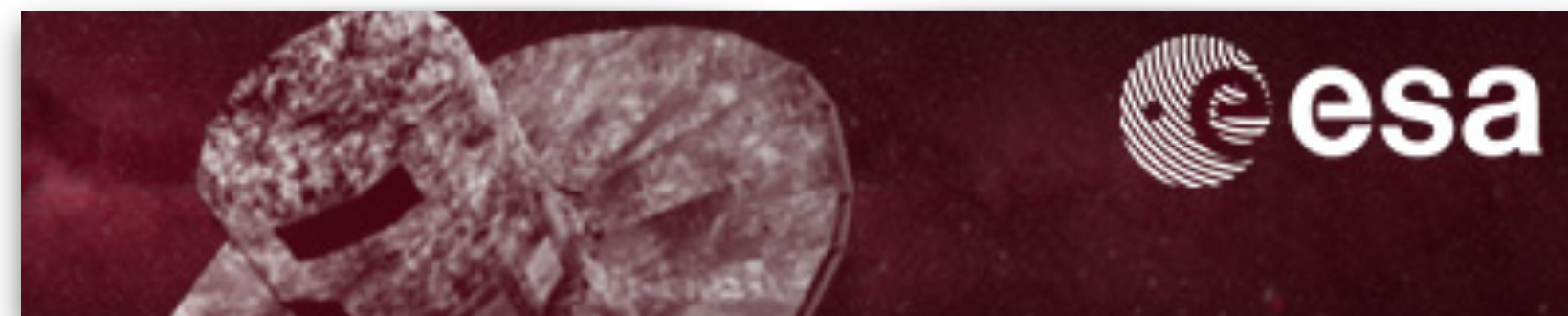
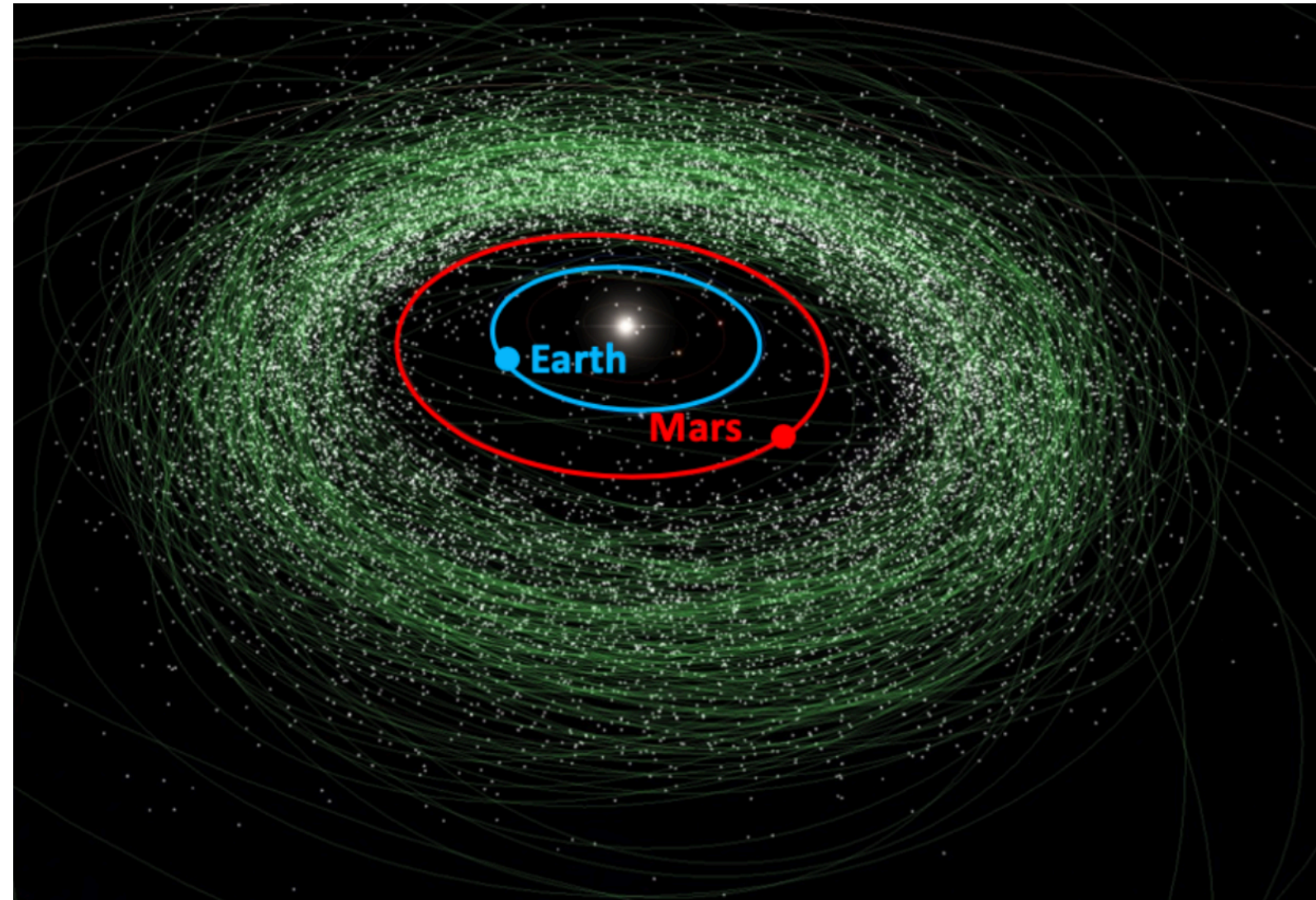


Gaia and the Solar System reaching a new dimension with the Data Release 3

P. Tanga

Observatoire de la Côte d'Azur, France

paolo.tanga@oca.eu

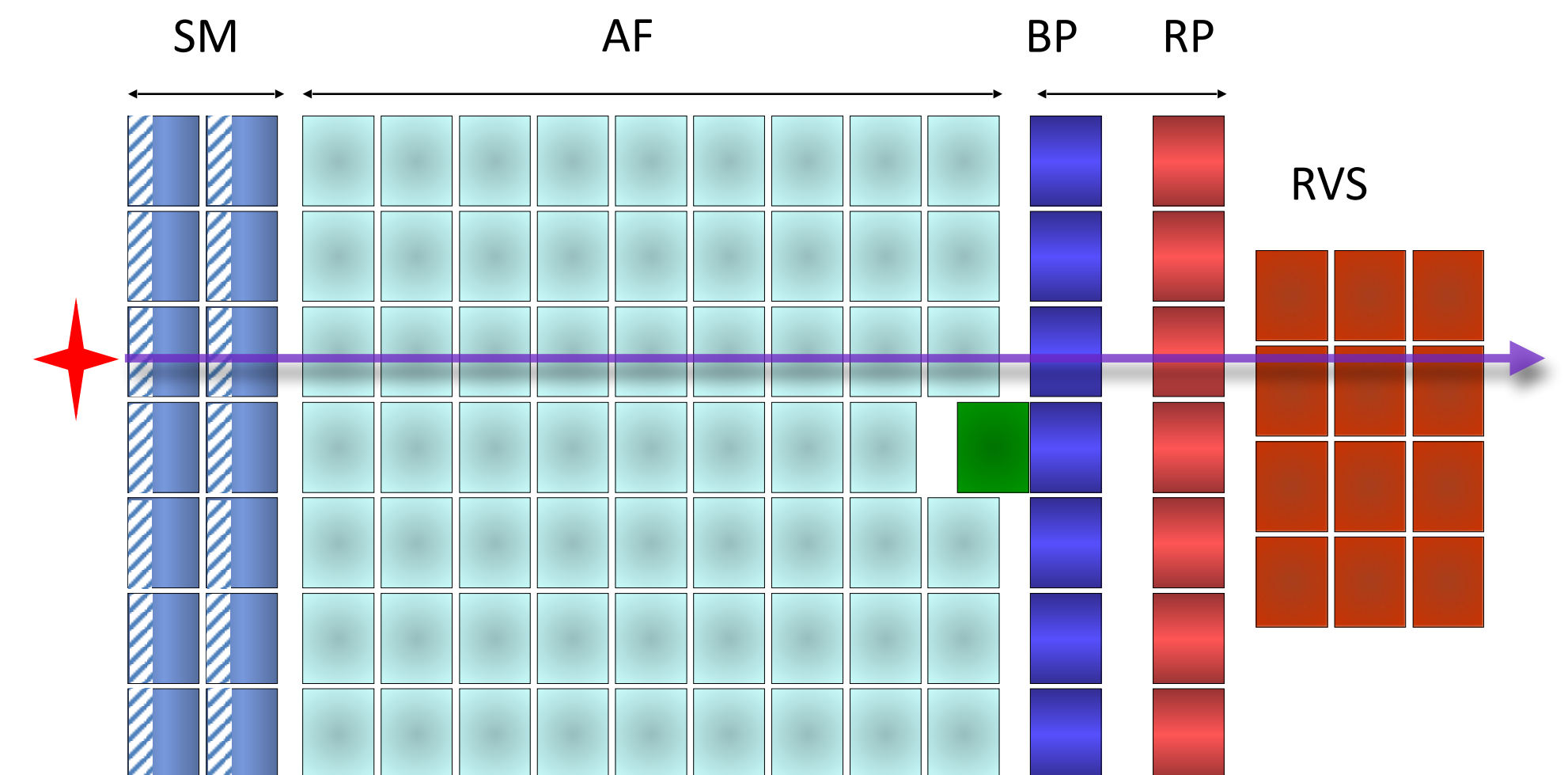
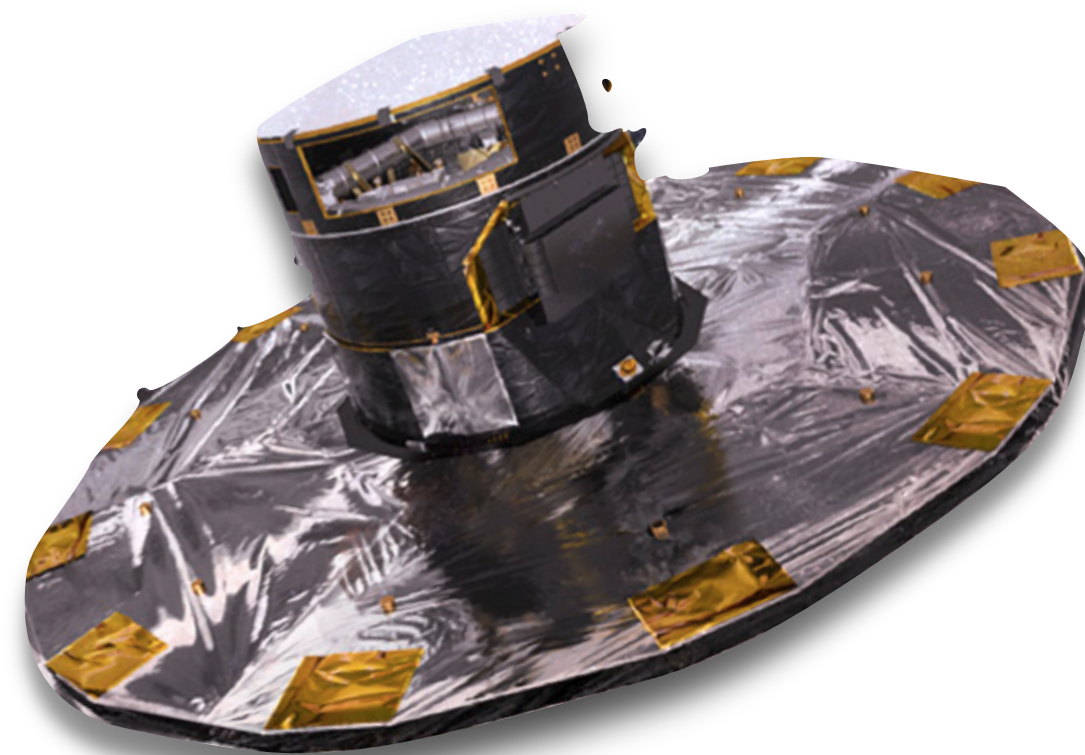


Gaia and the Solar System - the team of Coordination Unit 4

- *Selection, identification*: J. Berthier (IMCCE, France), F. Mignard (OCA, France)
- *Astrometry*: A. Dell'Oro (INAF/Arcetri), Th. Pauwels (ORB, Belgium)
- *Spectrophotometry*: A. Cellino (INAF/OCA), L. Galluccio, M. Delbo (OCA, France), K. Muinonen (Univ. Helsinki, Finland)
- *Orbits*: P. David, D. Hestroffer (IMCCE, France), F. Mignard (OCA, France), F. Spoto (MPC, USA)
- *Validation*: F. Spoto (MPC, USA), I. Slezak, P. Tanga (OCA, Nice) +... all the others mentioned above
- *Coordination*: P. Tanga (OCA, Nice)

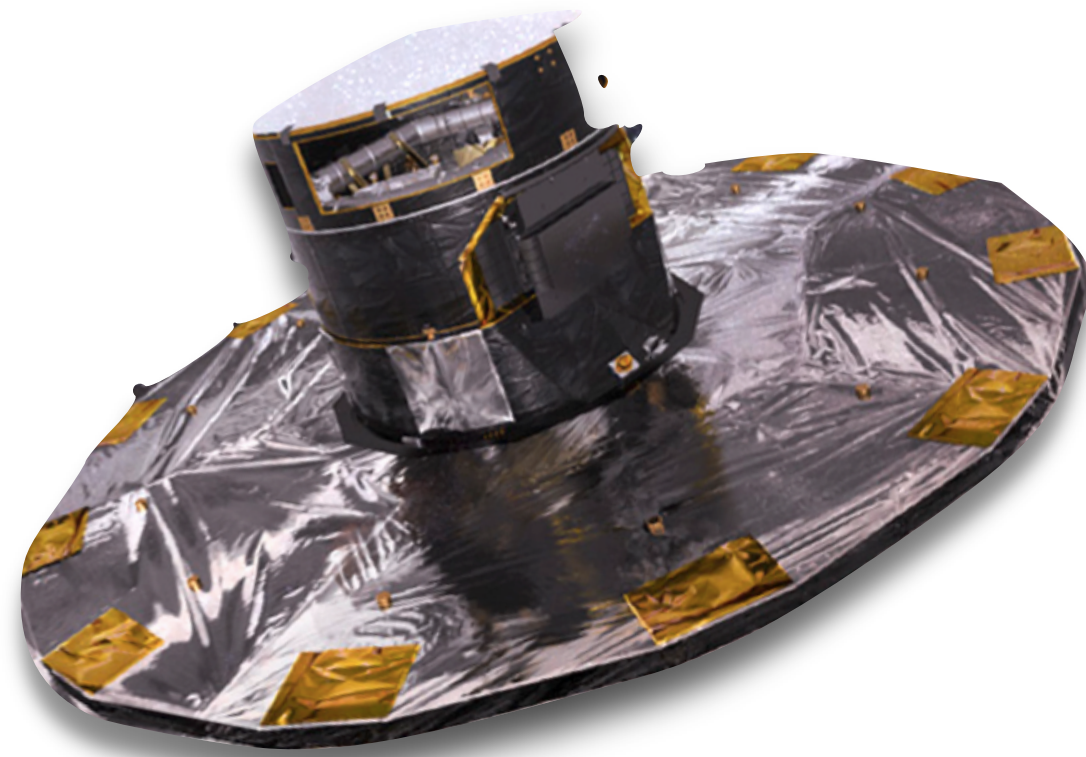
What kind of Solar System data by Gaia, in DR3 ?

- Epoch data
 - Epoch = 1 observation per CCD - maximum 9 observations per transit
 - Astrometry - uncertainties and correlations (+ Gaia positions...)
 - Photometry at transit level - G band - fluxes and errors



What kind of Solar System data by Gaia, in DR3 ?

- Epoch data
 - Epoch = 1 observation per CCD - maximum 9 observations per transit
 - Astrometry - uncertainties and correlations (+ Gaia positions...)
 - Photometry at transit level - G band - fluxes and errors
- Per-object properties
 - Orbital elements (state vector, osculating elements) based on Gaia astrometry *only*
 - Reflectance spectra



DR3, why a “new dimension” ?

DR3

- Transits in the output
 - With photometry
 - Objects in the output
 - With an orbit
 - With a BP/RP spectrum
- | |
|-----------------|
| 3,2 million |
| 3,0 M (95.9 %) |
| > 158 k |
| > 154 k |
| several 10.000s |

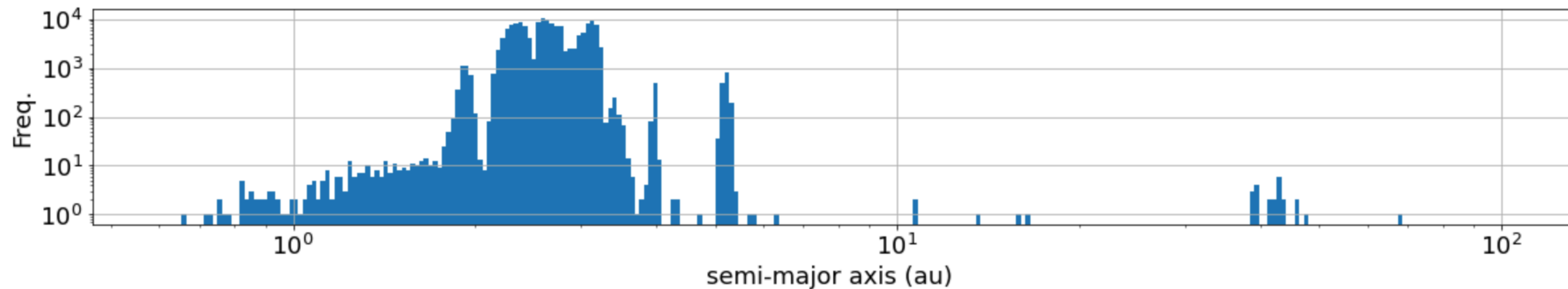
DR3, why a “new dimension” ?

	<i>DR3</i>	<i>DR2 reminder</i>
● Transits in the output	3,2 million	290,704
○ With photometry	3,0 M (95.9 %)	234,123 (80.5 %)
● Objects in the output	> 158 k	14,099
○ With an orbit	> 154 k	-
○ With a BP/RP spectrum	several 10.000s	-

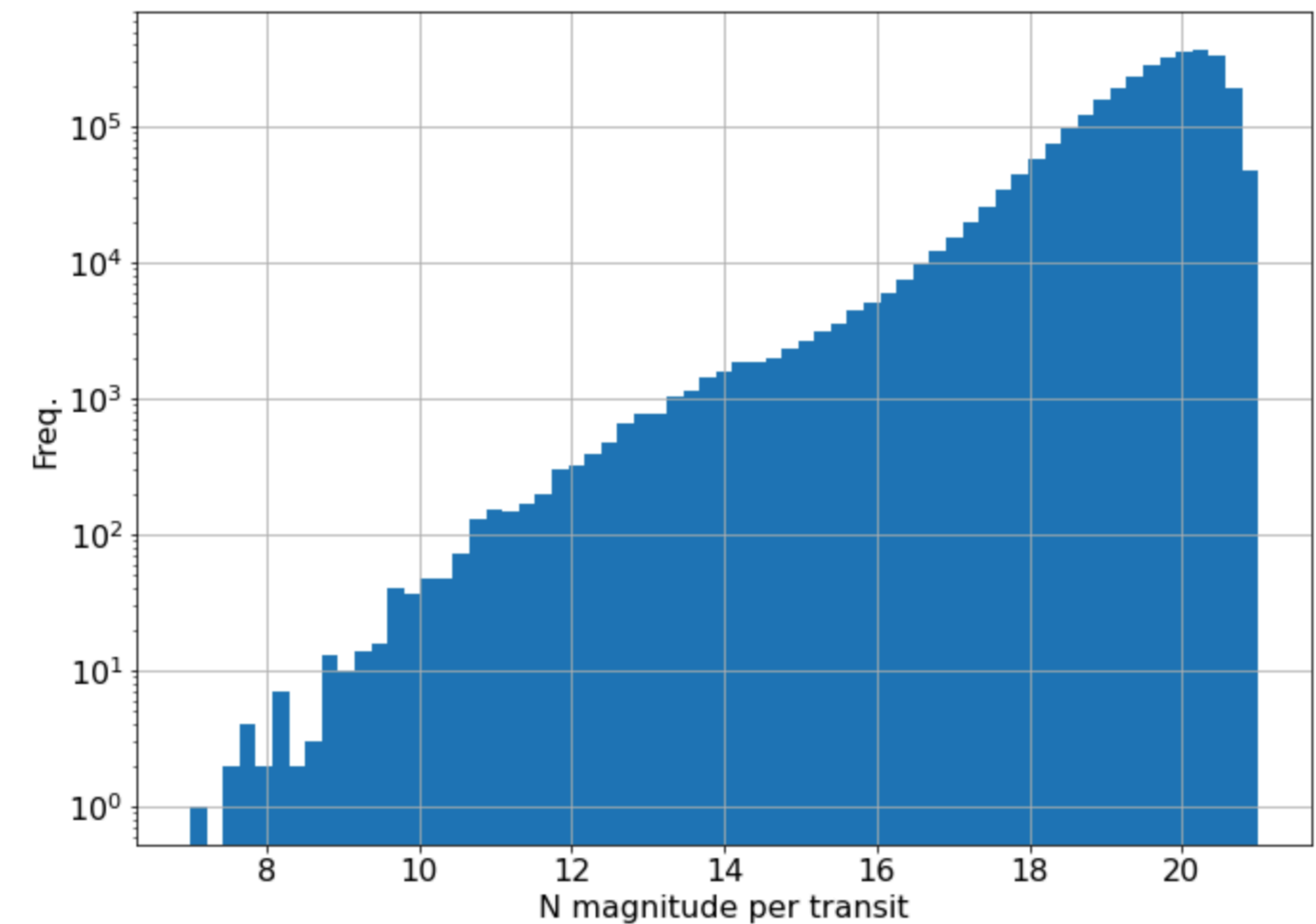
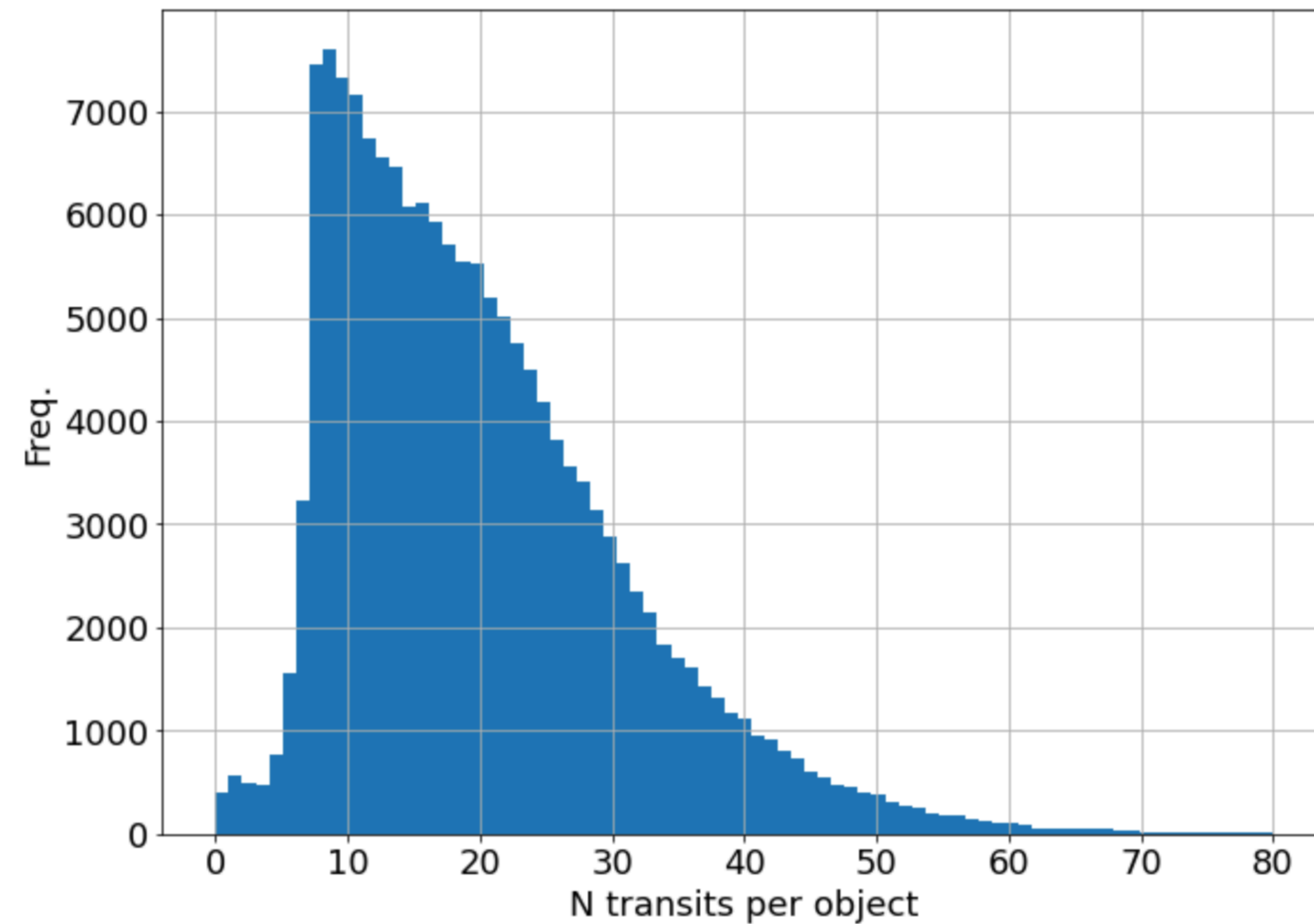
Gaia DR3 is the first release of a massive volume of Solar System data.
For the first time, spectral data are also present.
Exact numbers will be available after the detailed validation process.

Solar System: object categories in DR3

- Known asteroids (pre-selected) — matched by position to ephemeris of known minor planets - 99.1 %
- Planetary satellites (31)
- “Unmatched objects” - 0.8 % (isolated bundles)

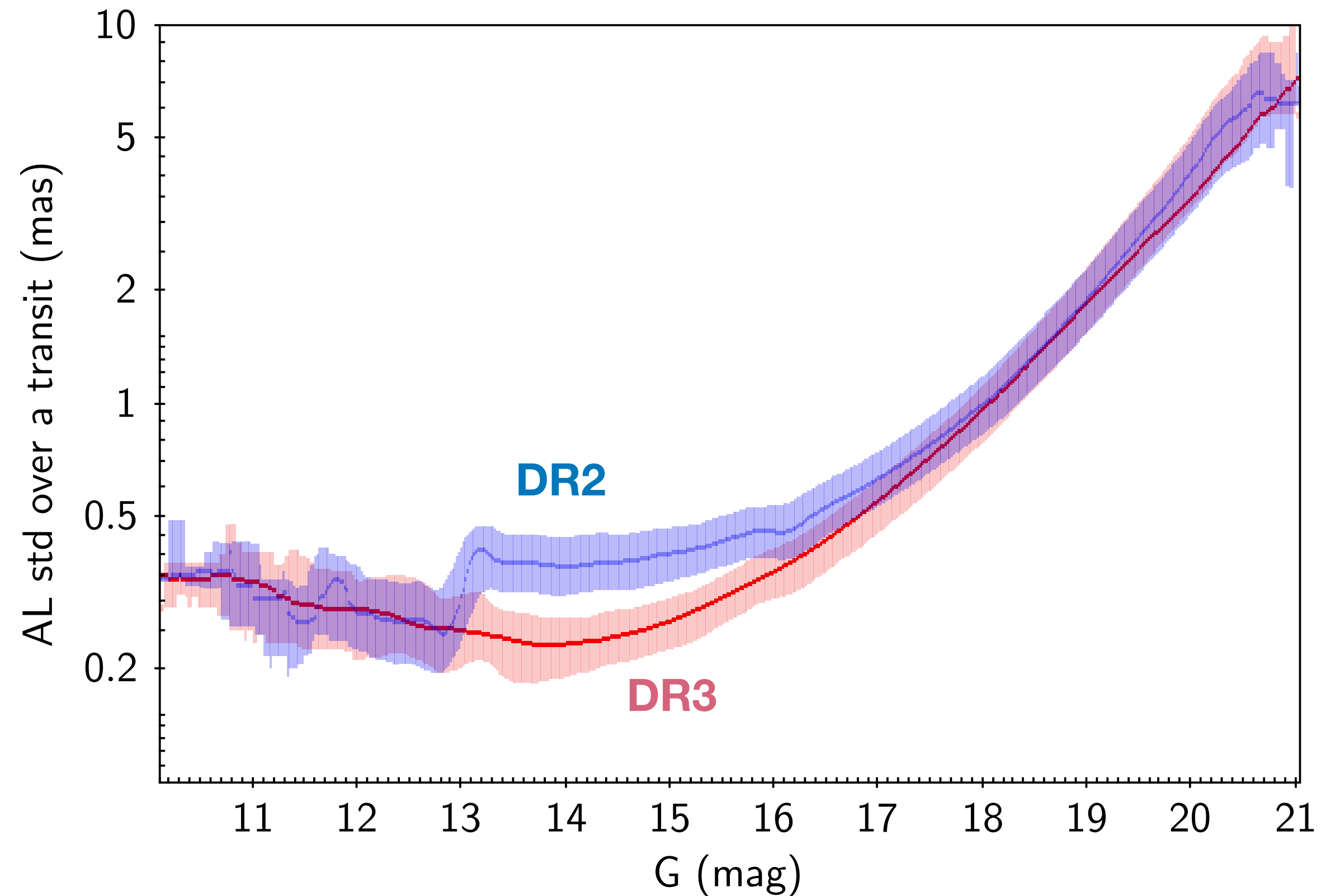


The Solar System data in DR3 - general properties - 1

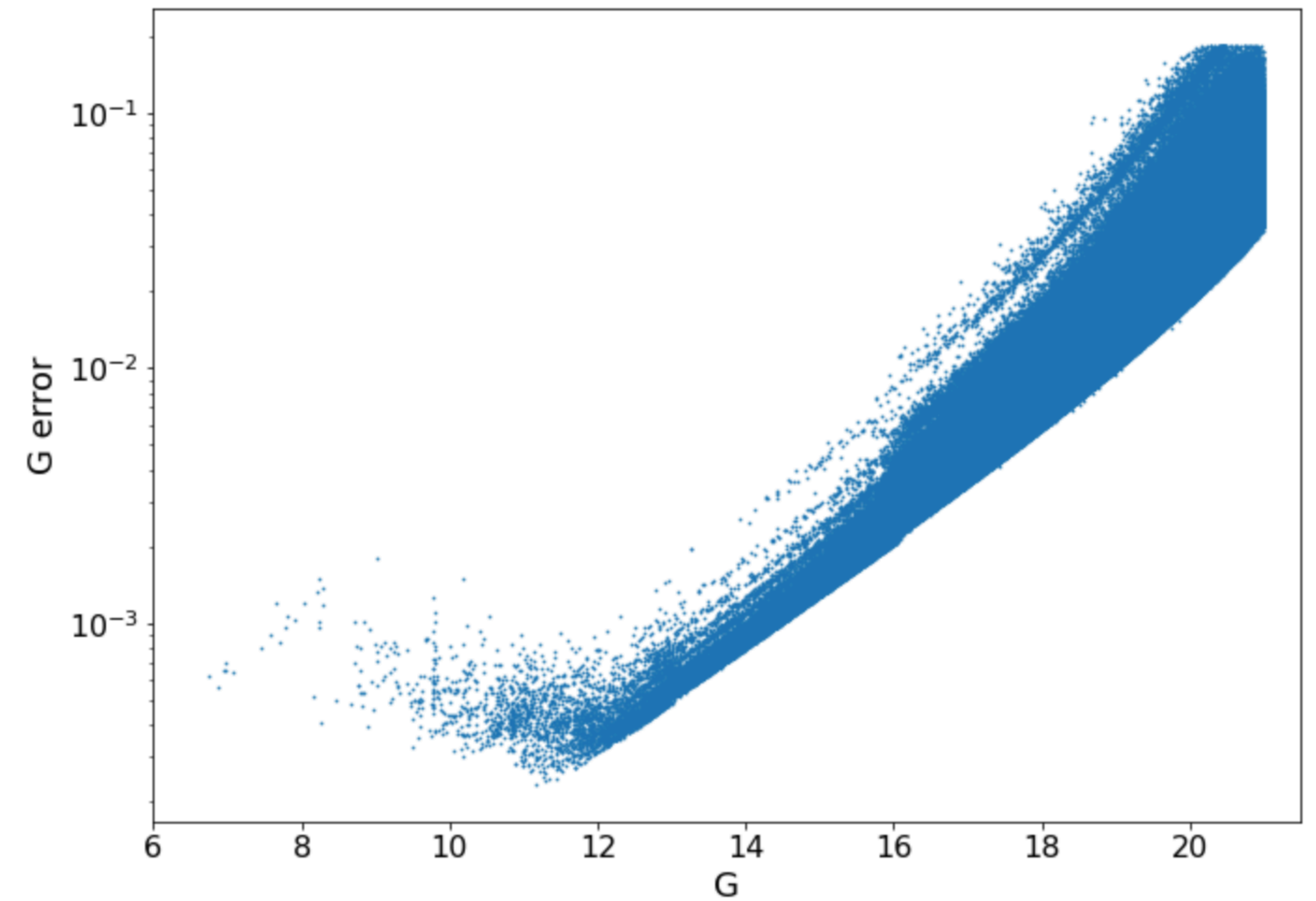


The Solar System data in DR3 - general properties - 2

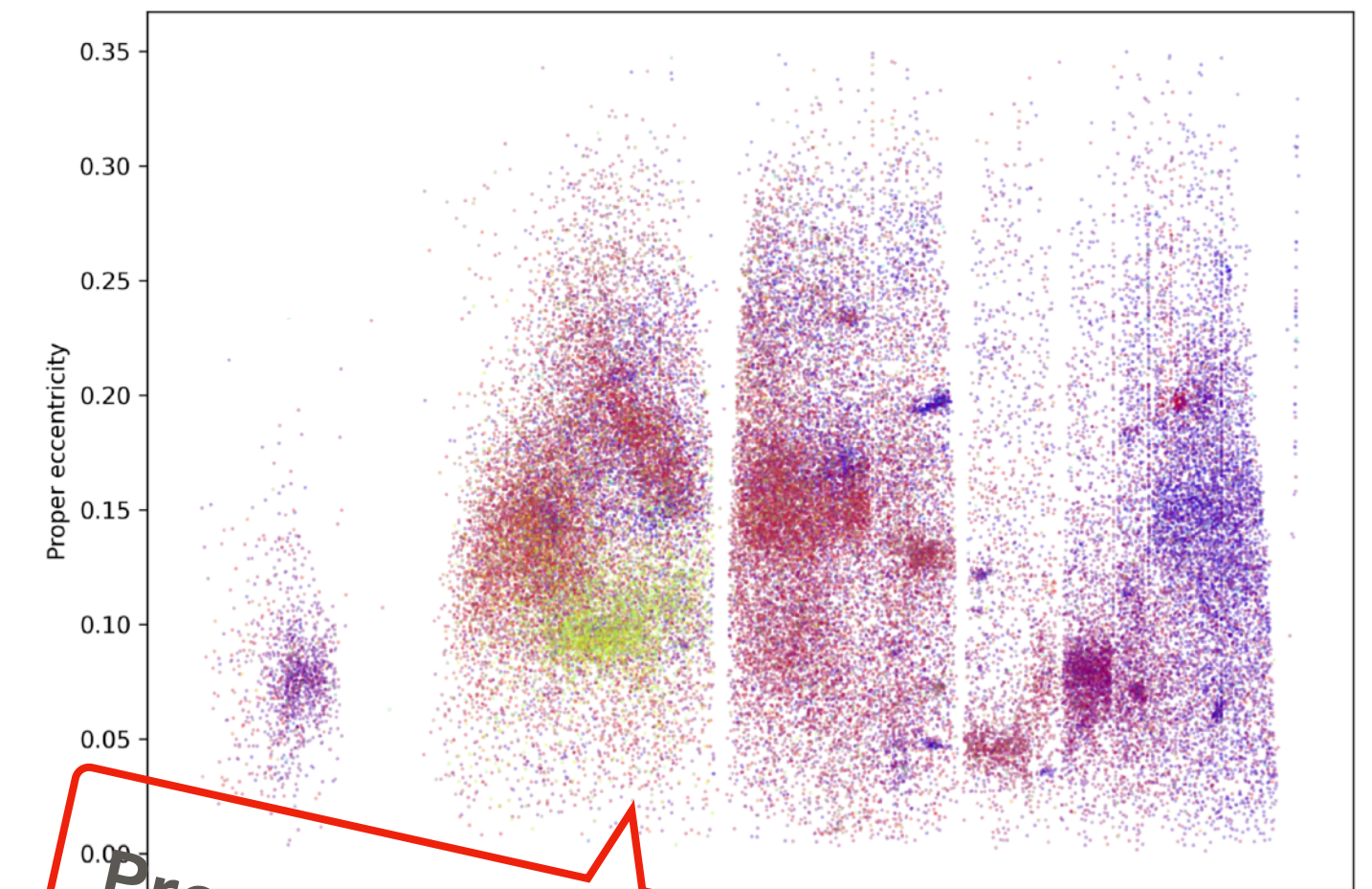
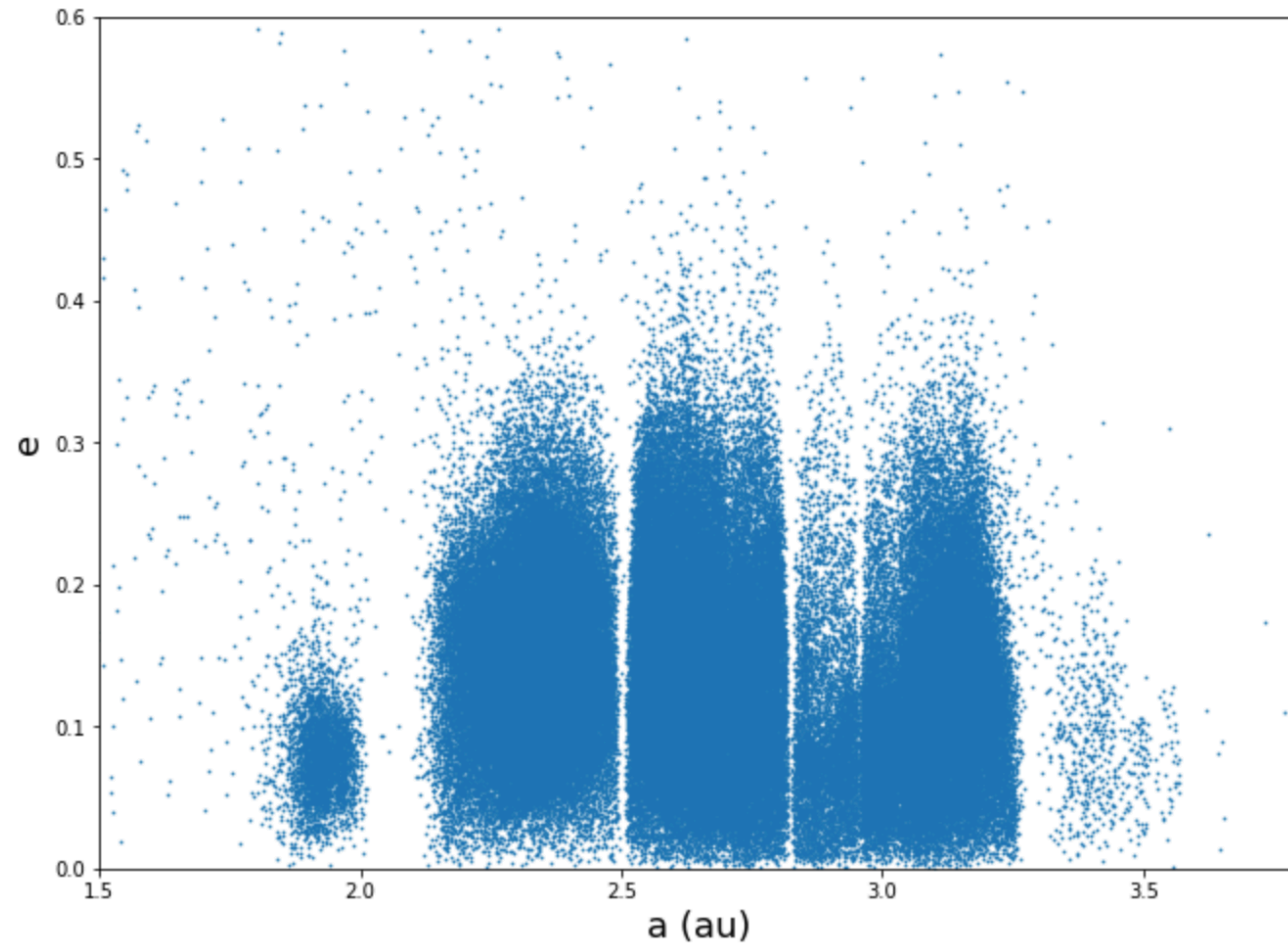
Random astrometric error / transit



Magnitude error / transit



DR3 : a rich portrait of the asteroid belt, in color

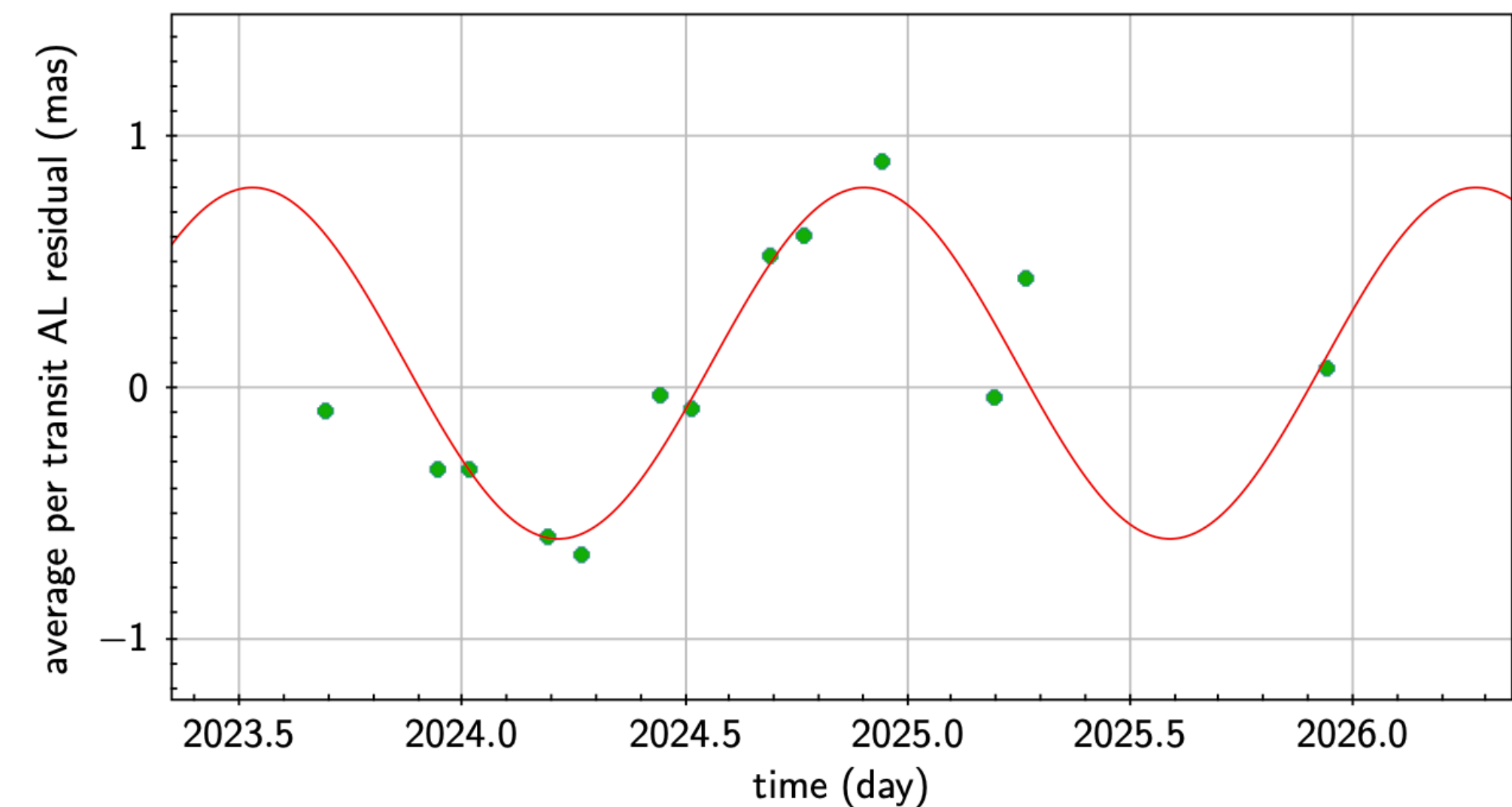
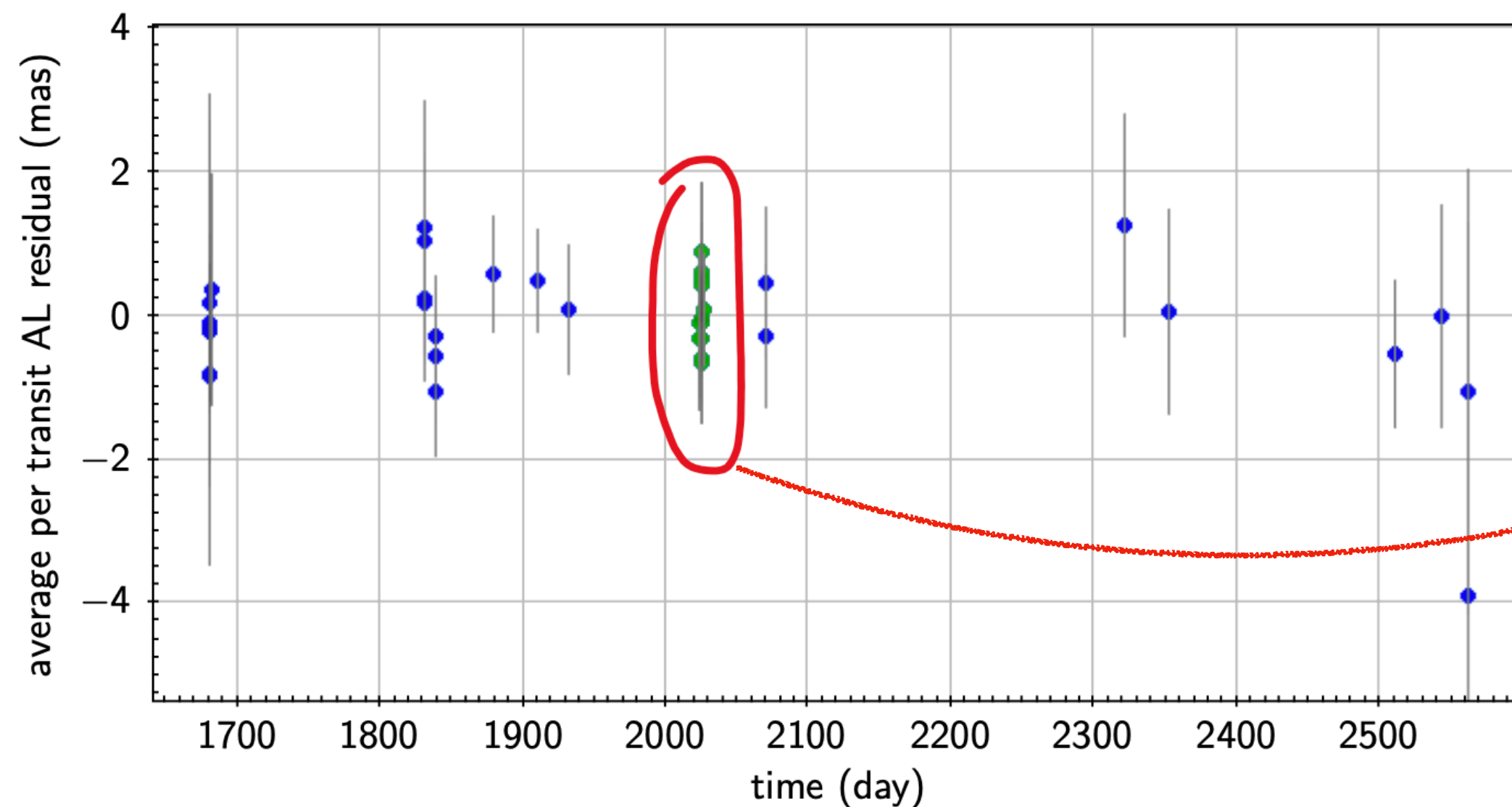


Presentation by M. Delbo et al.
tomorrow, June 29, same time,
this session.

Data mining will discover treasures - an example

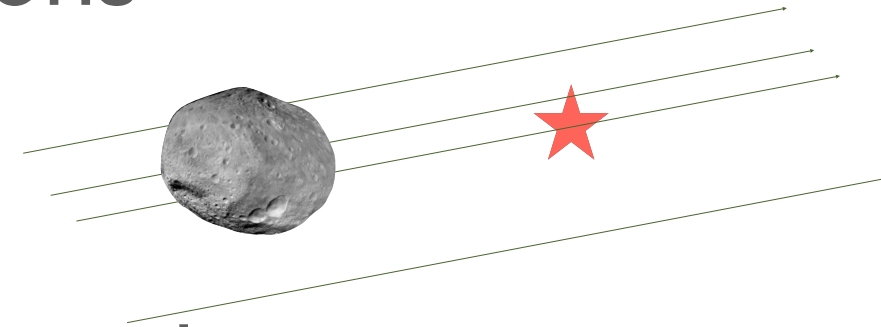
- Asteroid 4337 Arecibo
 - (First!) satellite discovered and confirmed by stellar occultation *only* (May 21, 2021)
 - Photometric inversion of Gaia data → period found (~1.3 days)
- Gaia DR3: possible first photocenter. wobbling due to a satellite detected on an asteroid (amplitude 0.8 mas, period corresponding to rotation)

Residuals with respect to orbital fit



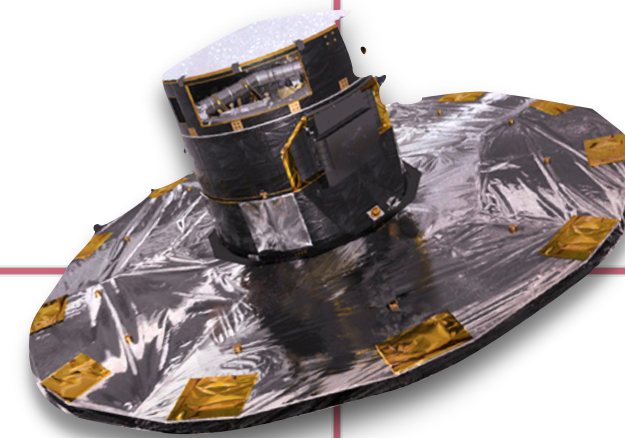
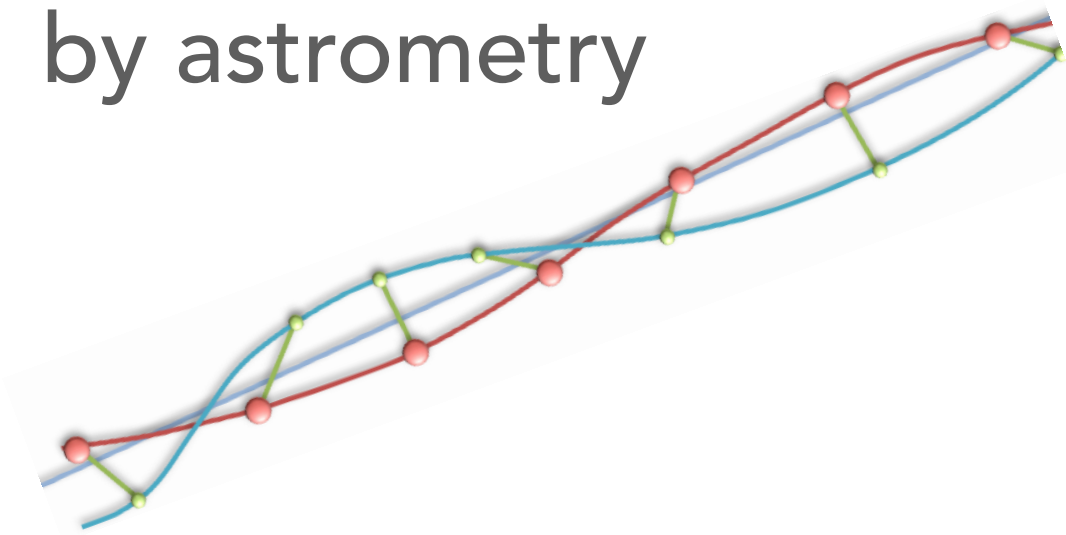
Conclusion: much closer to the science goals!

Improve predictions of stellar occultations

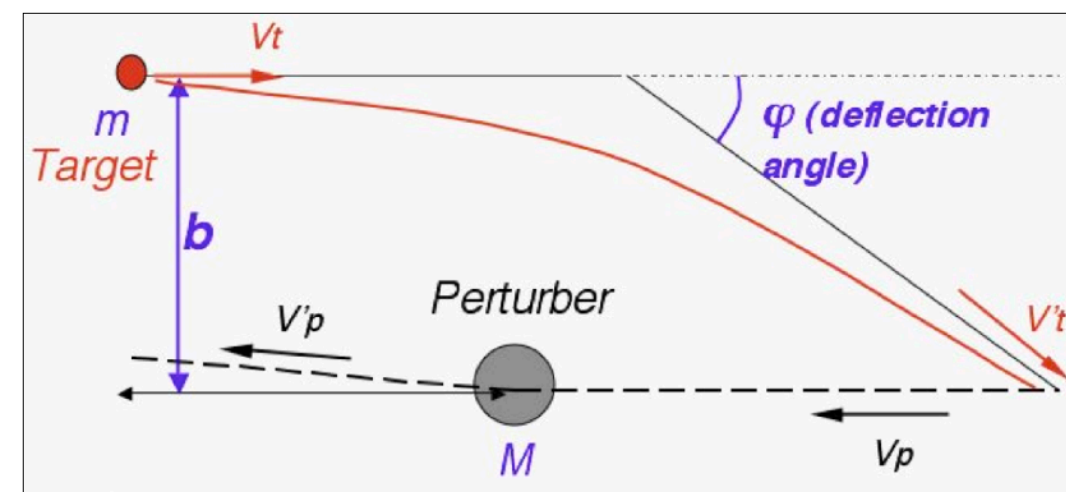
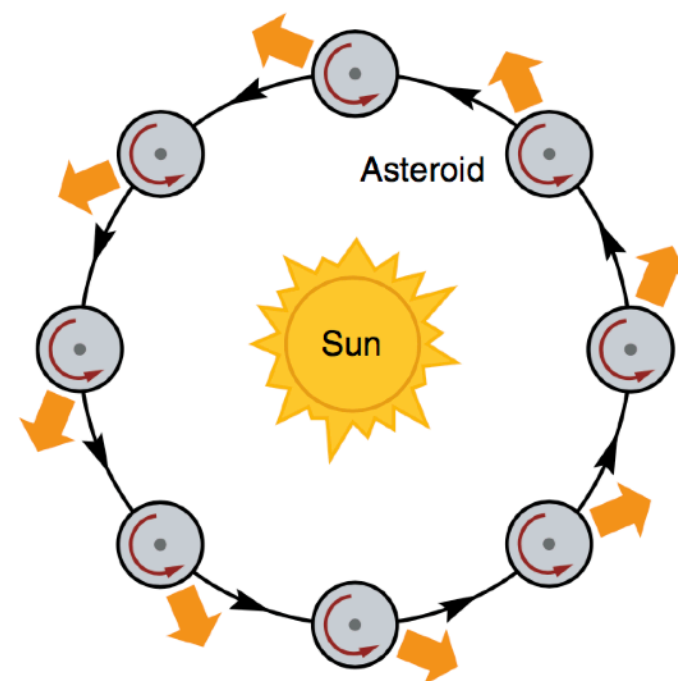


...to derive shape (+photometry), size.

Discover asteroid satellites by astrometry



A new spectro-photometric portrait of the asteroid belt



Measure the Yarkovsky force \rightarrow density

New / precise asteroid masses

