

Preparing GAIIA

- ⊙ Scientific case
- ⊙ Software / instrument requirements
- ⊙ Catalogue(s) output
- ⊙ Ground-based observations

What is to be prepared before GAIA?

- Which objects?
- Data: photometry, astrometry, radial velocity
- Science: physical parameters, fundamental physics, dynamic, reference frames
- Catalogues: detection, tracking, complementary observations

Scientific case

- ⊙ **Orbits & Physical parameters of asteroids**
- ⊙ **General relativity, reference frames**
- ⊙ **Other objects of the solar system**

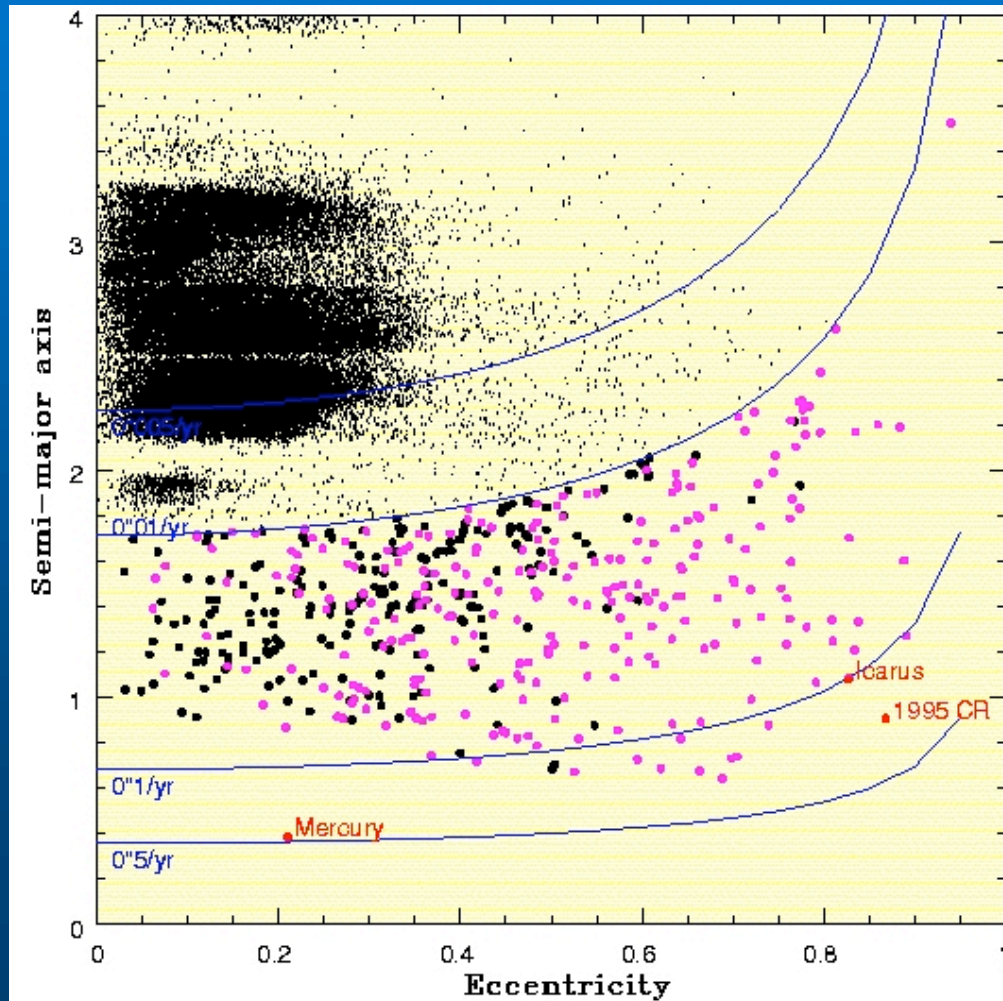
Orbits & physical parameters

- **Orbits: use of GAIA alone, use of the radial velocity**
- **Albedo, taxonomy**
- **Imaging: diameter/shape, binaries**
- **Mass/density: statistics, estimation of the precision**
- **Diameters of stars, fund. parameters**

Fundamental physics

- Test of GR (PPN)
 - perihelion precession (β)
 - trojans
 - η Nordvedt
 - equivalence principle
- Quasi-inertial reference frames
 - which objects (QSOs & asteroids)
 - residual rotation or vortex
- Need of accurate orbits

Perihelion precession



● Mercury : 0"43/yr

● Icarus : 0"1/yr

● $\Delta \omega \vartheta GM_{\text{Sun}} / [c^2 a (1 - e^2)]$

● $J_2^{\text{Sun}}, \beta, \gamma$

● Io (J1) : 2"7/yr

Fundamental physics

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Other objects

- Major planets (Uranus, Neptune, Pluto)
- Planetary satellites
 - distance to planet
 - new detection
- Comets

Software/instrument requirements

- ⊙ **Detection & identification**
- ⊙ **NEOs tracking**
- ⊙ **Adapting the instrumentation**
- ⊙ **Reduction pipe-line, Orbit determination**

Detection - Identification

- Identification-matching (updated catalogue)
- Newly discovered objects
 - Most objects will be known in 2010
 - Identification over one epoch
 - Special treatment for NEOs (fast moving objects).
Tracking along the AF. Use of the "spectro" field

Adapting the instrumentation

- Photometry near IR toward $1.1 \mu\text{m}$
- Spectra around $0.5\text{-}0.6 \mu\text{m}$
- Increase mission duration
- Spectro $V < 22$ good for NEOs & KBOs
 - > not only positions
- Angle to Sun (scan) $> 55 \text{ deg.}$

Simulations

- **Data acquisition & reduction pipe-line**
 - for all instruments (spectro, astro)
 - modelling the PSF (spectral type, size, velocity, and instrumental factors)
 - detection and identification algorithm, testing its efficiency
 - orbit restitution from short-arc
- **The solar system**
 - MBAs, KBOs, IEOs, Venus trojans
 - Catalogue completion (size, location)

...

Catalogues output

- ⊙ Ephemeris requirement
- ⊙ Stellar catalogues
- ⊙ Ground-based observations

Phase effect - orbits

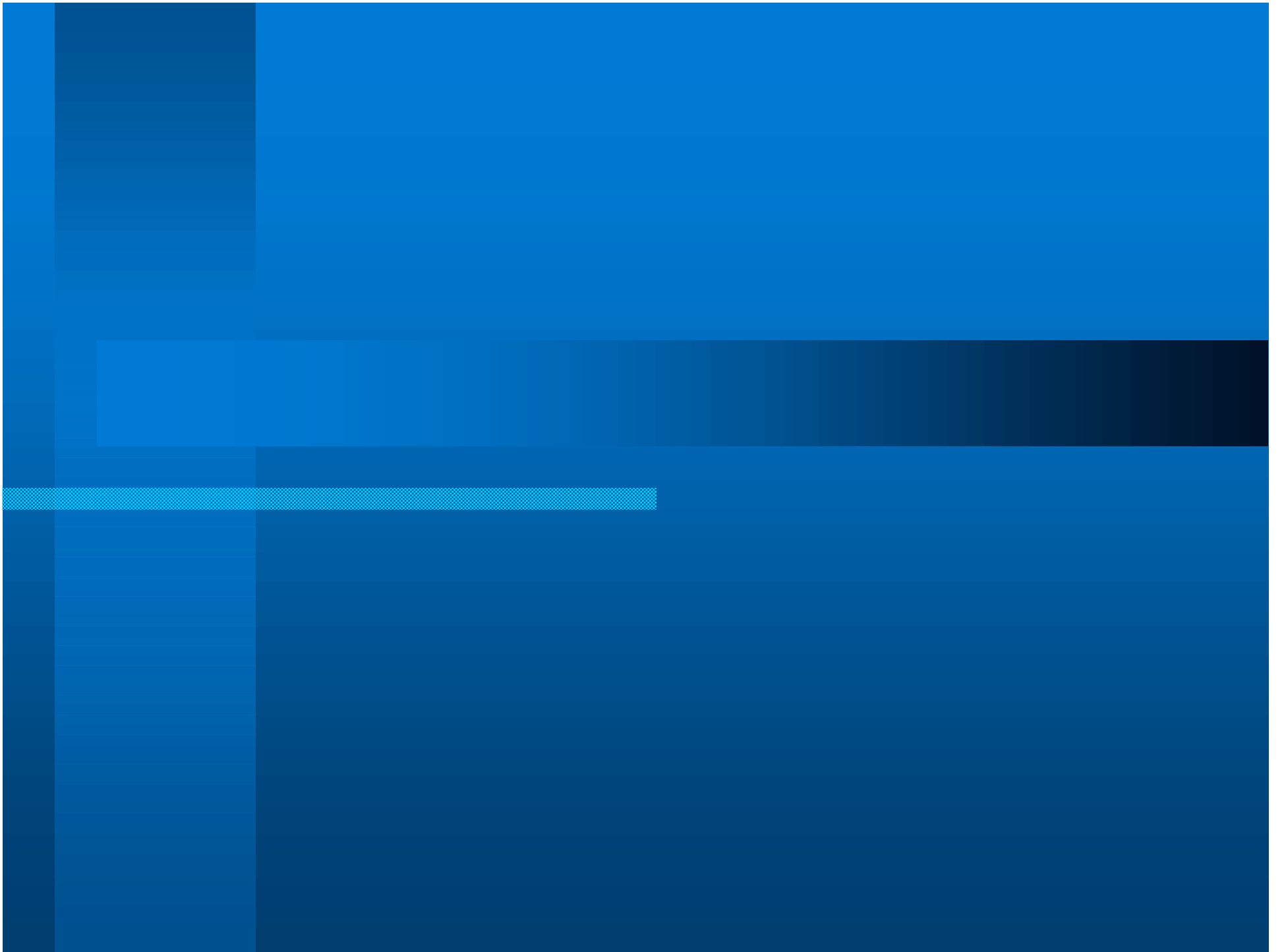
- **Photocenter offset**
 - Non predictable (irregular shapes, light diffusion)
 - Limited to the 'largest' objects
 - Hipparcos heritage
- **Mutual perturbations**
 - construction of accurate orbits

Stellar catalogues

- Stellar data (astrom. and photom.) corrupted by close approach
- Earth ephemerides (aberration): **OK**
- Deflection of light from planets: **OK**

Ground-based observations

- **Identify the needs**
 - science (also DIVA, FAME, DENIS, ...)
 - catalogue output
- **Alert procedure (newly discovered object)**
 - accuracy of the data
 - follow-up program
 - dedicated ground-based telescope(s)
South & North: size, automated, cost, efficiency (small solar elongation)

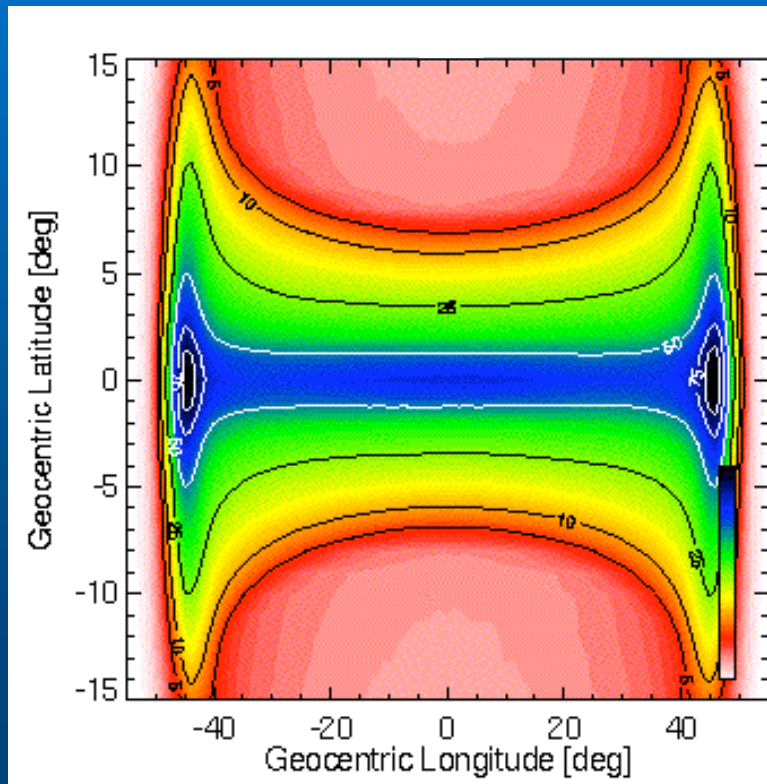


Trojans & co-orbitals

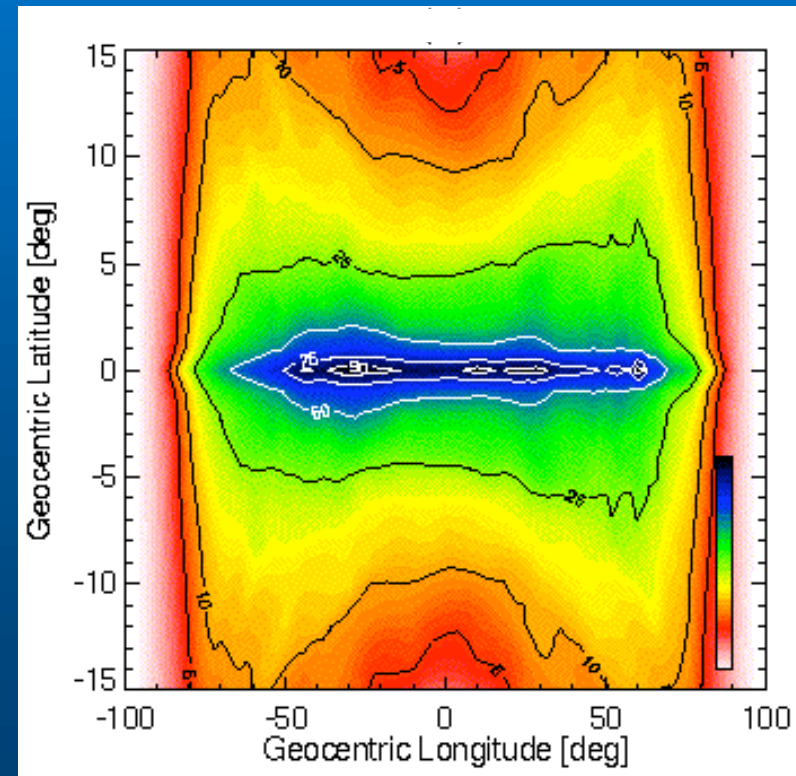
Venus

(Evans & Tabachnik, 2000)

Earth



$V \sim 67 \pm 8$ mas/s



$V \sim 40 \pm 6$ mas/s