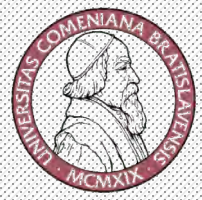


Comenius University

RNDr. Roman Nagy, PhD.

Leonard Kornoš

FMFI UK

AGO Modra

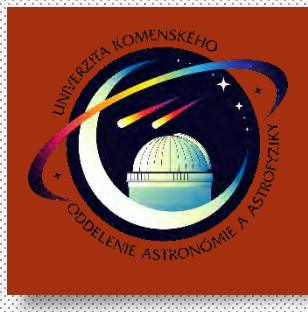
Students and colleagues

Students and colleagues

V Akademickom roku 2021/2022

- 13 magisterských študentov
- 9 doktorandov

Astronomy at Comenius University



- fields of research:
  - interplanetary matter
  - meteor astronomy
  - galactic astrophysics
  - space debris

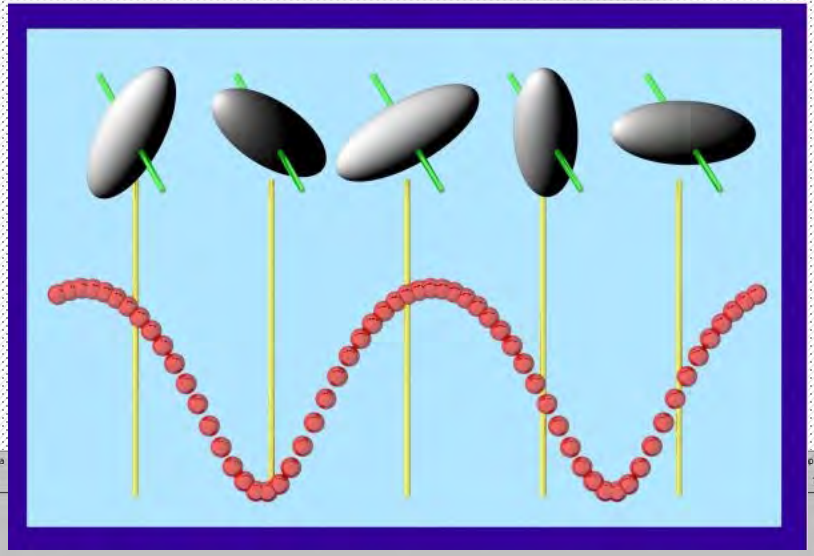
Interplanetary matter

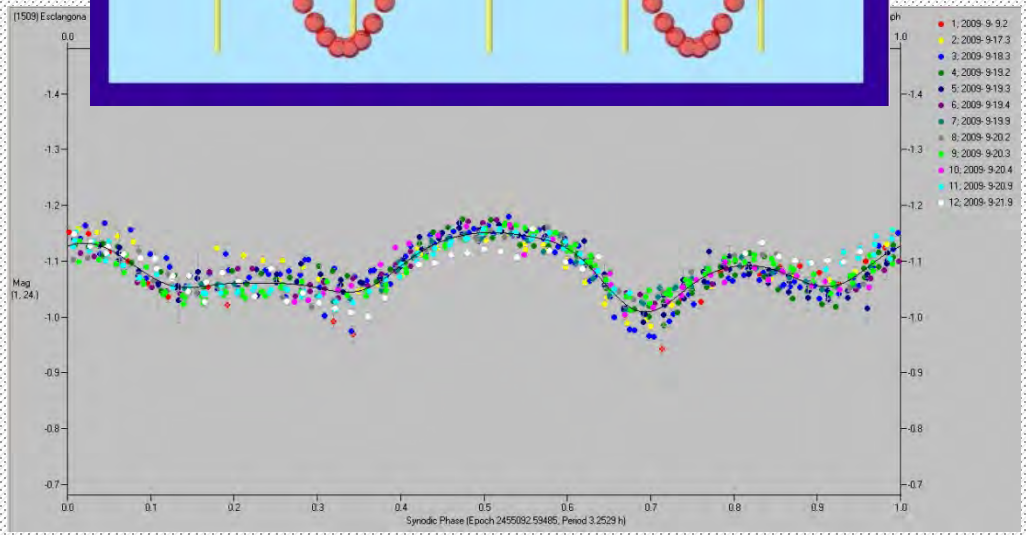
- astrometry and photometry of asteroids and comets
  - improvement of orbits
- dynamics and physical properties of asteroids (rotation rates, Yarkovski a YORP effects,...)
- theoretical research on gravitational motion and non-gravitational effects

60 cm telescope

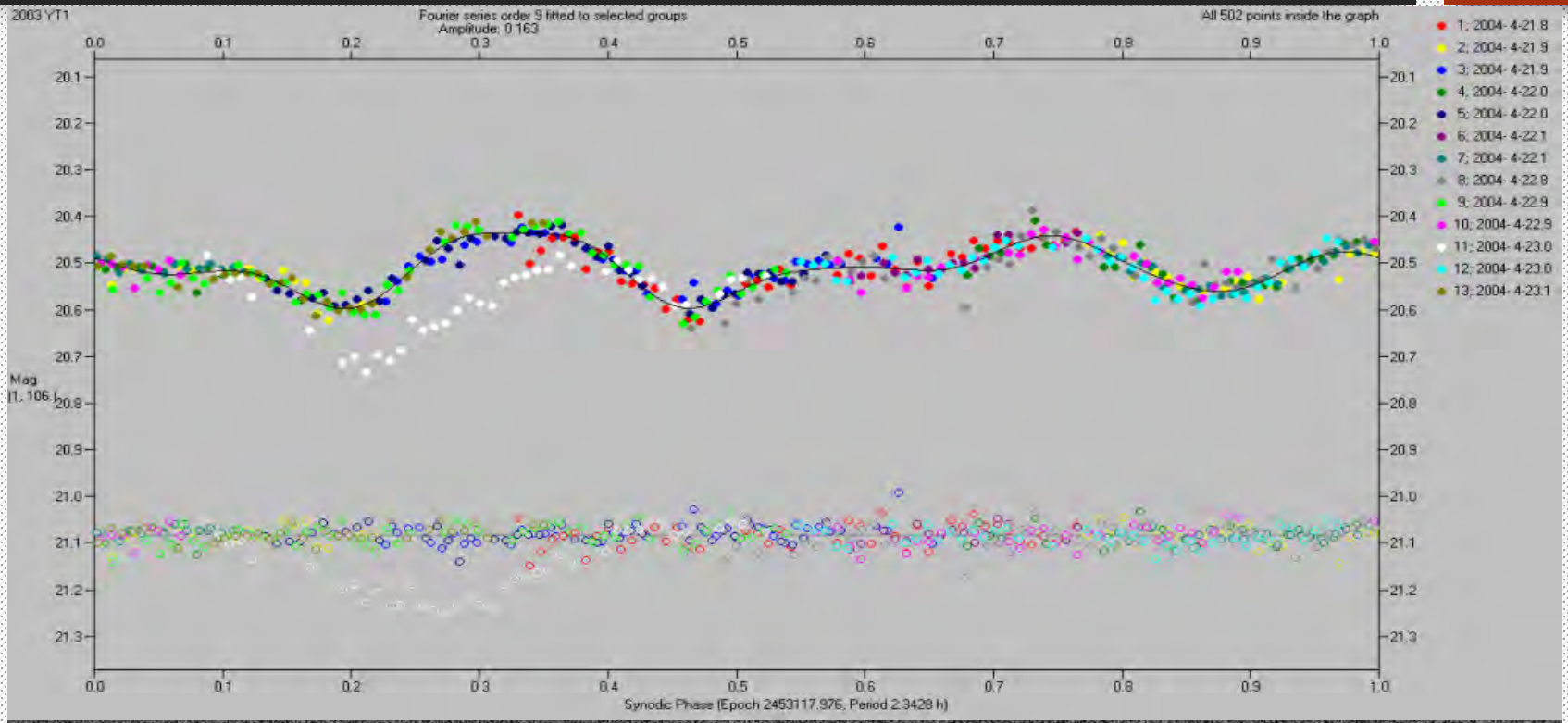
Photometry

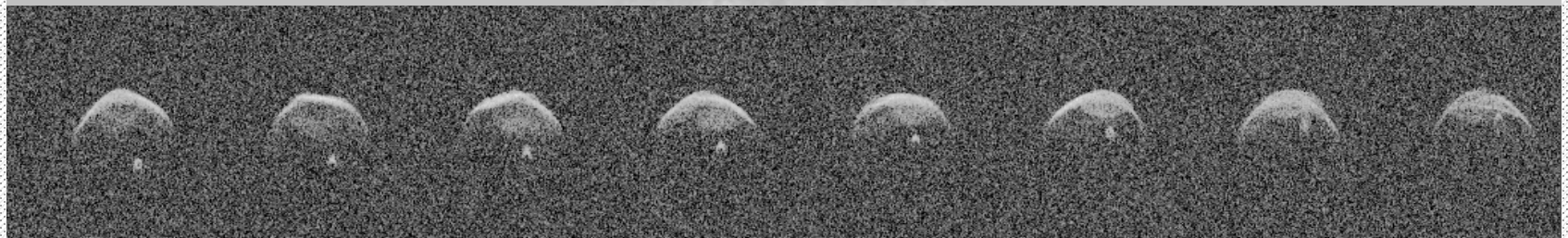
- 17. mag
- NEO, Mc, MBA
- Rotation period
- Precession



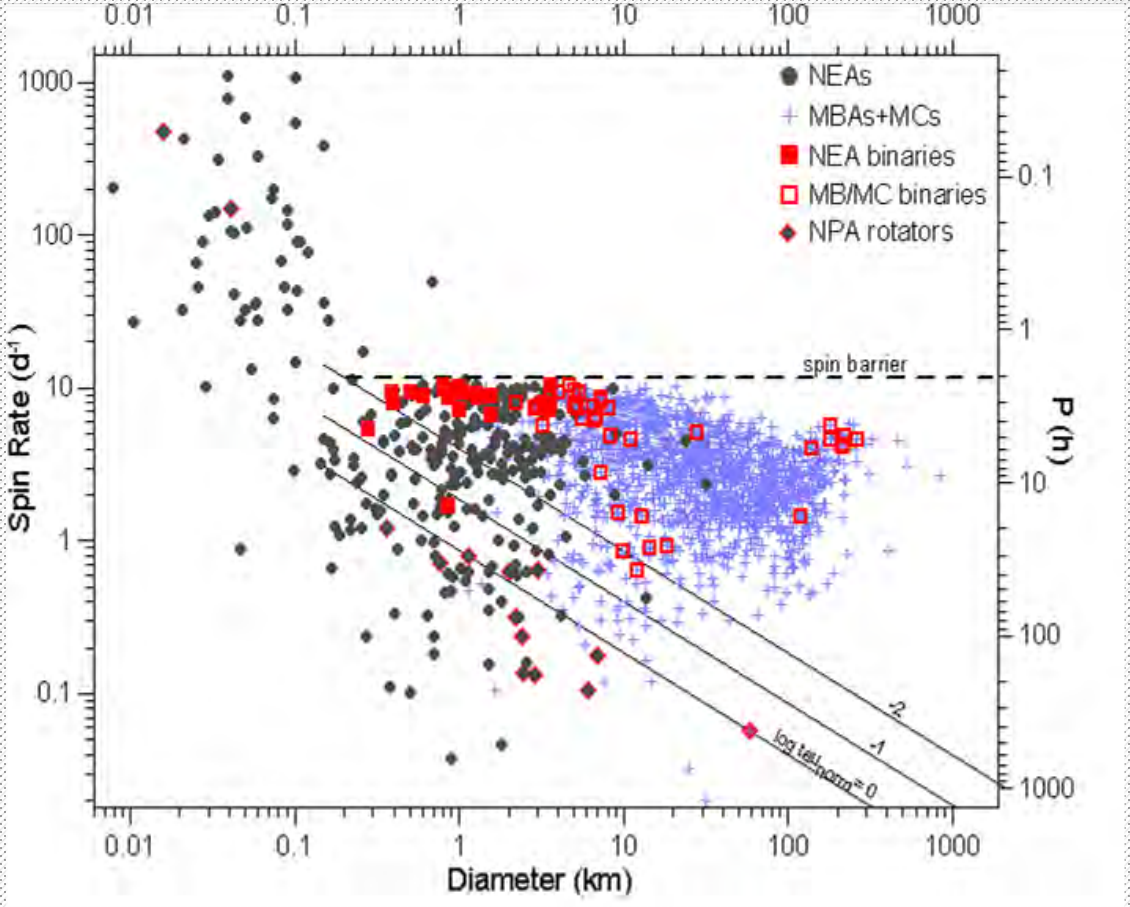


Photometry – binary asteroid



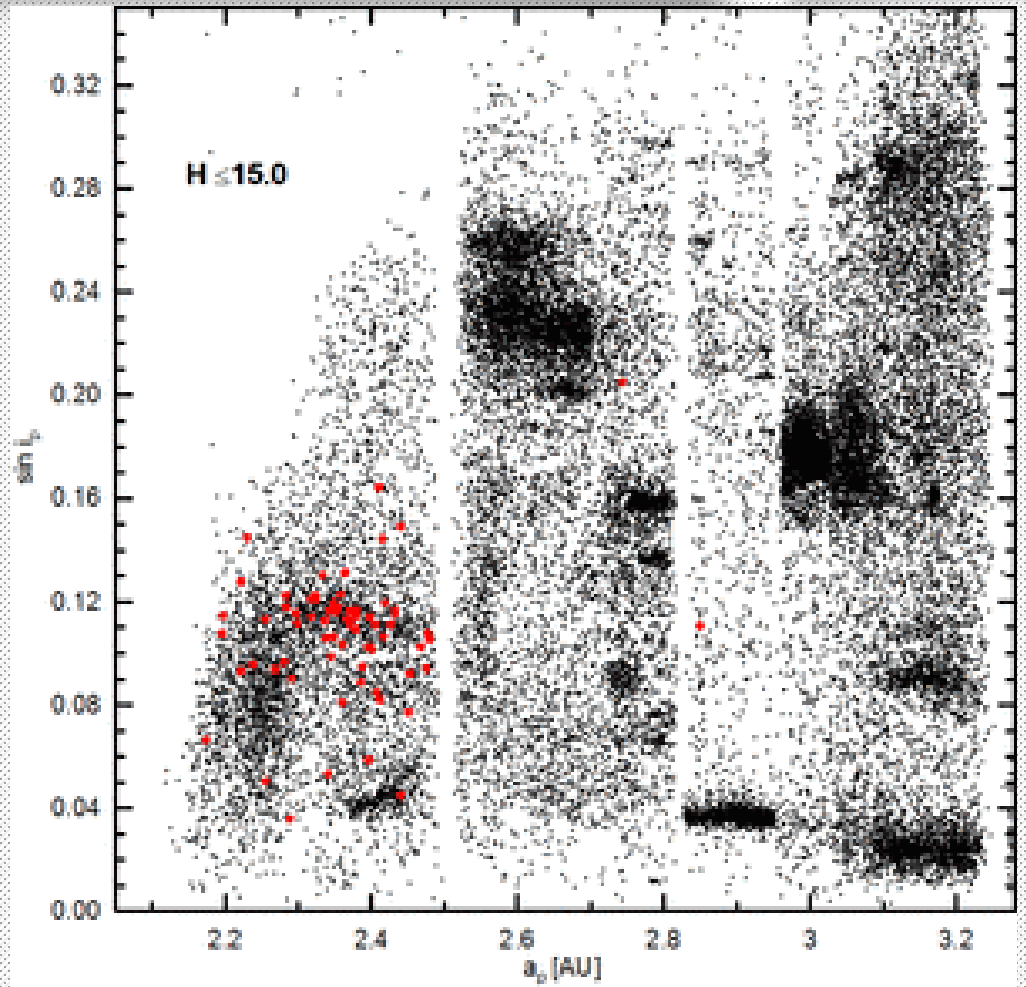


Rotational properties of asteroids spin barrier



Photometry – V-type astesroids

- asteroid Vesta
- Vesta family
- impact melting
- HED meteorites



Dynamical studies
Bennu and Ryugu

Kováčová et al., Planet. Space Sci 185, 2020

Dynamical studies
Fast Lyapunov Indicator

8:3

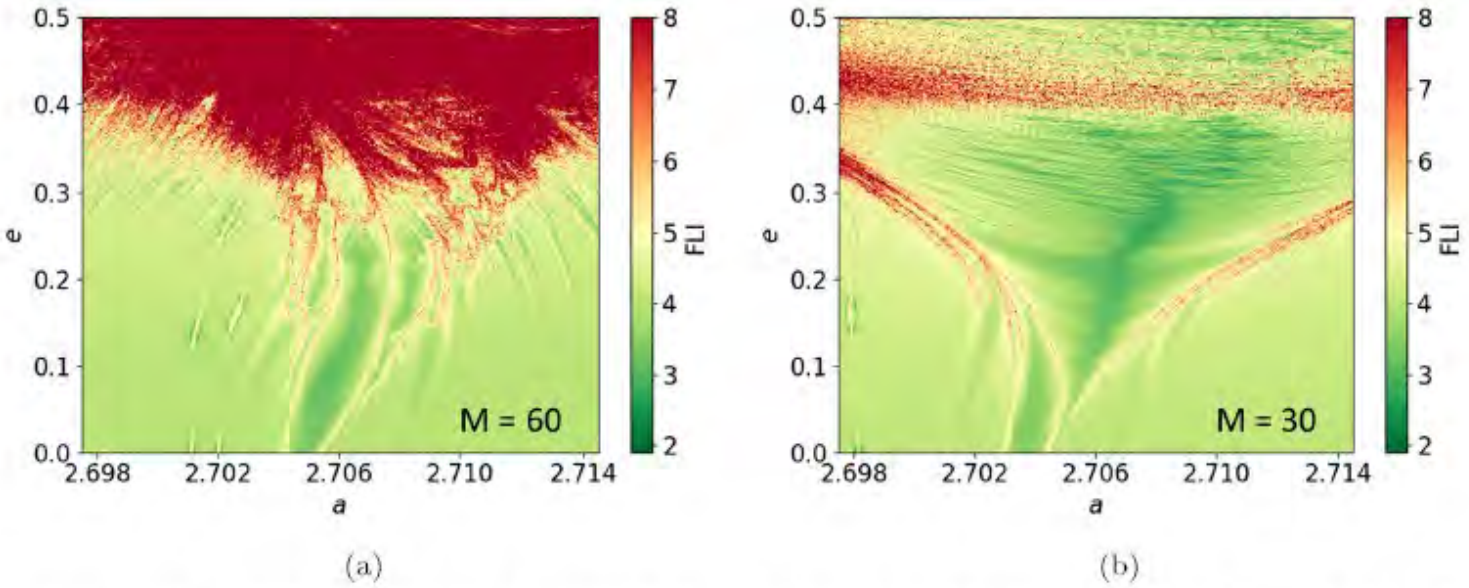


Figure 3. FLI maps of the 8:3 MMR with Jupiter in orbital plane of Ceres ($i = 10.594°$, $\omega = \mathbf{73.37°}$, $\Omega = \mathbf{80.306°}$) for mean anomaly (a) $M = 60°$ and (b) $M = 30°$. Maps were computed for $5\,kyr$ on a grid of 400×400 initial conditions (test particles) whereas semi-major axis $a \in \langle 2.6975, 2.7145\rangle\ AU$ and eccentricity $e \in \langle 0, 0.5\rangle$. Colour scale represents FLI values determined as a maximum from values obtained for three different initial deviation vectors.

Kovačová et al., Planet. Space Sci. 185, 2020

Dynamical studies

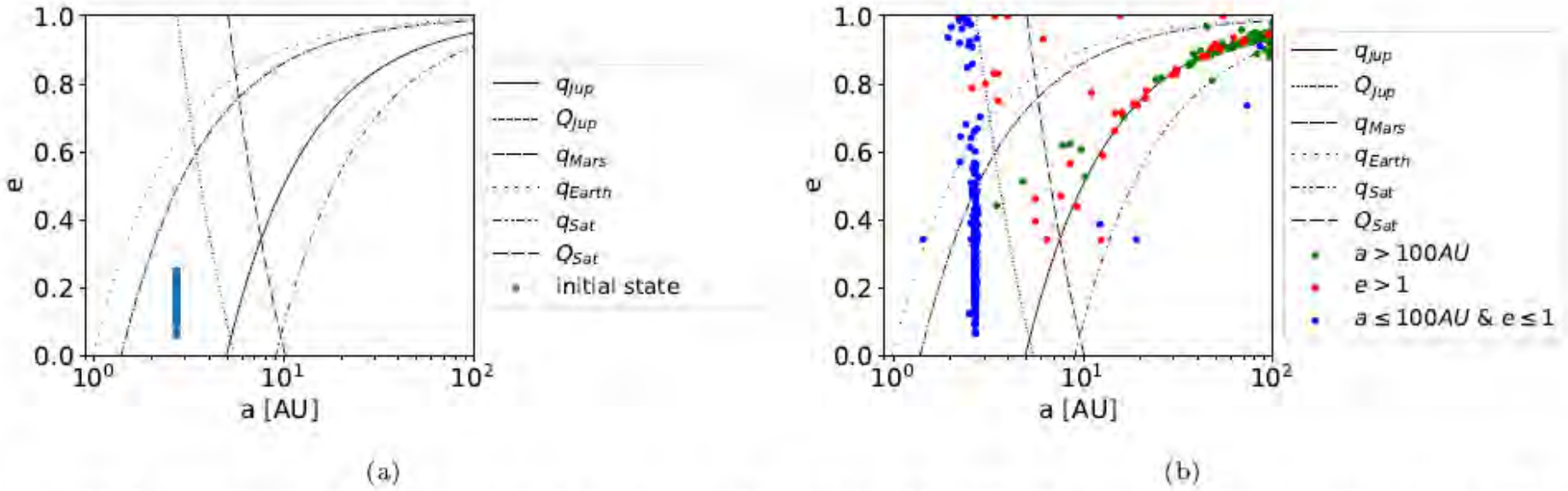
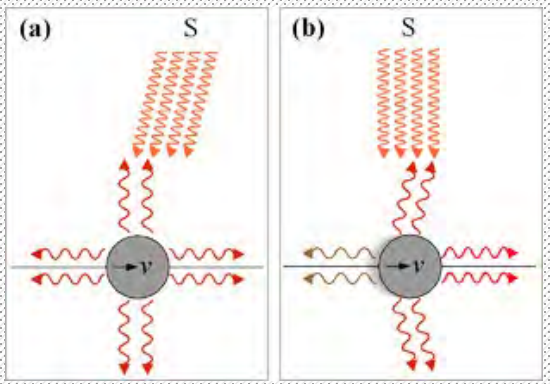


Figure 11. Initial (a) and end (b) state of simulation for unstable particles ($M = 60°$). If particles reached the orbit with $a > 100\,AU$ (green dots) or hyperbolic orbit (red dots) on the graph there are their last known parameters displayed before they got ejected to these orbits. Black lines represent perihelion and aphelion distances of selected planets.

Kovačová et al., Planet. Space Sci. 185, 2020

Non-gravitational effects

- Non-gravitational influence of the Sun:
  - Solar radiation pressure
  - Poynting-Robertson drag
  - Solar wind



- Strongly influencing dynamical evolution of dust grains in the Solar System:
  - L4 and L5 points under action of non-gravitational effects
  - modelling of extrasolar dust discs

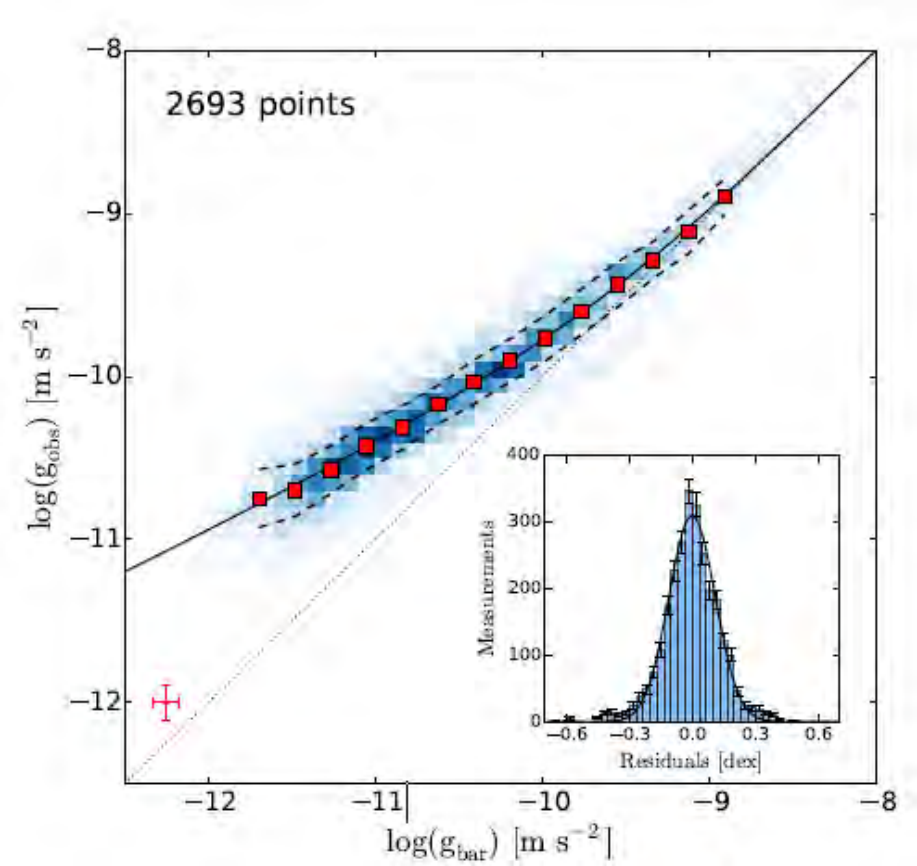
Galactic astrophysics

- kinematics and dynamics of the Galaxy:
  - GAIA – galactic flare
  - GAIA – galactic warp
  - simulation – comparison of MOND and NEWTON theories of gravity
- effects of galactic tides on the Solar System
- theory of gravity

Theory of gravity

$$g_{obs} = \mathcal{F}(g_{bar}) = \frac{g_{bar}}{1 - e^{-\sqrt{g_{bar}/g_\dagger}}}$$

- two body problem – not elliptical motion
- 10x reduced size of the Oort cloud



McGaugh, 2016


roman nagy

Galactic flare

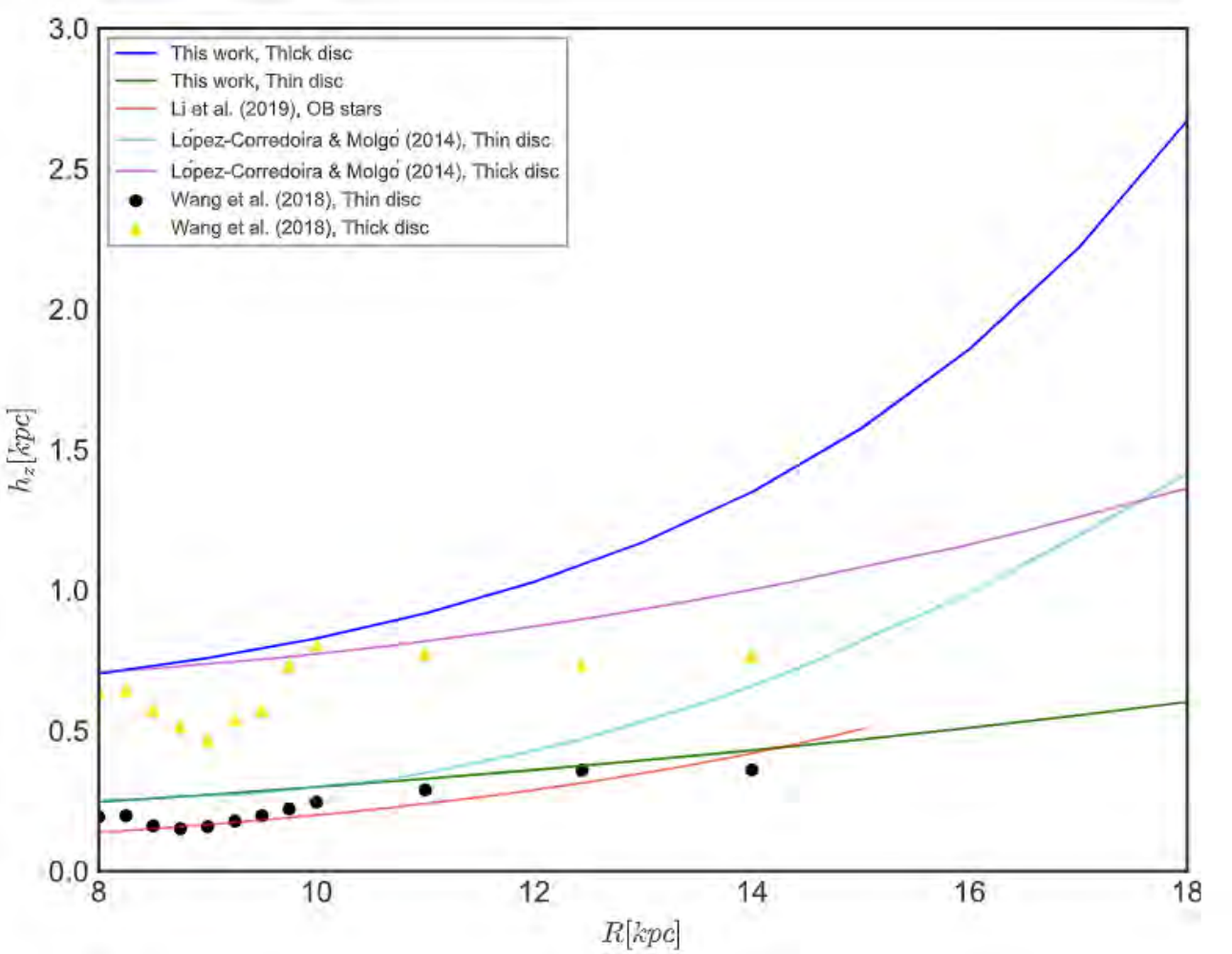
- Flare – thickening of the Galacitc disc with Galactocentric distance R

$$\rho(R,z) = \rho_0(R) \times \exp(-R/h_r) \times \exp(-|z|/h_z) \quad ; \quad hz(R)$$

- Especially in remote regions of the Galaxy

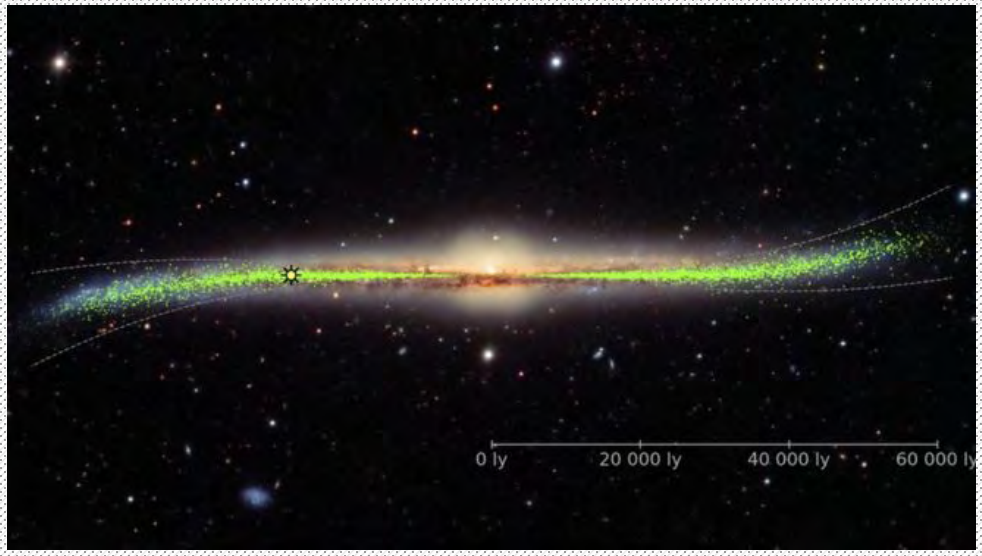
- Observed in hydrogen gas as well as in stellar populations

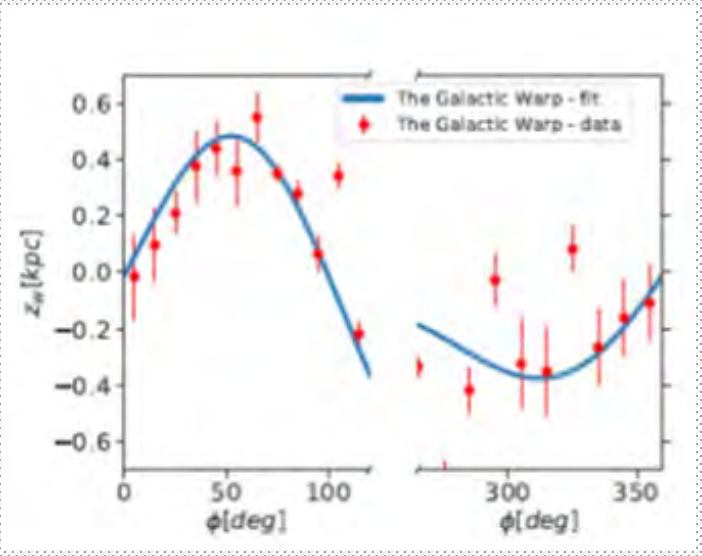
Galactic flare



Galactic warp

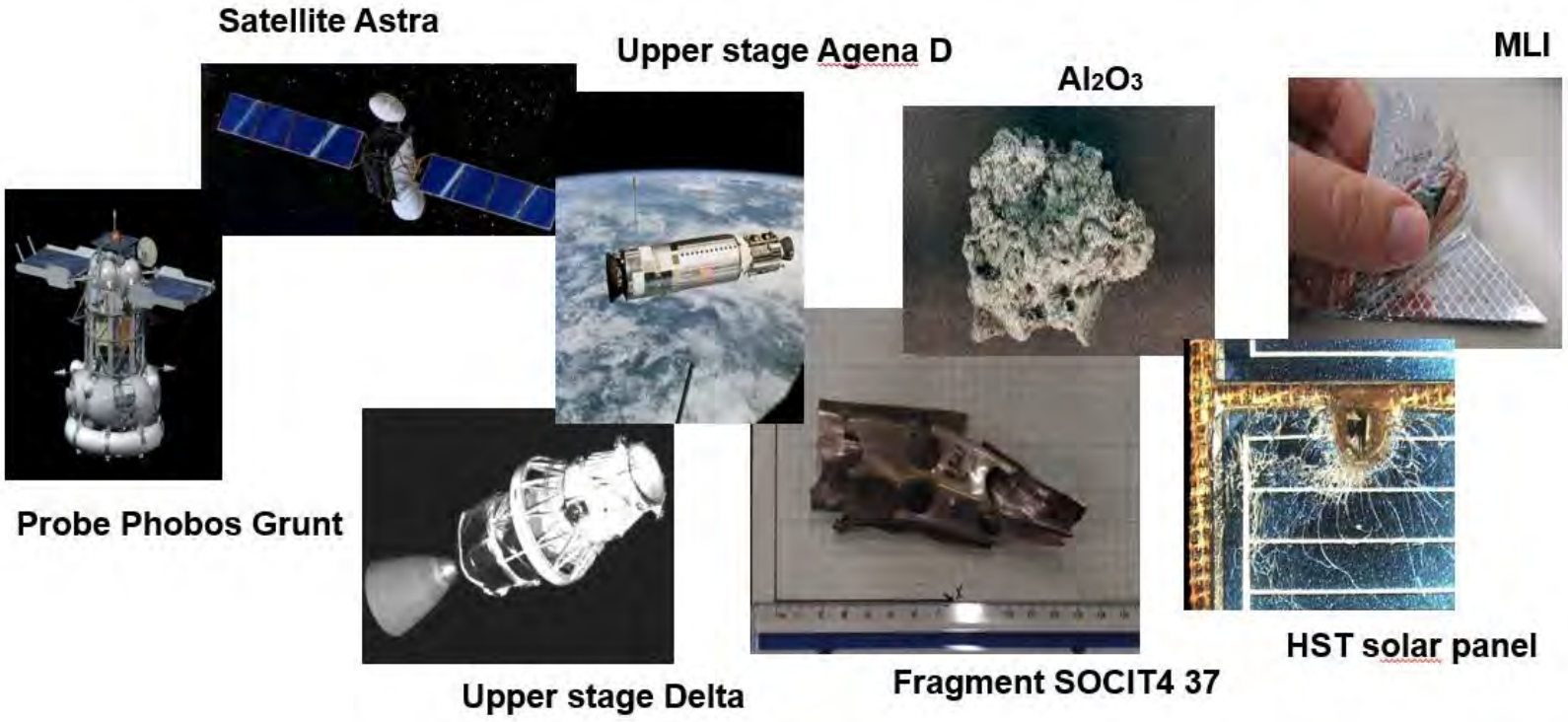
- Warp – "S" shape warping of the Galactic disc



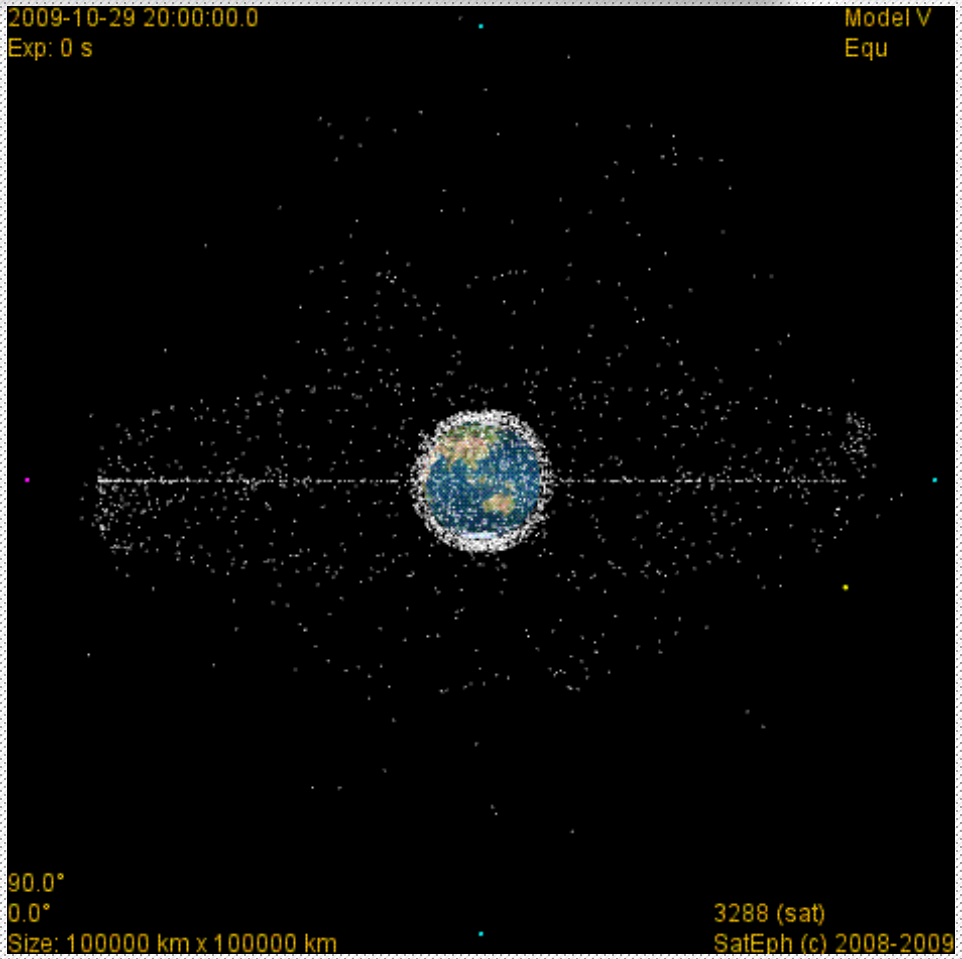


Space debris

- **"All the man-made objects which are orbiting the Earth and have no further application."**



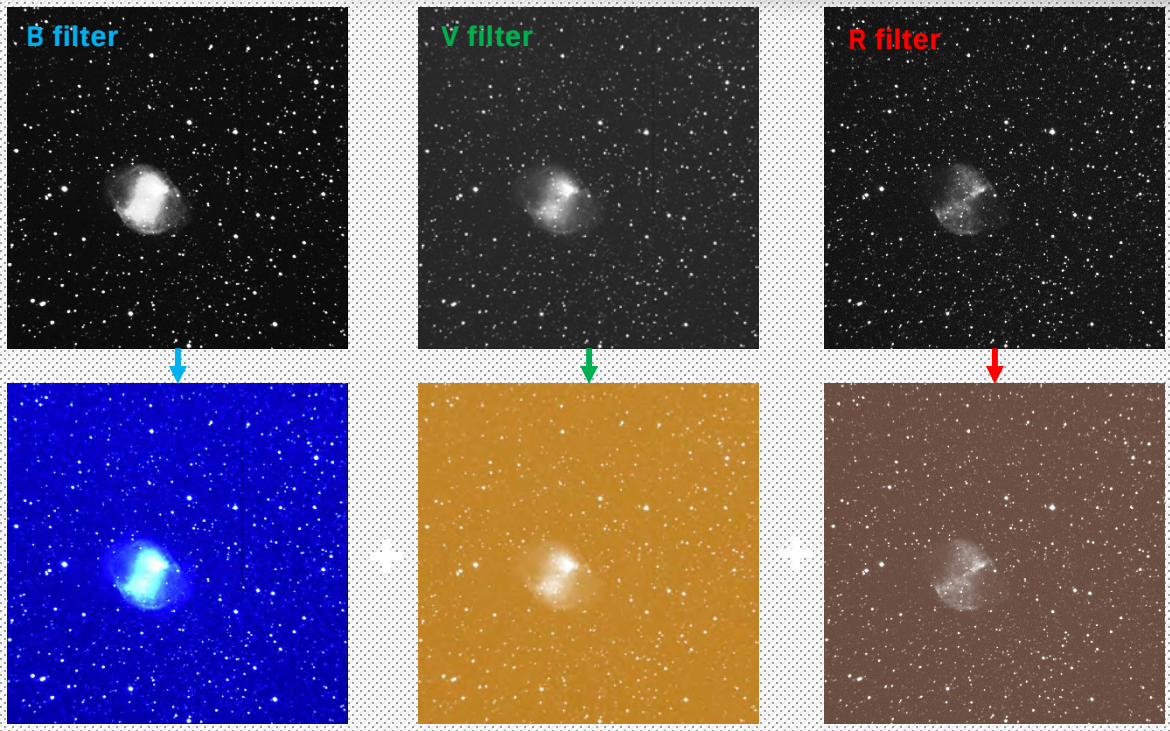
70 cm telescope – space debris



FMPI AGO
70 cm Newton telescope

- Three major programs on AGO 70cm:
  - **Astrometry, surveys -** to maintain the objects catalogue, to discover new objects, cooperation with partners
  - **Photometry, light curves (LC)** – attitude state characterization, attitude motion determination, attitude evolution monitoring
  - **Photometry, colors and color indices (CI)** – surface properties, space-weathering aging monitoring
  - **Reflectance spectroscopy**

Optical observations, color photometry



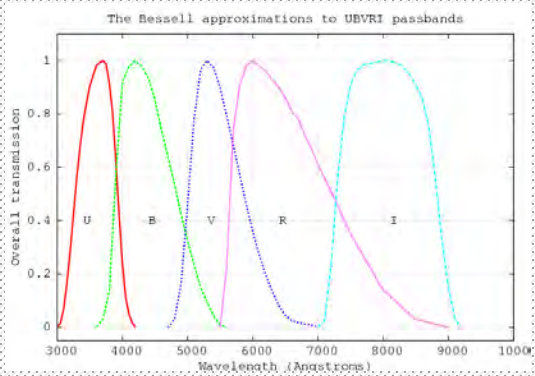
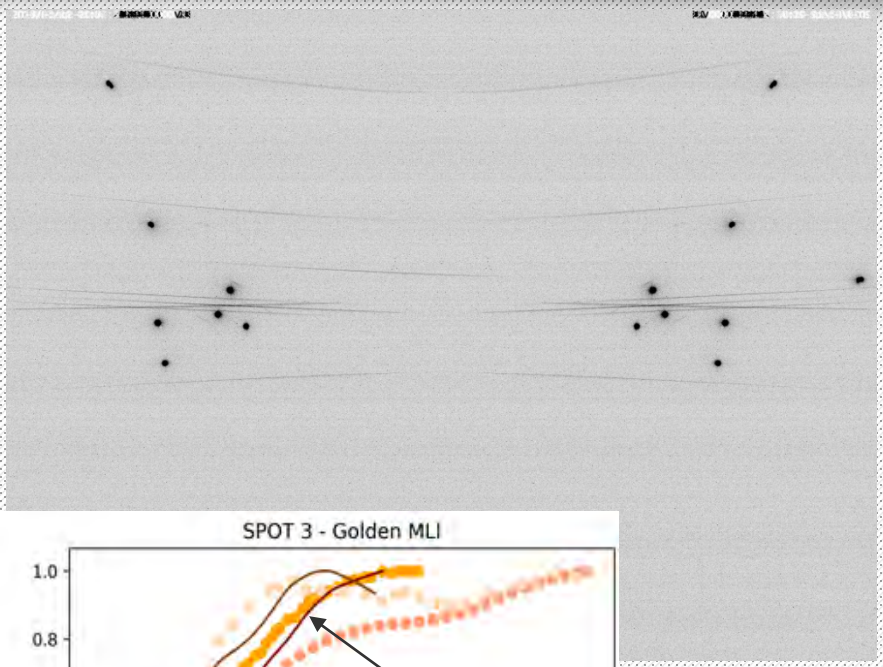
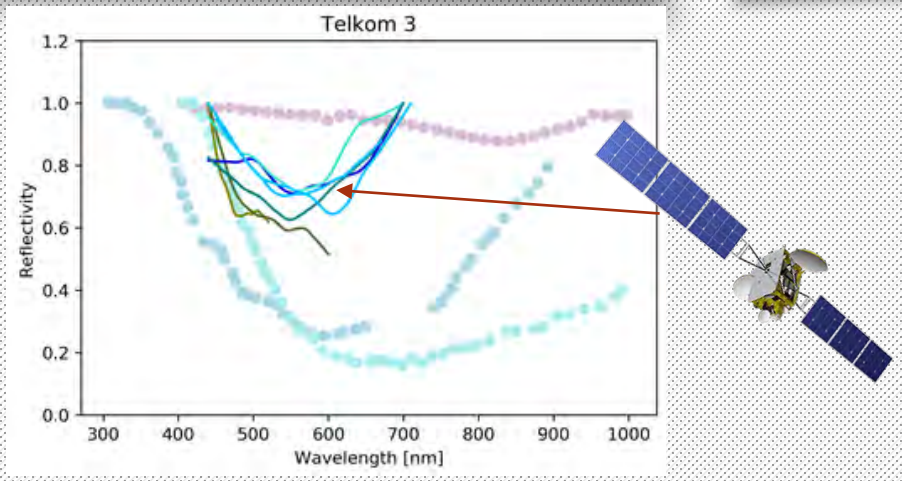
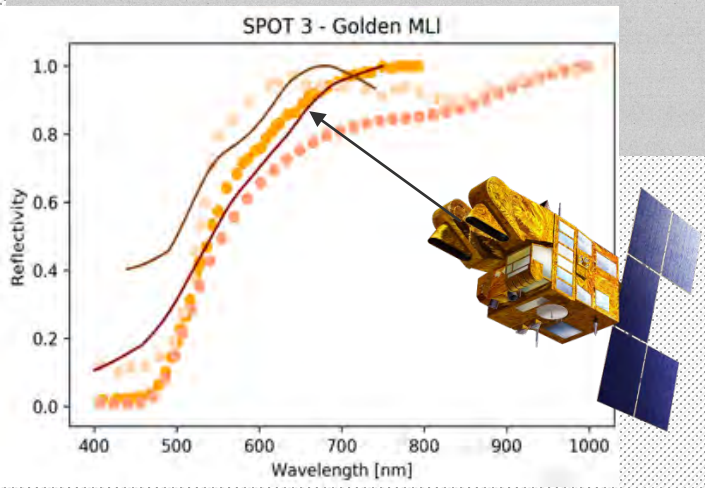


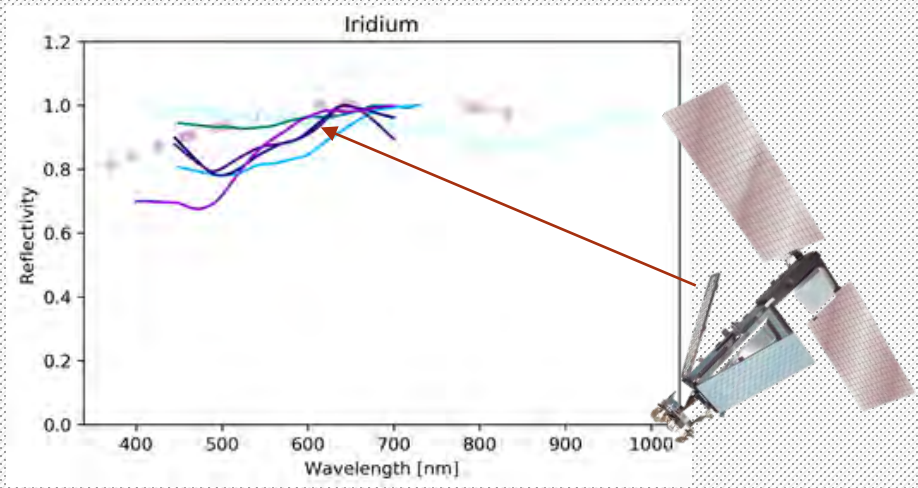
Figure – Dumbell nebula M27. Images acquired in B (left), V (middle) and R filters (right). Images acquired by AGO 70-cm telescope. Used exporuse was 60s.

Space debris spectra by AMOS spectral cameras










1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3


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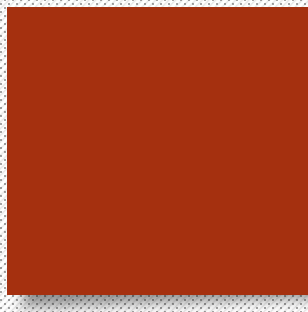
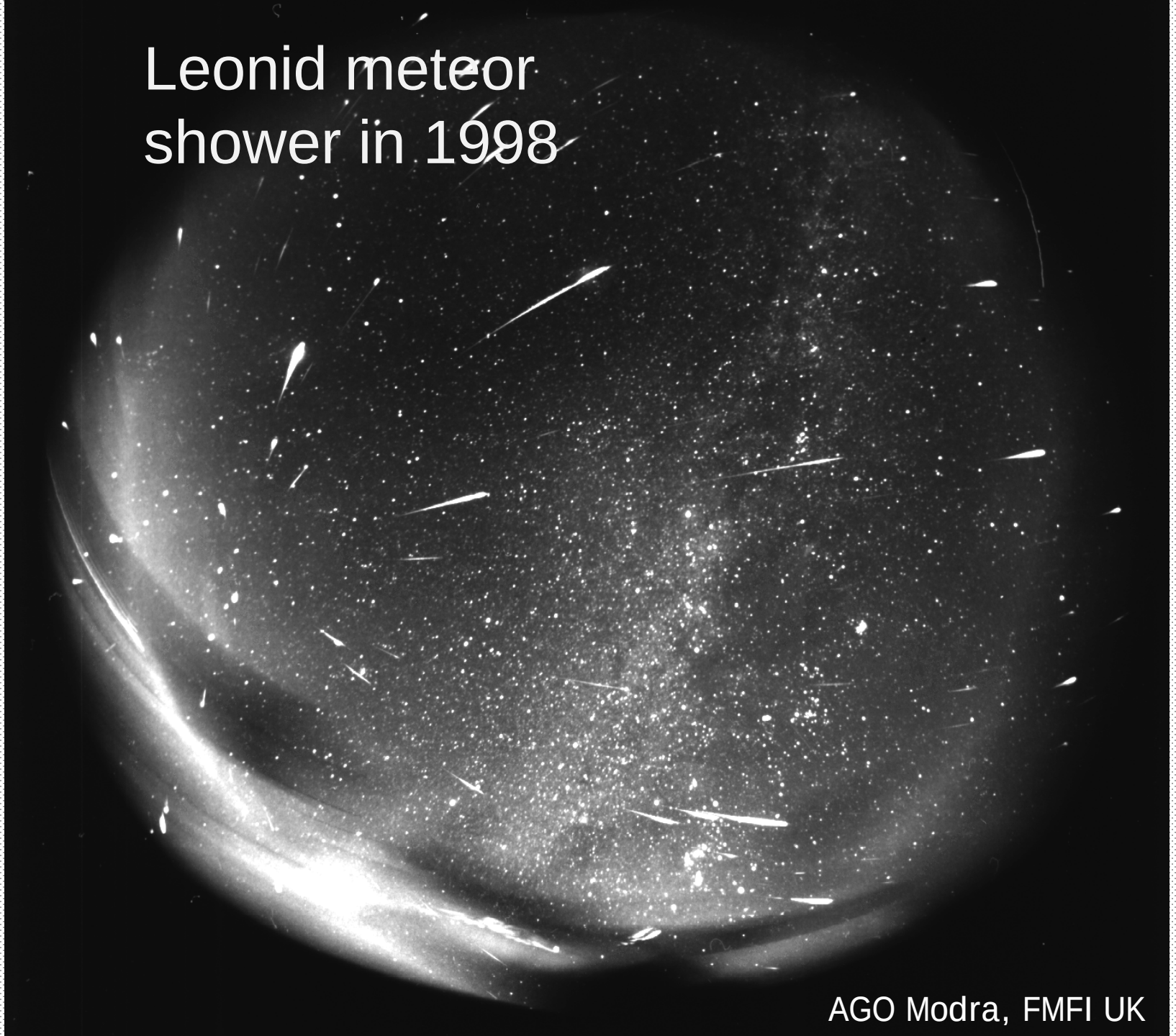
5


UNIVERZITA KOMENSKÉHO
ODDELENIE ASTRONÓMIE A ASTROFYZIKY



Meteor astronomy

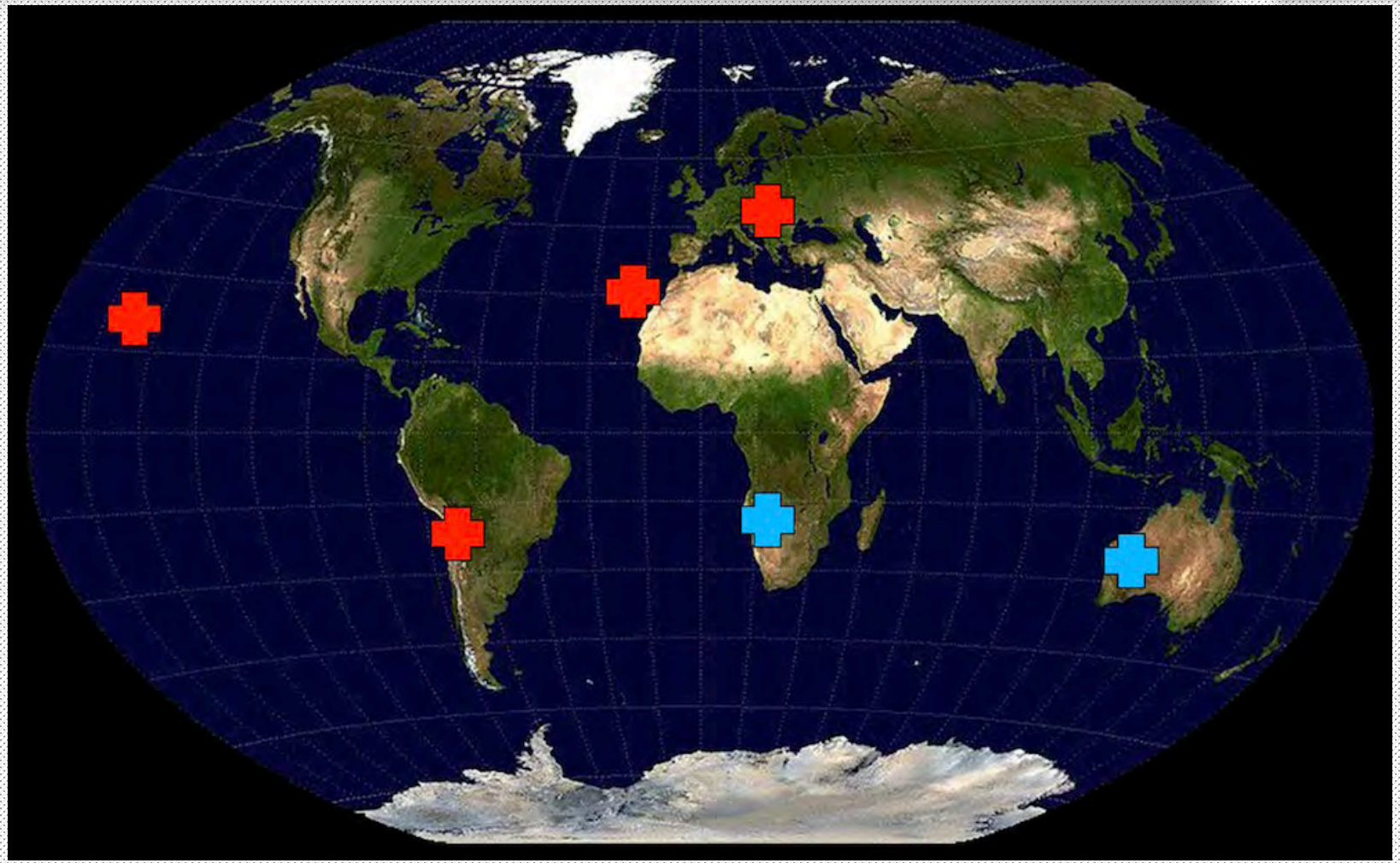
- observations:
  - video
  - radar
  - spectroscopic


Leonid meteor
shower in 1998
AGO Modra, FMFI UK

Video observations

- AMOS – All-sky Meteor Orbit System
- from 2009
- 10 stations (Slovakia, Canary Islands, Chile, Hawaii)

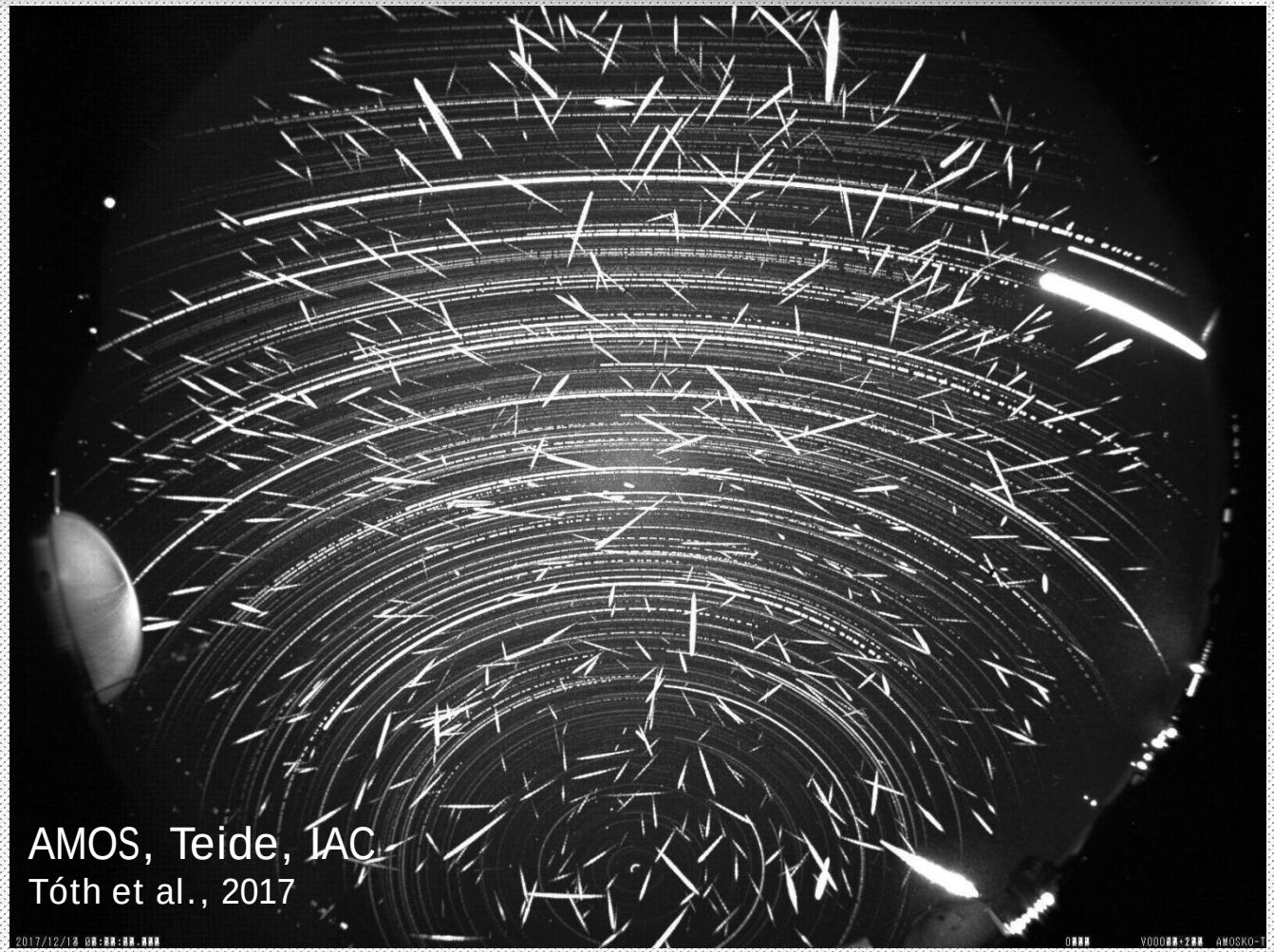
AMOS



AMOS – Teide Observatory

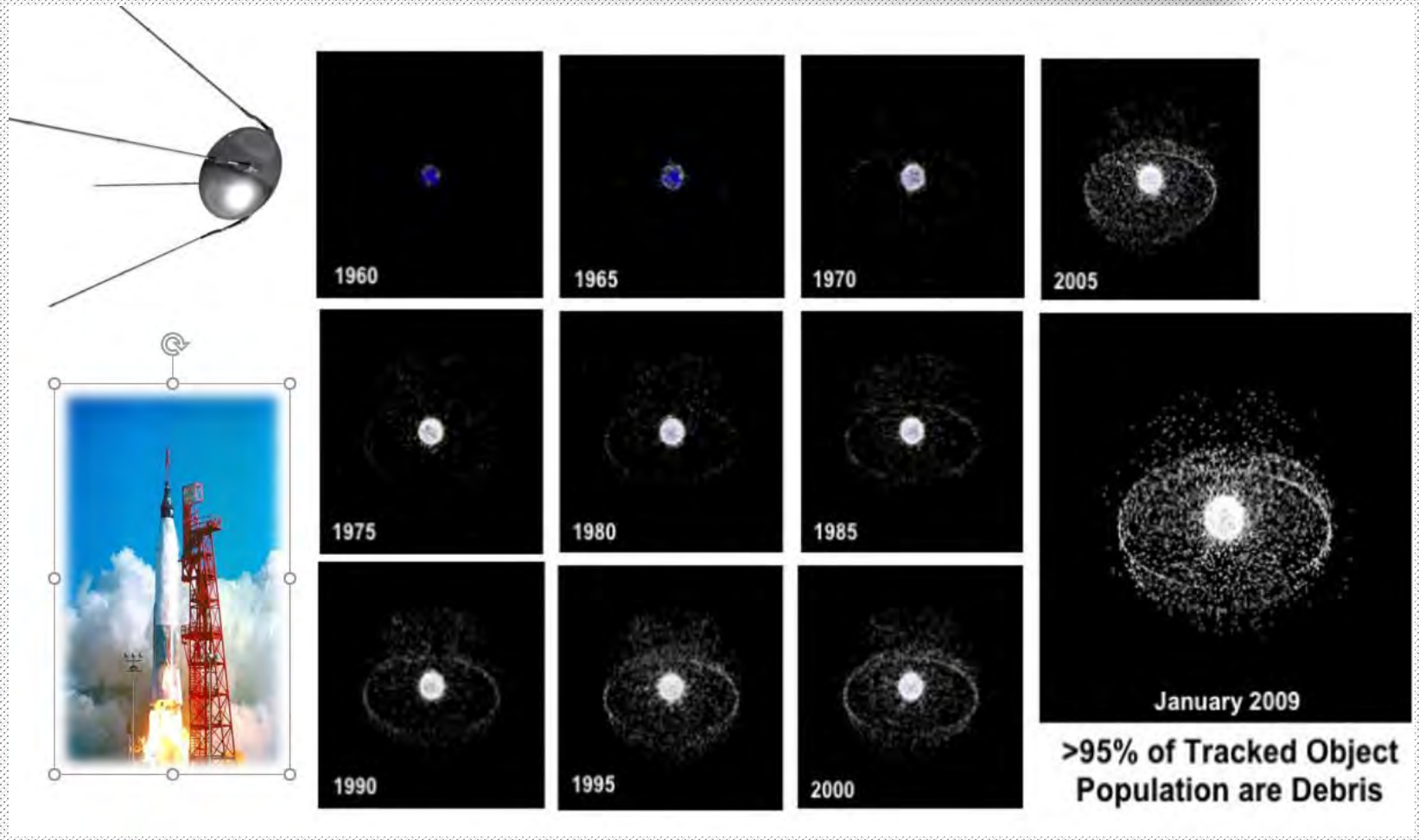
AMOS – Hawaii

One thousand Geminids above Tenerife Dec.13/14, 2017




2016/11/17 04:20:09.595
V00337+250
PGRACAM-LP
All-sky Meteor Orbit System

Space debris, history



FMPI AGO
70 cm Newton telescope