
Paolo Tanga

Gaia et les *alertes* pour les Système Solaire



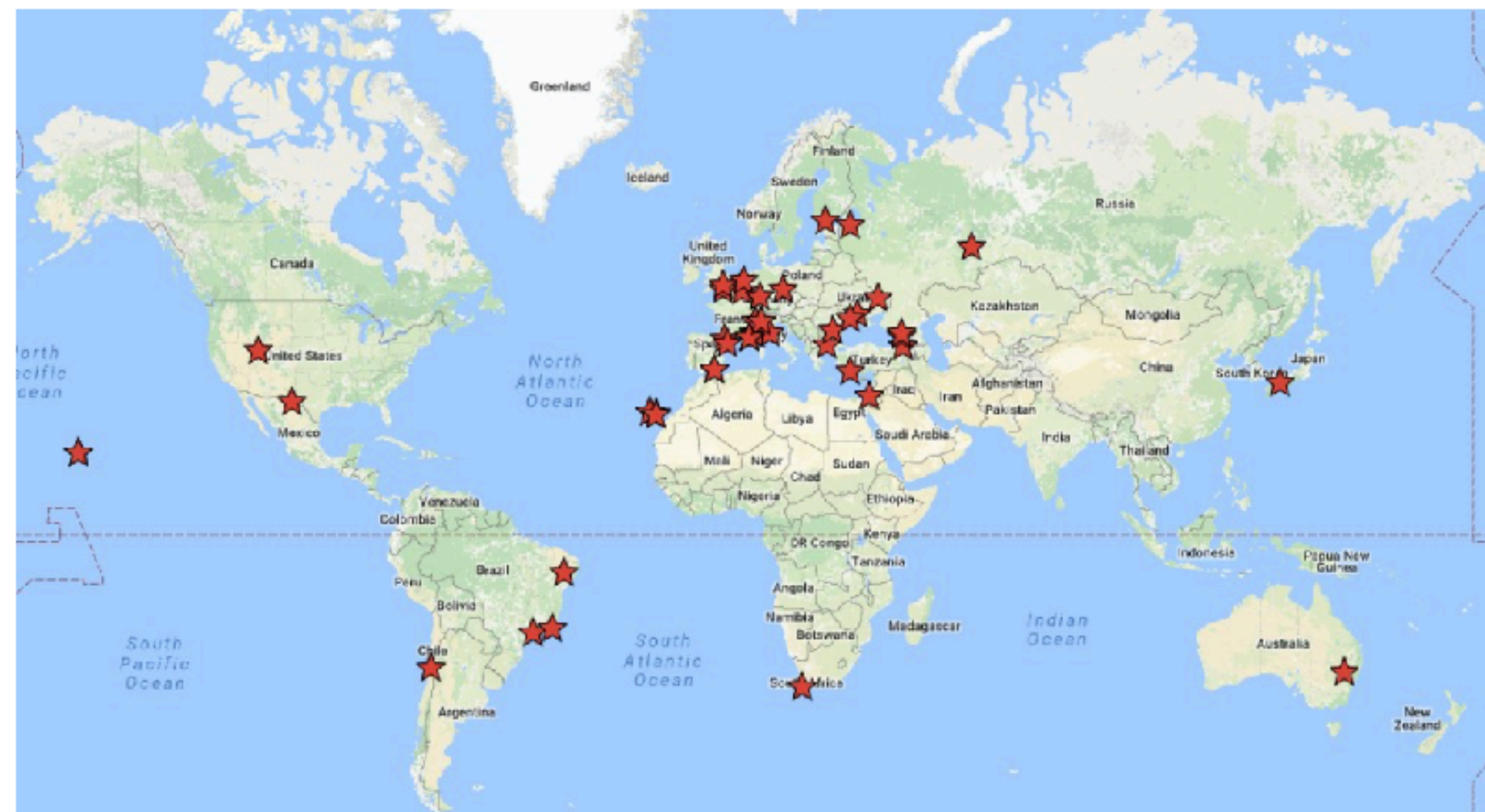
Le alertes *rapides* - fin le 15 Janvier 2024

Gaia Follow-Up Network for Solar System Objects

Goal

The Gaia Follow-Up Network for Solar System Objects (Gaia-FUN-SSO) has been set up in the framework of a task (DU459) of the Coordination Unit 4 (Object processing) of the Gaia Data Processing and Analysis Consortium (DPAC). Its goal is to coordinate ground-based observations on alert triggered by the data processing system during the mission for the confirmation of newly detected moving objects or for the improvement of orbits of some critical targets. Gaia will scan the sky following a pre-defined scanning law and such ground-based observations are required to avoid the loss of newly detected Solar System objects and to facilitate their subsequent identification by the probe.

These pages provide an access to the alerts, including the ephemeris to help finding the targets, for the registered members of the Gaia Follow-up network. The network currently consists in about 80 observers in 27 observing sites, spread all over the world (January 2018).



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Alert and network statistics

This pages lists the statistics on released alerts, and on observations by the ground-based network. The number of observations and list of most productive observatories are based on the reports provided by the observers through the Gaia-FUN-SSO alert pages (not from MPC reports).

Statistics on alerts and reports

Summary of released alerts

First alert	2016-12-01
Current last alert	2024-08-16
Number of alerts	2689

Summary of ground-based observations

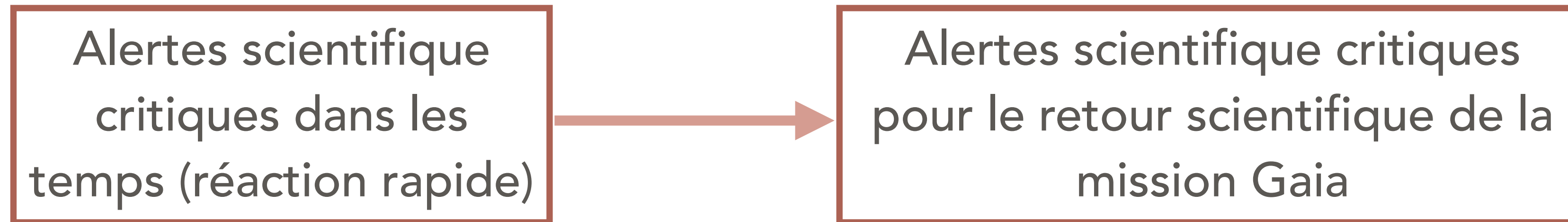
Number of observations	532
Reported candidates	512
Reported attempts without identification	20

The number of observed candidates is larger than the actual number of Gaia alerts recovered from the ground as unknown SSOs may be present in the same field of view and mis-attributed to the alert.

Extension du concept d'alertes dans le cas de Gaia

- Les atouts de Gaia :
 - Une précision astrométrique de centaines de fois meilleure
 - Une photométrie très précise
 - Une collection homogène de spectres dans le visible, sans précédents (richesse, étendue)
- Les observations Gaia :
 - Nous indiquent la possible découverte d'objets avec des particularités
 - Renforcent le rôle et les possibilités des observations au sol (parfois d'une manière drastique)
 - Exemple des occultations stellaires

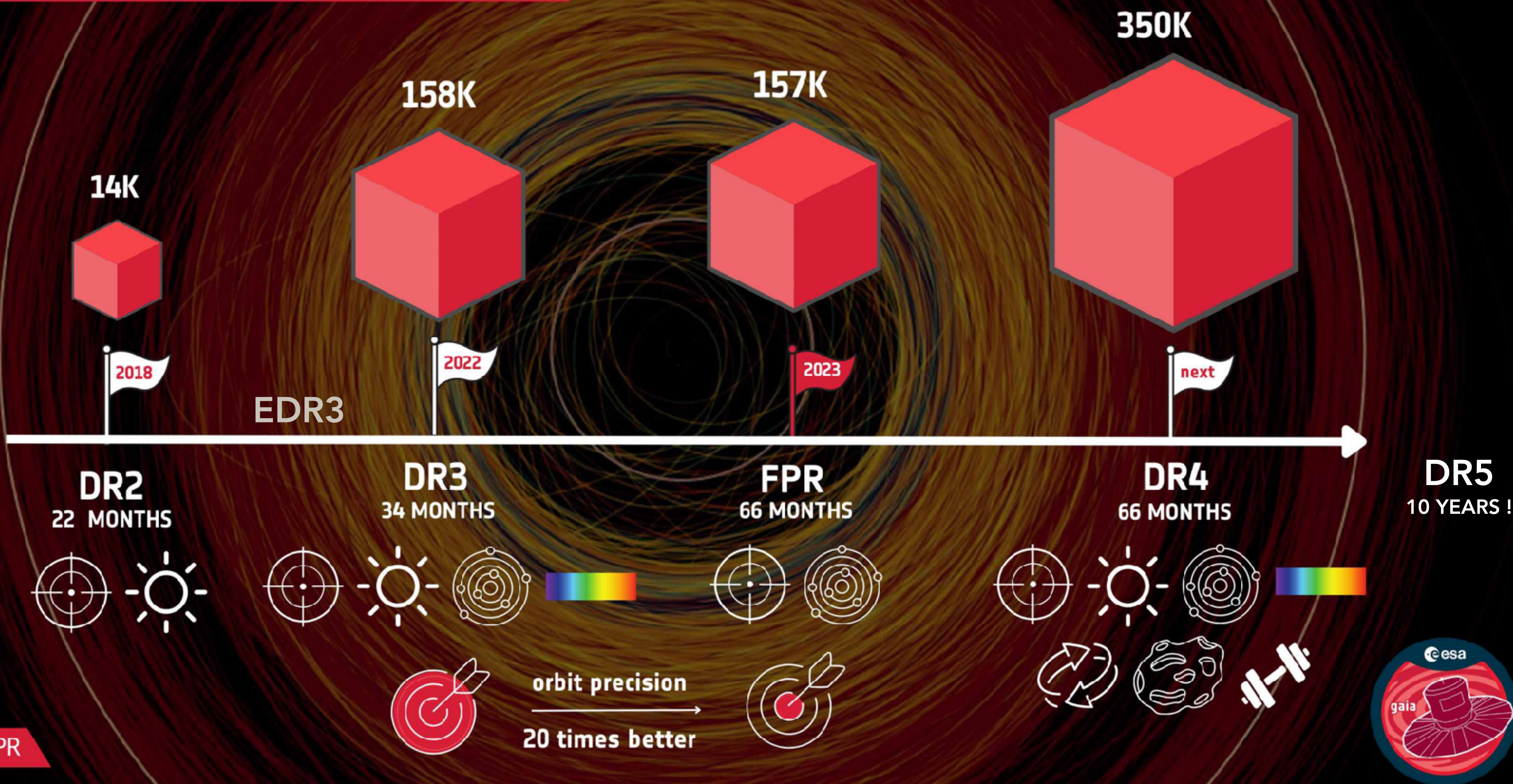
Extension du concept d'alertes dans le cas de Gaia



- Plus grand choix d'astéroïdes observables
- Impact scientifique garanti
- Démultiplication la réussite de Gaia dans le domaine de la planétologie

GAIA FOCUSED PRODUCT RELEASE

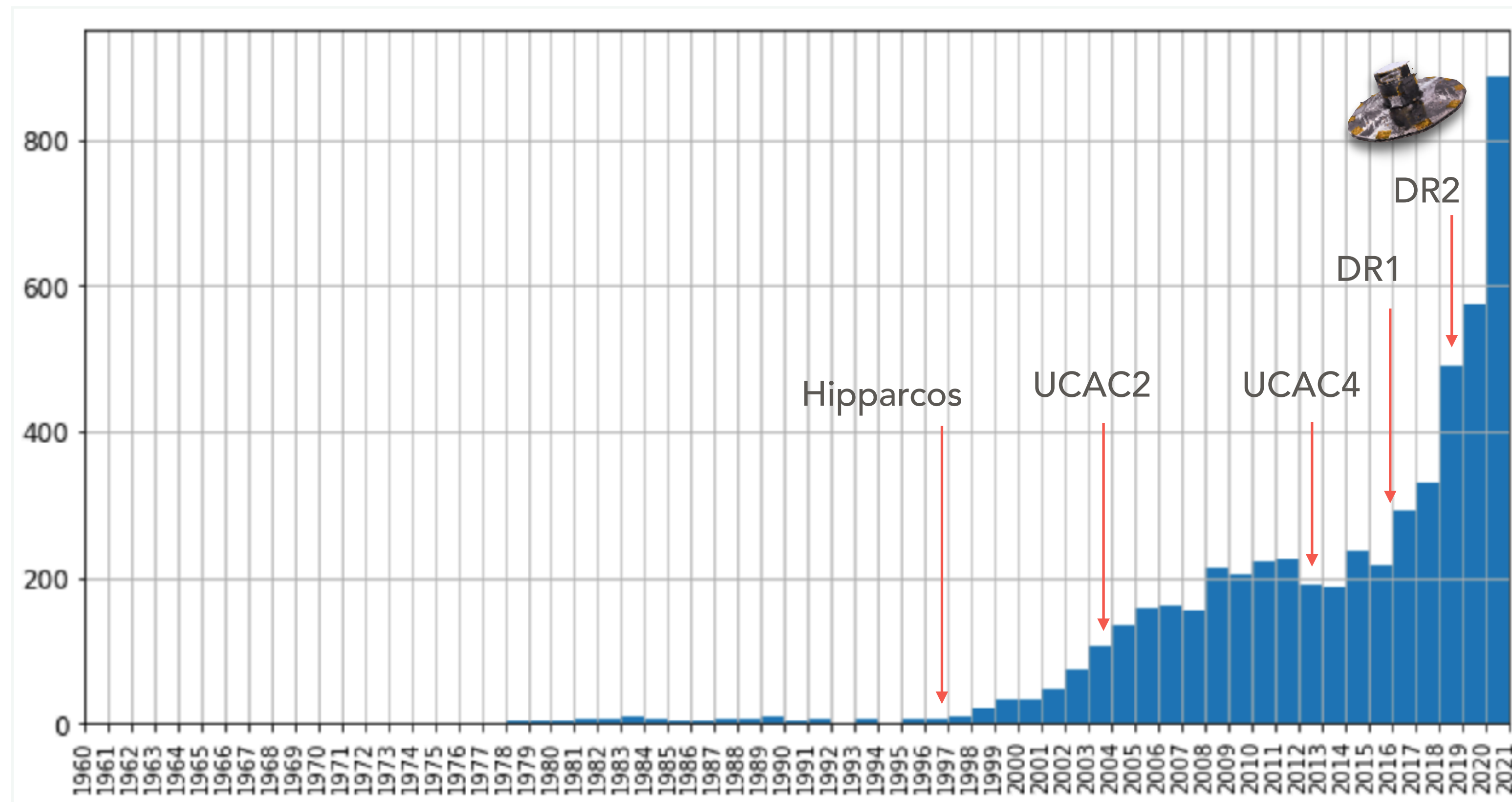
GAIA'S FOCUS ON SOLAR SYSTEM OBJECTS



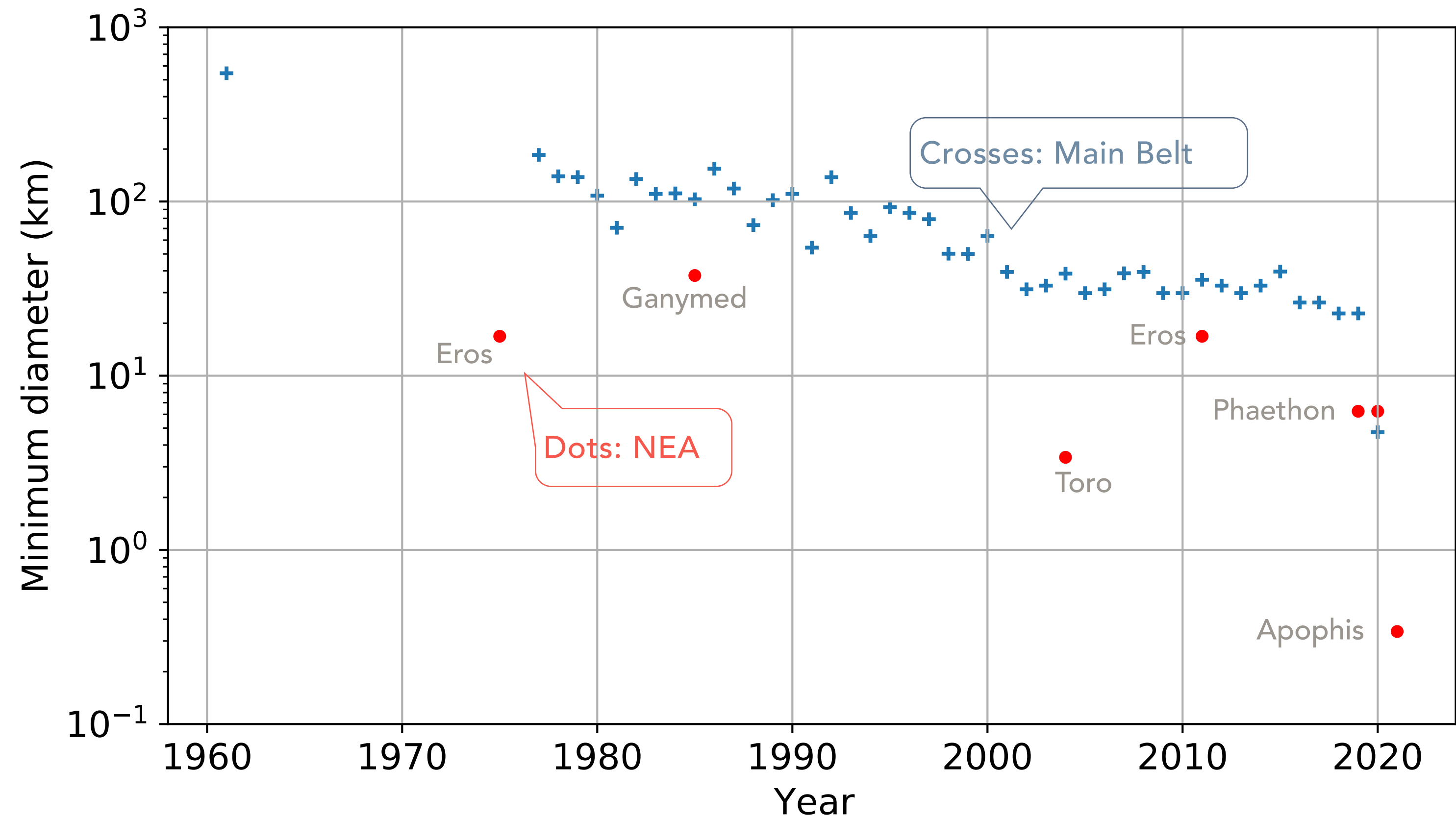
#GaiaFPR

Impact on ground based observations: the improvement of stellar occultations

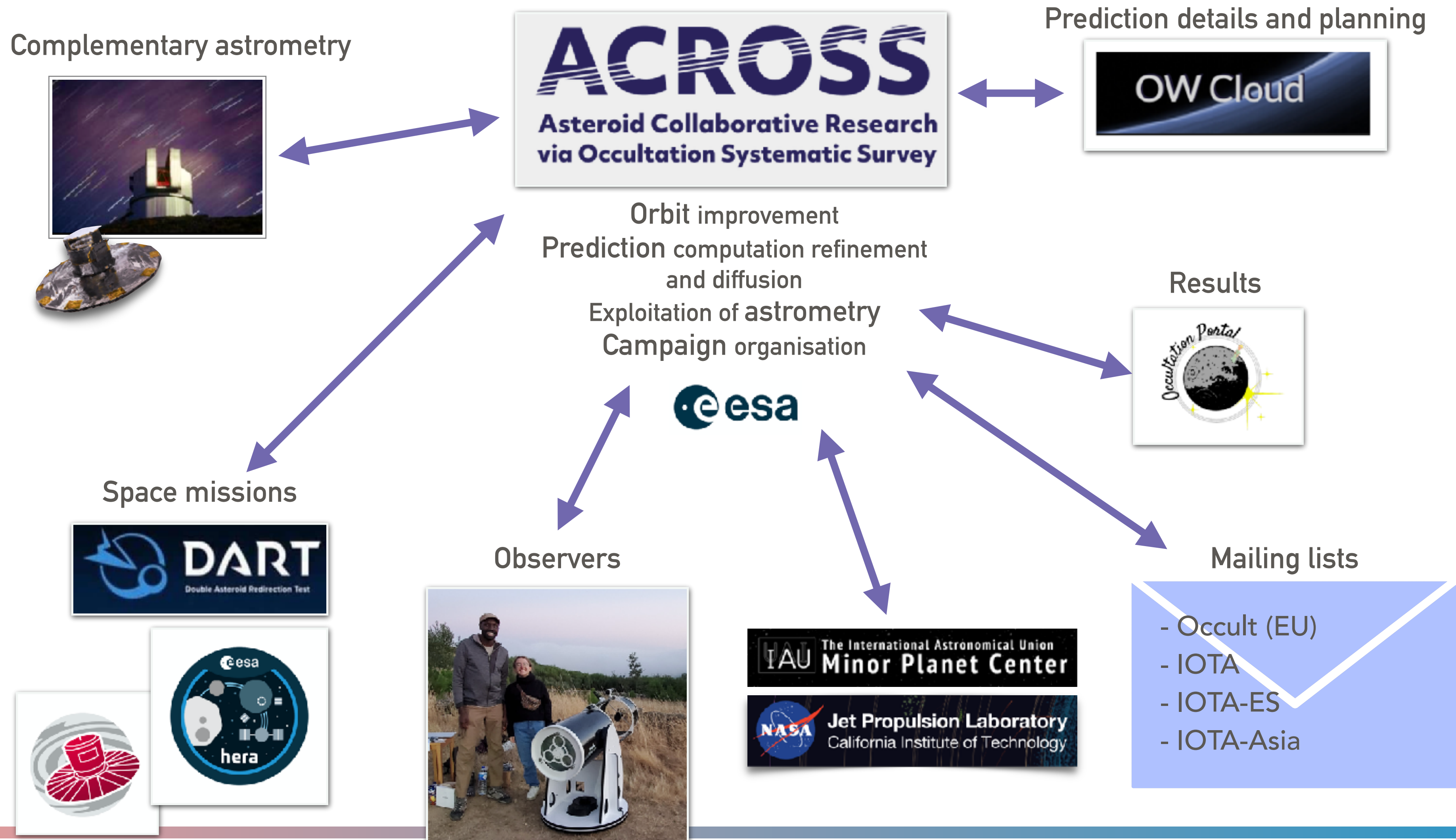
- Better stellar astrometry
- Improved orbits (Gaia astrometry + reference stars / system)



The new frontier: small NEAs



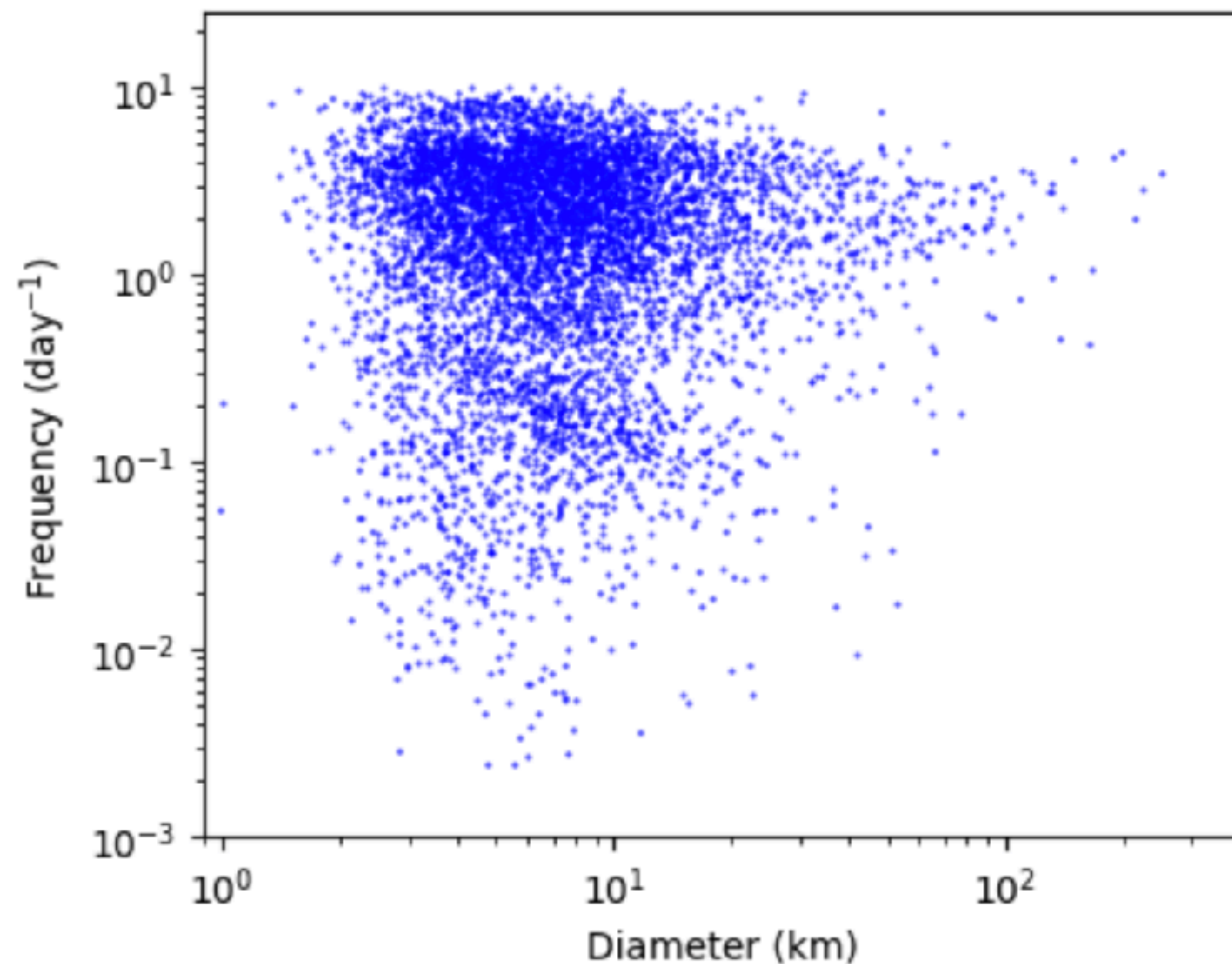
THE ACROSS SYSTEM



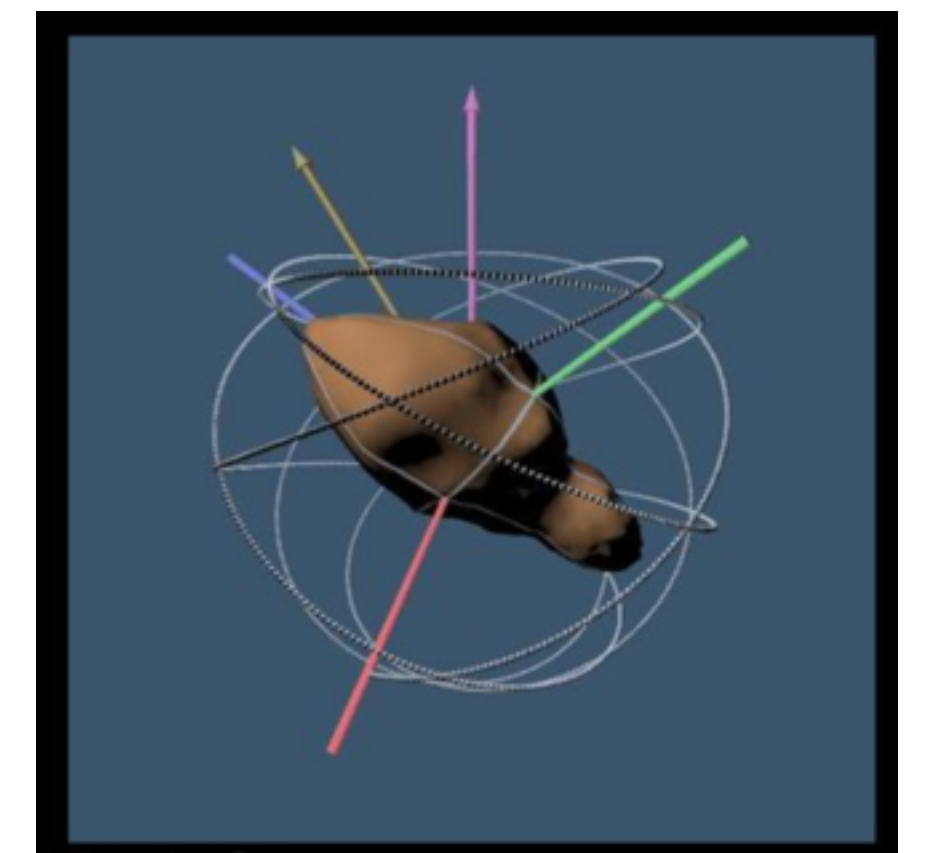
Suivi au sol : la photométrie

Périodes de rotation

Cellino, Tanga, Muinonen, Mignard
A&A (2024)



- Une grande quantité de rotateurs “lents” et “super-lents” (> 10 jours)
 - Des “tumblers” ?
 - Sont ils réels?
- Besoins: courbes de lumière



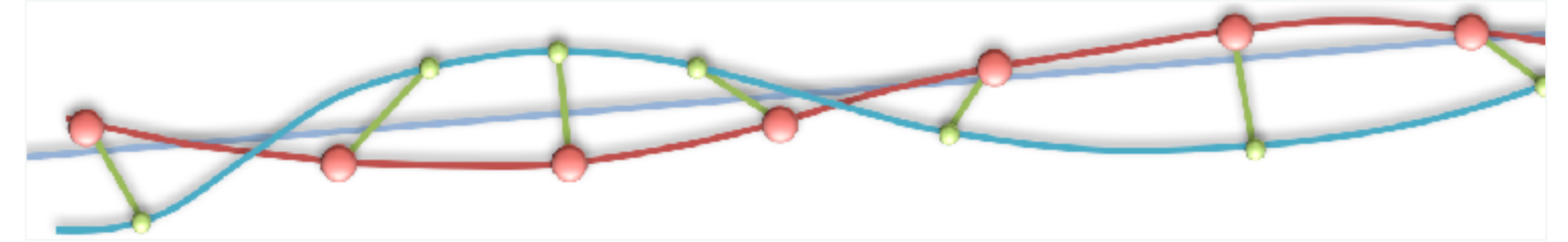
Toutatis

Suivi au sol : l'astrométrie

Recherche d'astéroïdes binaires

Gaia MOONS

anr ©
agence nationale
de la recherche



Coordinator

Paolo Tanga

Université Côte d'Azur, CNRS/UMR7293 Laboratoire Lagrange, Observatoire de la Côte d'Azur

Partner coordinators

Josselin Desmars

IMCCE, PSL Obs. de Paris, IPSA

Dagmara Oszkiewicz

University of Poznan (Poland)

Core tasks and team members

Signal analysis: David Mary - Observatoire de la Côte d'Azur

Stellar occultations: Lyu Abe - Obs. de la Côte d'Azur, B. Sicardy - Obs. de Paris

Physical properties: Benoit Carry - Observatoire de la Côte d'Azur

Gaia data: Laurent Galluccio - Observatoire de la Côte d'Azur

post-doc - Luana Liberato - Observatoire de la Côte d'Azur

PhD student - Raphael Lallemand - Observatoire de Paris

Collaborators

Rodrigo Leiva (Inst. de Astrofísica de Andalucía, Spain)

Katherine Minker (Obs. de la Côte d'Azur, France)

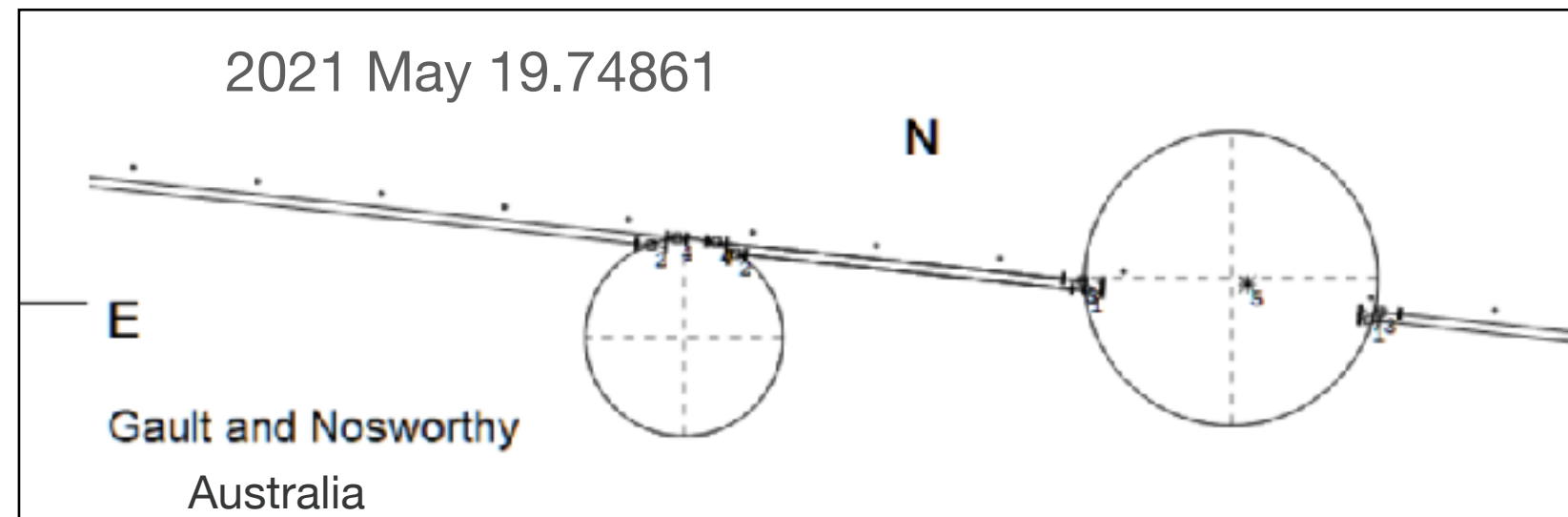
Alexandros Siakas (Univ. Thessaloniki, Greece)

Sotirios Tsavdaridis (Univ. Thessaloniki, Greece)

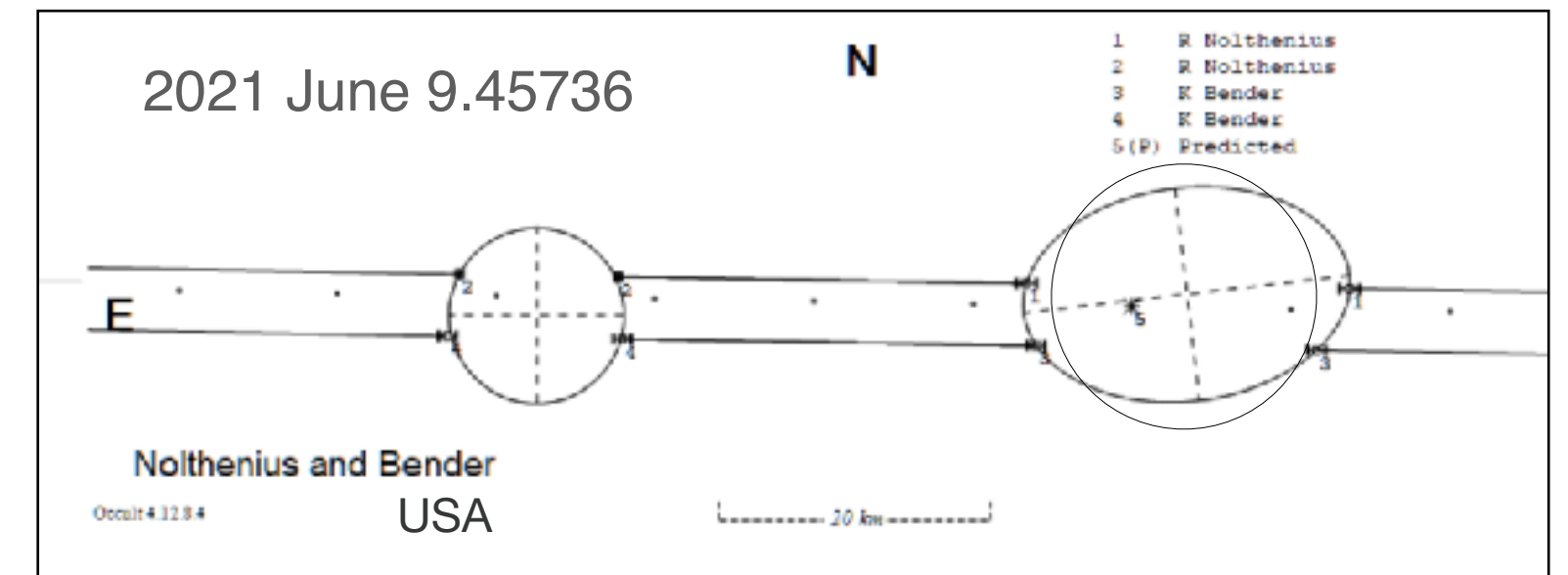
Kleomenis Tsiganis (Univ. Thessaloniki, Greece)

The outstanding case of (4337) Arecibo

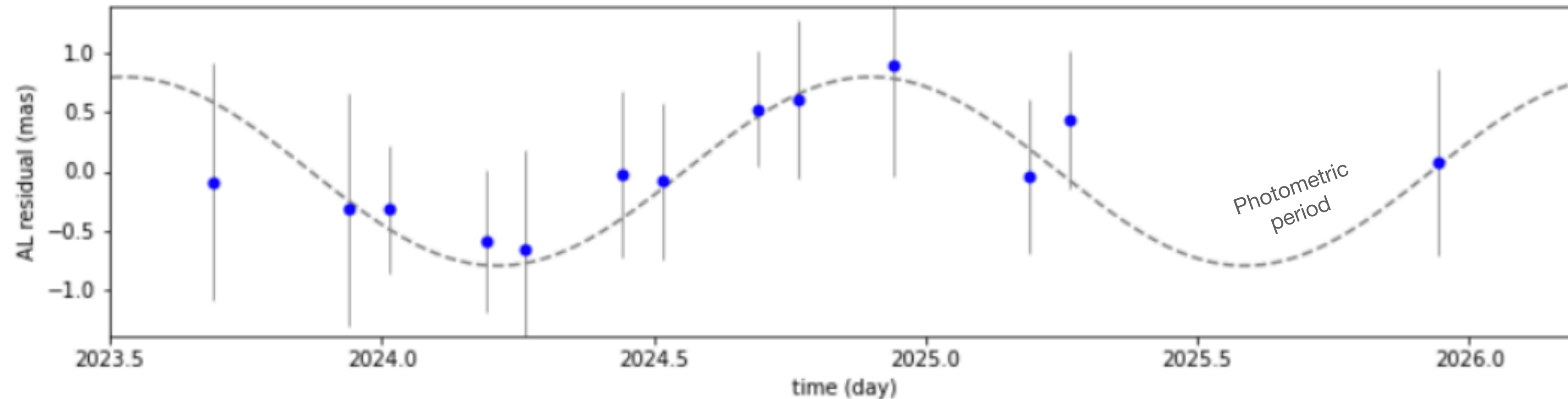
- ~25 km asteroid, Main Belt, Themis family
- **Two occultation events in 2021**

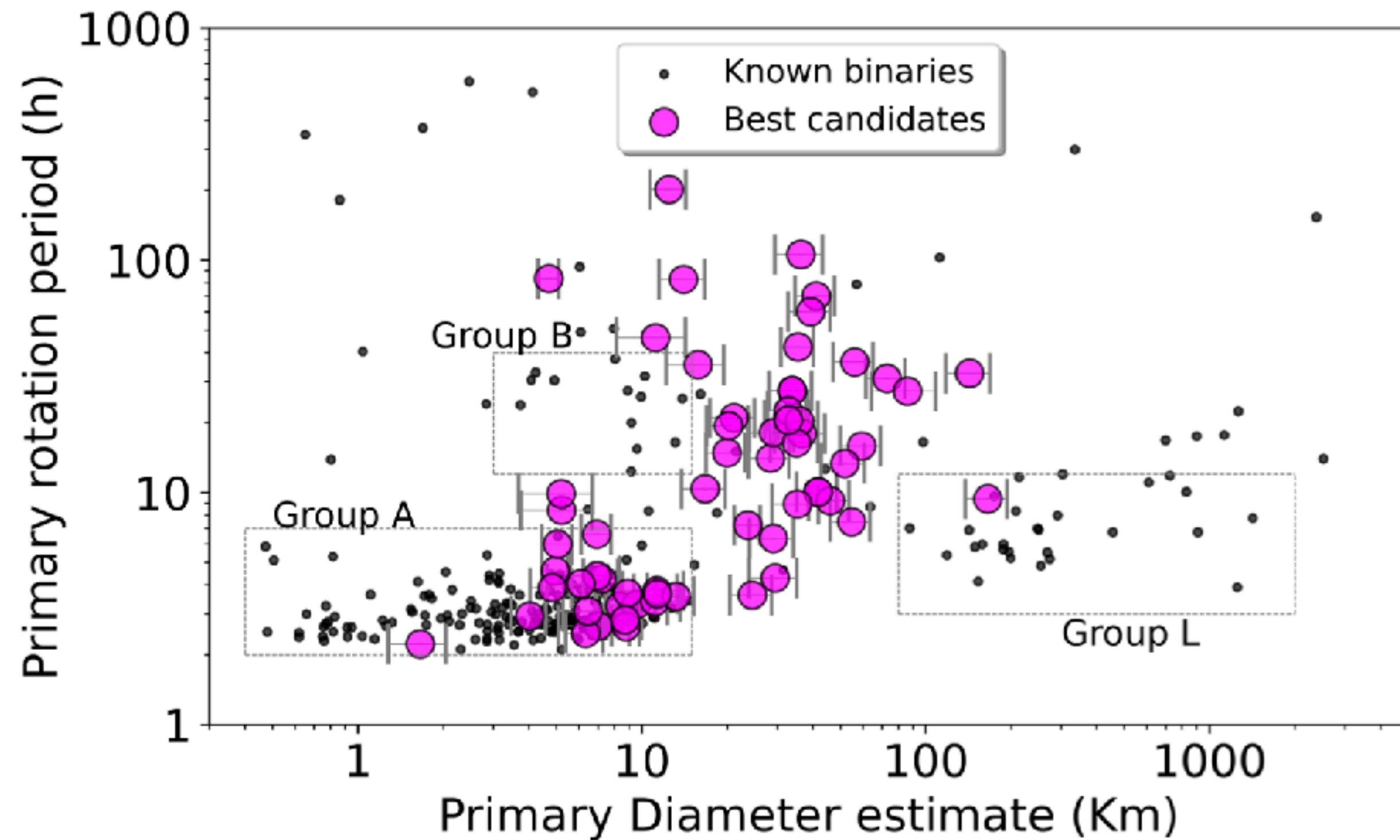


Two accurate relative positions
Size ratio $k \sim 0.55$
Possible polar flattening



- **Gaia : one sequence of transits over ~3 days**
- Photometric inversion : $T = 32.972823$ hours, $(\lambda, \beta) = (271^\circ, 68^\circ) \pm 10^\circ$



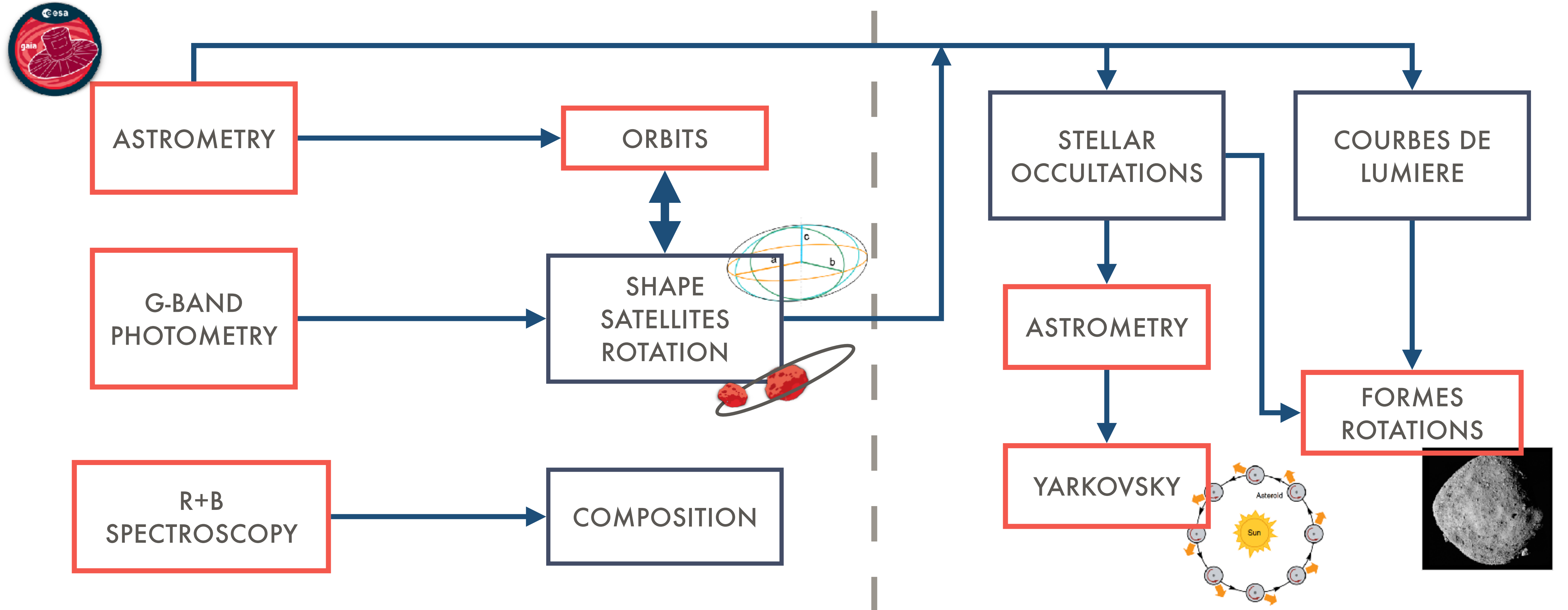


Liberato et al. 2024

- Besoins:
 - Photométrie (occultations mutuelles)
 - Occultations stellaires (R. Lallemand, thésard à IMCCE)
- Perspectives:

Nouvelles liste de candidats à venir (2025)

Gaia exploitation for dynamics and physics of the Solar System



Conclusions

- Gaia est une source d'information scientifique qui va alimenter des nouvelles observations au sol (au delà de DR5 → 2030 / 31)
- Une opportunité importante pour les astronomes amateurs

Pour plus d'information

- Asteroid spins and shape properties from Gaia DR3 photometry
Cellino, Tanga, Muinonen, Mignard, Astronomy & Astrophysics 687, id.A277
- GaiaMoons <https://www.oca.eu/fr/gaiamoons>
- ACROSS <https://www.oca.eu/fr/home-across>