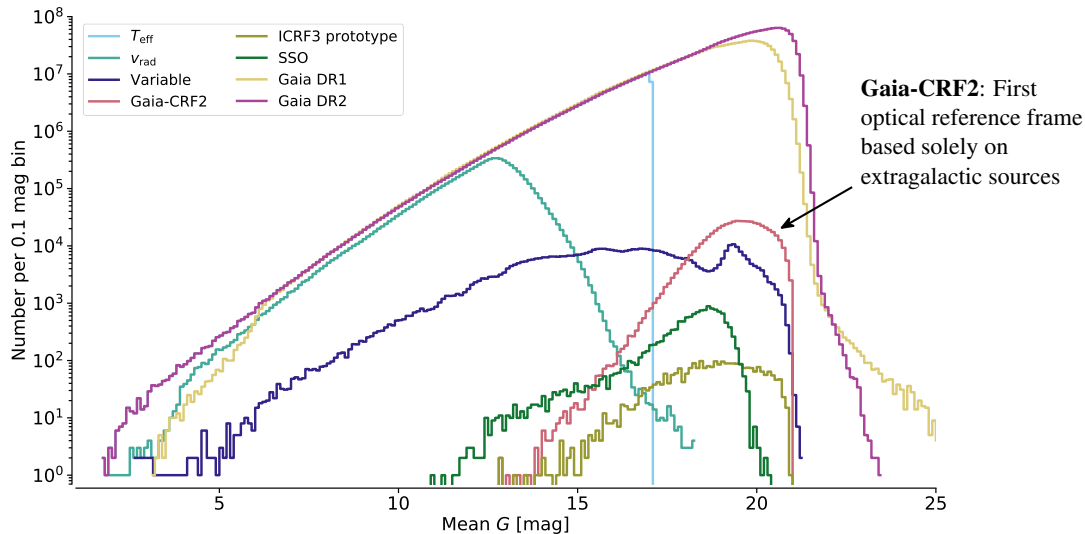
`brown@strw.leidenuniv.nl`

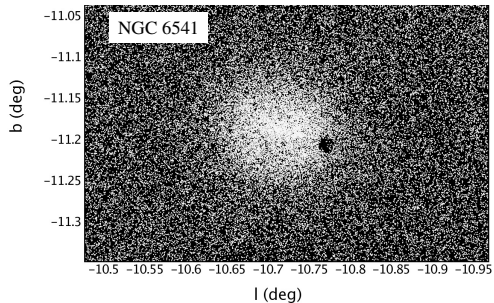
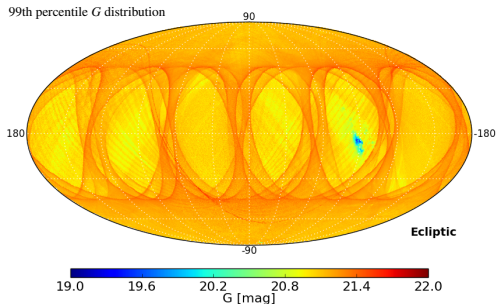


Gaia DR2 in numbers

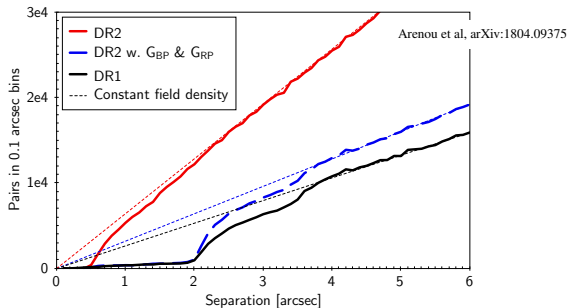


Source counts

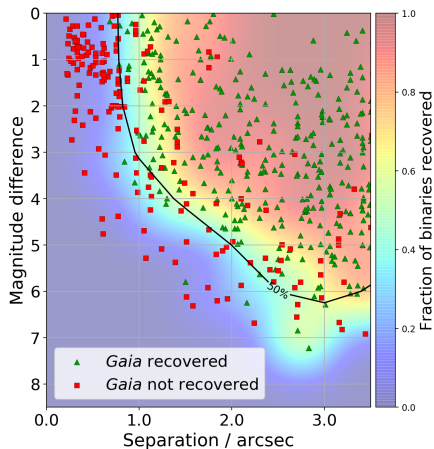




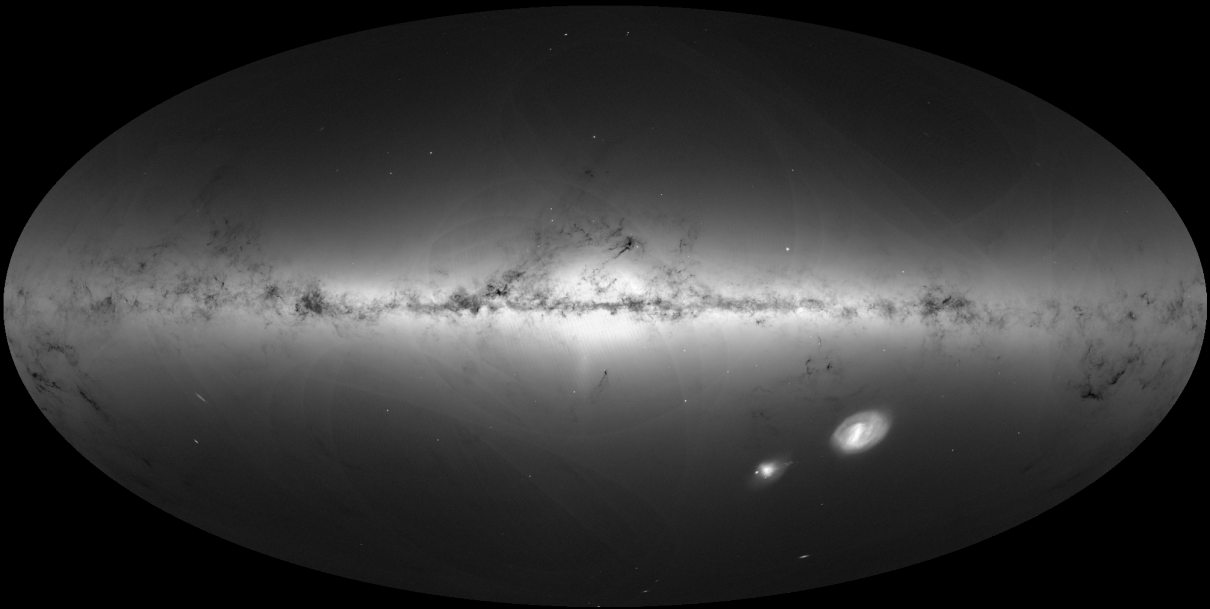
- Varying magnitude limit; severe incompleteness in small number of crowded regions
- Much improved completeness at $G \sim 3-8$
- About 20% of stars with $\mu > 0.6$ arcsec/yr missing



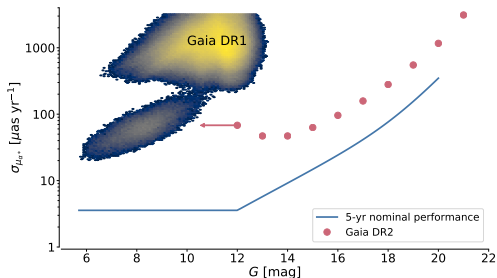
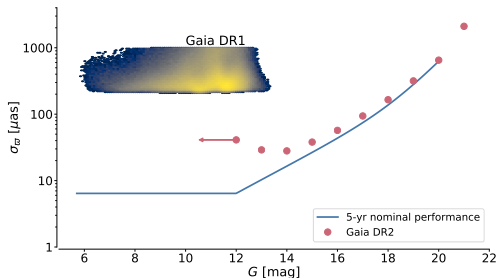
- Angular resolution limited to 0.4–0.5 arcsec
 - ▶ significantly better than all existing ground-based surveys
- Will get better in later data releases
 - ▶ currently no treatment of crowded sources, including binaries that are in principle resolved by Gaia



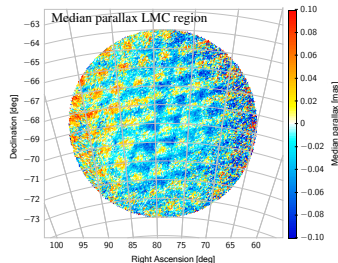
Ziegler et al, arXiv:1806.10142



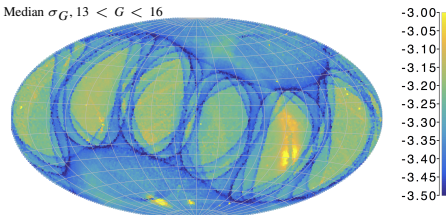
Astrometric performance Gaia DR2



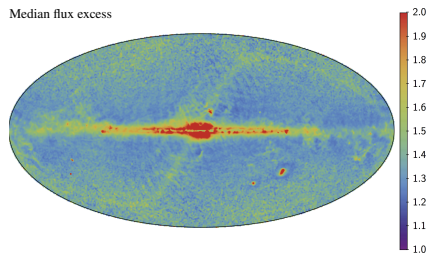
- Astrometric data of unprecedented quality and quantity
- Uncertainties close to Gaussian, but underestimated
 - ▶ $\sim 10\%$ at faint end, up to 40% at $G \lesssim 15$
- Systematic errors generally below 0.1 mas
- Spatial correlations at ~ 1 to ~ 20 degree scales
- Bright star performance is calibration limited
- Luri et al (arXiv:1804.09376) for guidance/tutorials



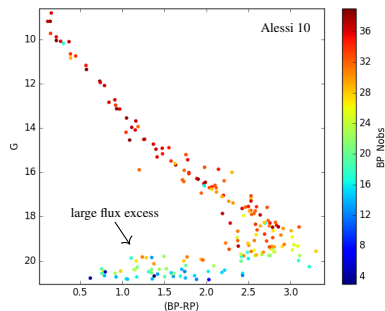
Median σ_G , $13 < G < 16$

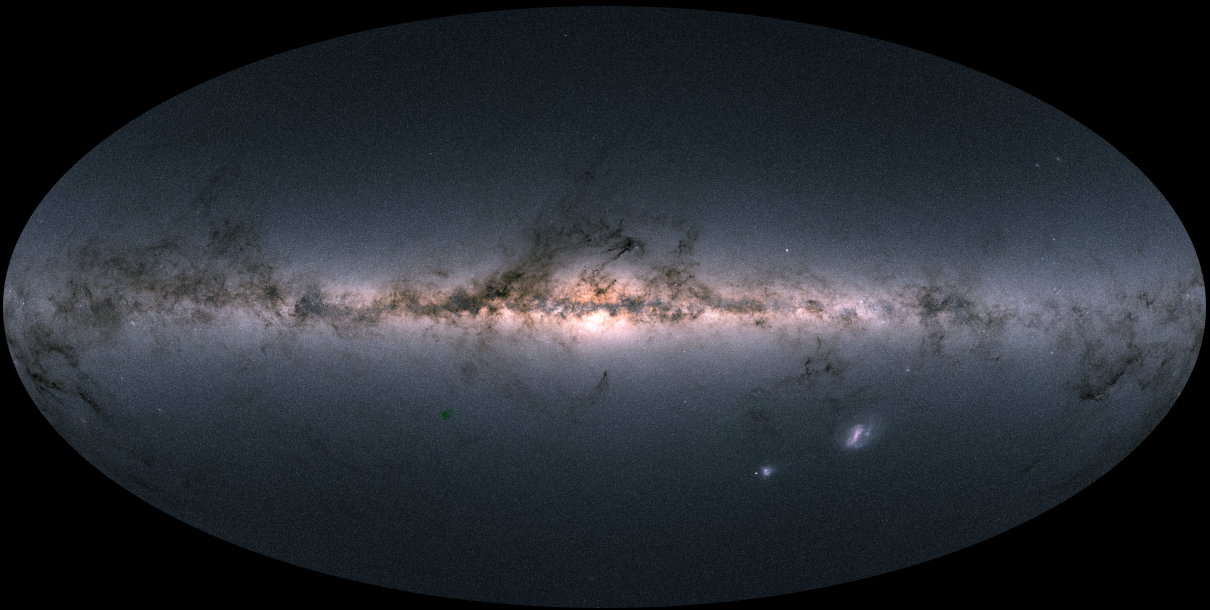


Median flux excess

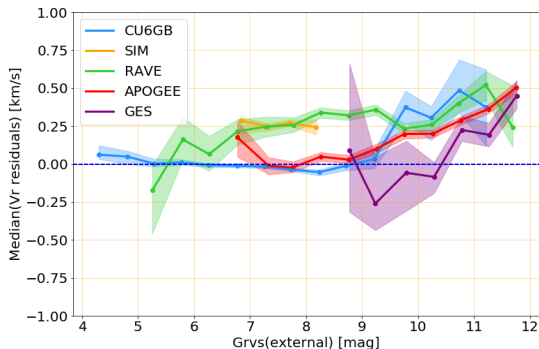


- Precise, homogeneous, all-sky optical photometry
 - ▶ σ_G : 0.3–10 mmag, $\sigma_{G_{BP}, G_{RP}}$: 2–200 mmag
- Colours suffer from insufficiently accurate background characterization
 - ▶ crowded regions, near bright stars, faint sources at $G > 19$
 - ▶ pay attention to `phot_bp_rp_excess_factor` field

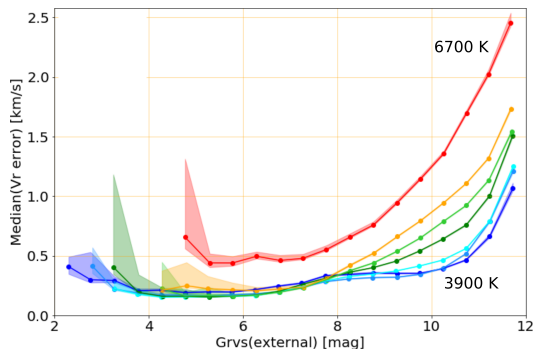




Radial velocity accuracy

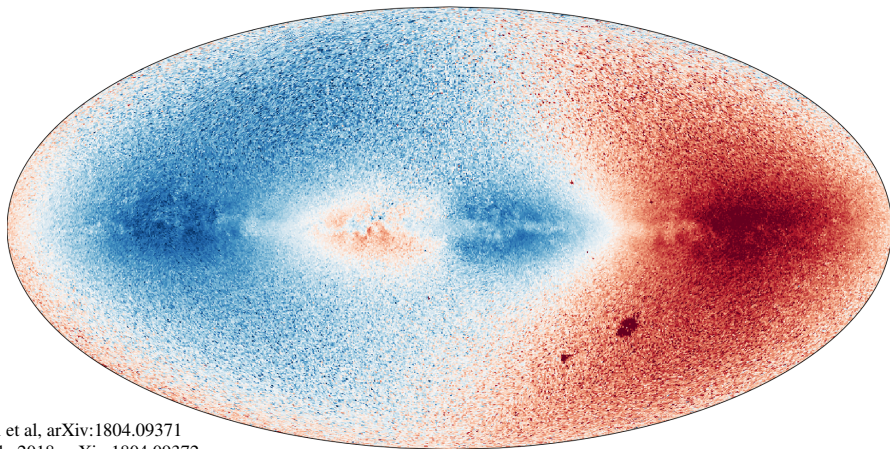


Radial velocity precision



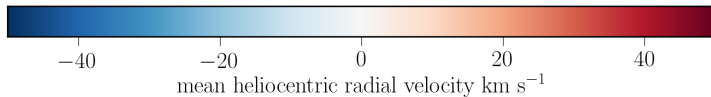
- Radial velocity residuals with respect to other surveys reflect a magnitude term in RVS results as well as systematic errors in the other surveys
- End of mission precision requirement at bright (1 km s^{-1}) already exceeded
- Radial velocities only for sources at $3550 \lesssim T_{\text{eff}} \lesssim 6900 \text{ K}$

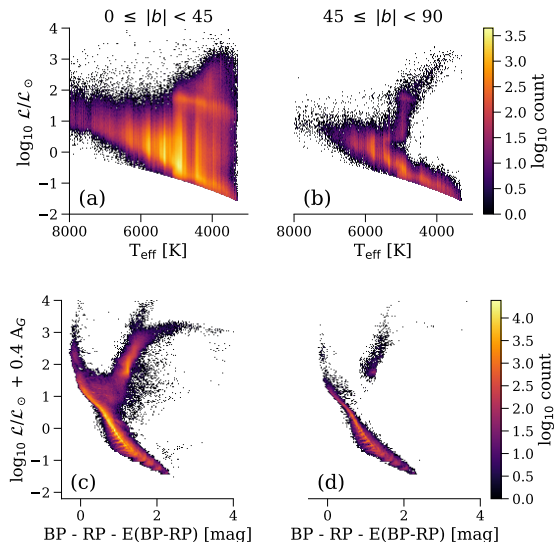
Mean radial velocity on the sky



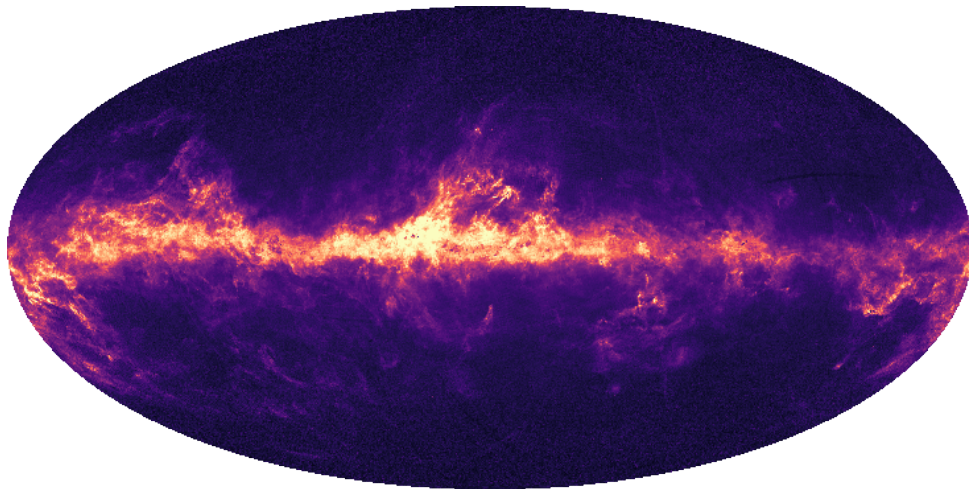
Sartoretti et al, arXiv:1804.09371

Katz et al., 2018, arXiv:1804.09372





- Determination $T_{\text{eff}}, A_G, E(G_{\text{BP}} - G_{\text{RP}}), \mathcal{L}, \mathcal{R}$, based *only* on $G, G_{\text{BP}}, G_{\text{RP}}$, and parallax
 - ▶ Strong $T_{\text{eff}} - A_G$ degeneracy in broad-band colours necessitates strong assumptions
 - ▶ Asymmetric uncertainties, positivity constraint on A_G
 - ▶ T_{eff} estimates constrained to 3300–8000 K
 - ▶ Radius/luminosity estimation assumes $A_G = 0$ (correction to non-zero A_G possible)
 - ▶ Results to be interpreted with care
- See Andrae et al. (2018, arXiv:1804.09374) and online documentation

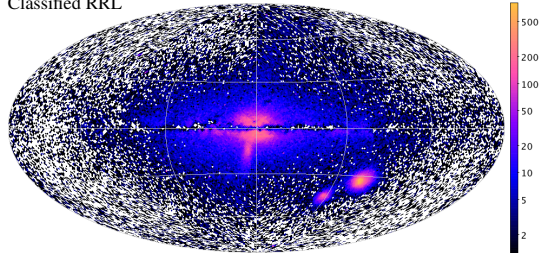


Andrea et al., 2018, arXiv:1804.09374

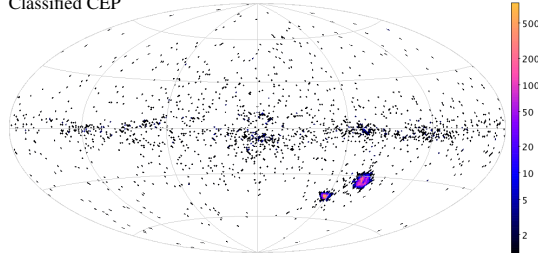


Variable stars in Gaia DR2

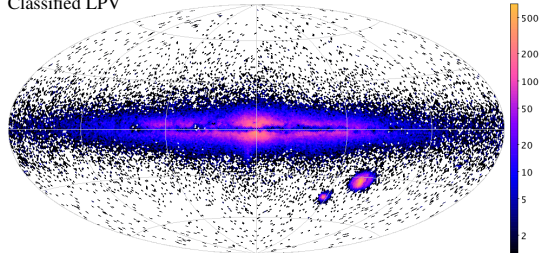
Classified RRL



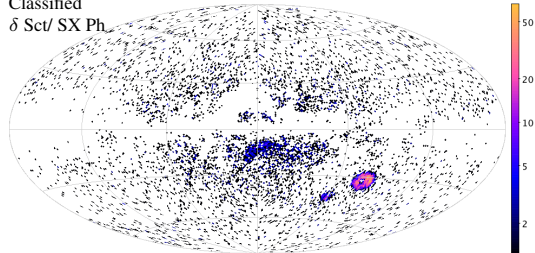
Classified CEP



Classified LPV

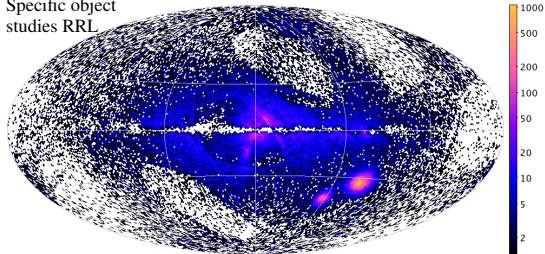


Classified
 δ Sct/ SX Ph

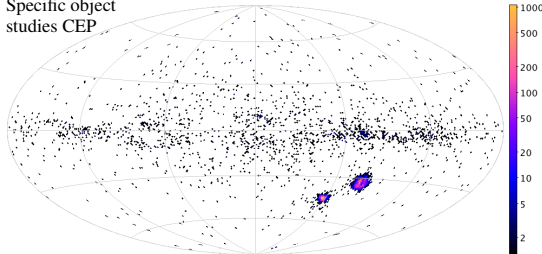


Variable stars in Gaia DR2

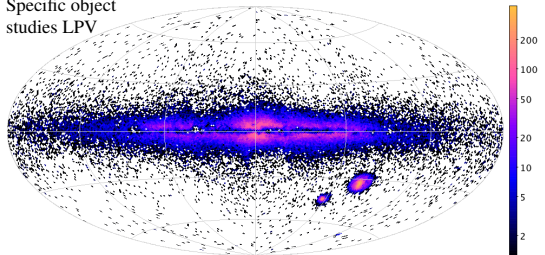
Specific object
studies RRL



Specific object
studies CEP



Specific object
studies LPV



- 551 thousand variables identified
 - ▶ many more to come in future
- Subset classified by variability type
 - ▶ based on 2+ transits
- Overlapping subset studied in detail
 - ▶ based on 12+ transits



GAIA DATA RELEASE 2 IS AVAILABLE FROM THE GAIA ARCHIVE

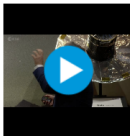


Released on 25 April 2018 at 12:00 CEST

WAITING FOR GAIA...



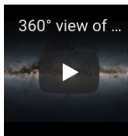
GAIA DATA RELEASE 2 PRESS CONFERENCE



THE HYADES CLUSTER



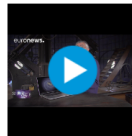
360 DEGREE VIEW OF GAIA'S SKY



INTERVIEW WITH ANTHONY BROWN



EURONEWS: GAIA'S REVOLUTION IN ASTRONOMY



GAIA DR2 INFO

Information on Gaia Data Release 2 contents, completeness and limitations.

GAIA DR2 PAPERS

Titles and links to papers describing the data processing and demonstrating the science potential of Gaia Data Release 2.

GAIA DR2 DOCUMENTATION

The full documentation for the second data release, both on webpages and with a downloadable PDF-file

GAIA DR2 DATA

Gaia Data Release 2 data is now available.

GAIA DATA CREDITS

When using Gaia data, please acknowledge the work of the people involved and provide credits and necessary citations.

GAIA DR2 PASSBANDS

More information on the photometric system used for Gaia Data Release 2.

TUTORIALS AND HELP

Help is available to guide you through the process of getting the data you need. Check out the tutorials as they are very instructive!

LEARN ADQL

Gaia Data Release 2 contains a lot of data. While downloading the data will be possible, you can also bring your code to the data and access the data in a smart way. You can use ADQL queries to extract the data and then download the resulting

- Online documentation: <https://gea.esac.esa.int/archive/documentation>
- Accompanying papers in A&A special issue
 - ▶ Summary: contents, survey properties, limitations
 - ▶ Details on processing and validation of each Gaia DR2 data set
 - ▶ Overall catalogue validation
 - ▶ <https://www.aanda.org/component/toc/?task=topic&id=922>
 - ▶ ‘A Guide for Scientists’ videos:
<https://www.cosmos.esa.int/web/gaia/guide-to-scientists>
- Tutorial paper on the use of Gaia astrometry
 - ▶ with source code and Python/R notebooks
 - ▶ <https://repos.cosmos.esa.int/socci/projects/GAIA/repos/astrometry-inference-tutorials/>
- Gaia information, news, links: <https://www.cosmos.esa.int/web/gaia/>
- Gaia Helpdesk: <https://www.cosmos.esa.int/web/gaia/gaia-helpdesk>
- Known Issues: <https://www.cosmos.esa.int/web/gaia/dr2-known-issues>

Gaia DR3

- Likely to appear in first half of 2021, firmer schedule to be announced in 2019
- Examples of new data products
 - ▶ Source classification and astrophysical parameters
 - ▶ BP/RP and RVS spectra for sources with astrophysical parameters
 - ▶ Non-single stars: various levels of astrometric binary solutions (where possible), eclipsing binaries
 - ▶ Updated and extended variable star catalogue
 - ▶ Updated and extended solar system objects catalogue

Gaia DR4

- Final release for the nominal mission
 - ▶ schedule TBD
- Foreseen data products
 - ▶ Full astrometric, photometric, and radial-velocity catalogues
 - ▶ All available variable-star and non-single-star solutions
 - ▶ Source classifications (probabilities) plus multiple astrophysical parameters (derived from BP/RP, RVS, and astrometry) for stars, unresolved binaries, galaxies, and quasars
 - ▶ An exo-planet list
 - ▶ All epoch and transit data for all sources, including all BP/RP/RVS spectra

At the back of your paper...



Gaia 

- Please acknowledge the work by DPAC and ESA in your papers!
 - ▶ helps us argue the case for continued funding of the data processing
 - ▶ strengthens the mission extension case
 - ▶ <https://gea.esac.esa.int/archive/documentation/credits.html>