Achille A. Nucita
on behalf of the EUCLID consortium team @ Lecce

Department of Mathematics and Physics “E. De Giorgi” & *INFN*

New experiment @ INFN/LECCE

Astrophysics Team @ Unisalento

Currently, Team with 5 staff members

F. Strafella, G. Ingrosso, E. Orofino, F. De Paolis & A.A. Nucita

2 Ph.D. Students

Mosè Giordano (Gravitational Microlensing), Giulia Alemanno (Planetary Space Missions)

At present 6 trainee degree students of which

1) Simone Squaregna (An overview of the Euclid mission

2) Elena Codazzo (SSOs as observed by Euclid)

2 Post Doctoral positions

Luigi Manni (High Energy Astrophysics),

Francesca Mancarella (Planetary Space Missions)

The team has a long standing expertise in

Data analysis (High energy astrophysics, Infrared, Radio, Optical data). Software development for scientific purposes.

Monte Carlo Simulations

Theoretical and observational studies on microlensing issues.

Designing of instrumenst for space based missions

ACTIVE AND FRUITFUL COLLABORATIONS WITH NASA, ESA, INAF, INFN…

In the framework of the INFN vision “The Dark Universe”, the local section is involved in the EUCLID experiment

Partly migration of a few of us in CSNII.
Strafella, Ingrosso, De Paolis, Nucita at 50% on EUCLID @ Lecce.

We are within the **EUCLID CONSORTIUM**

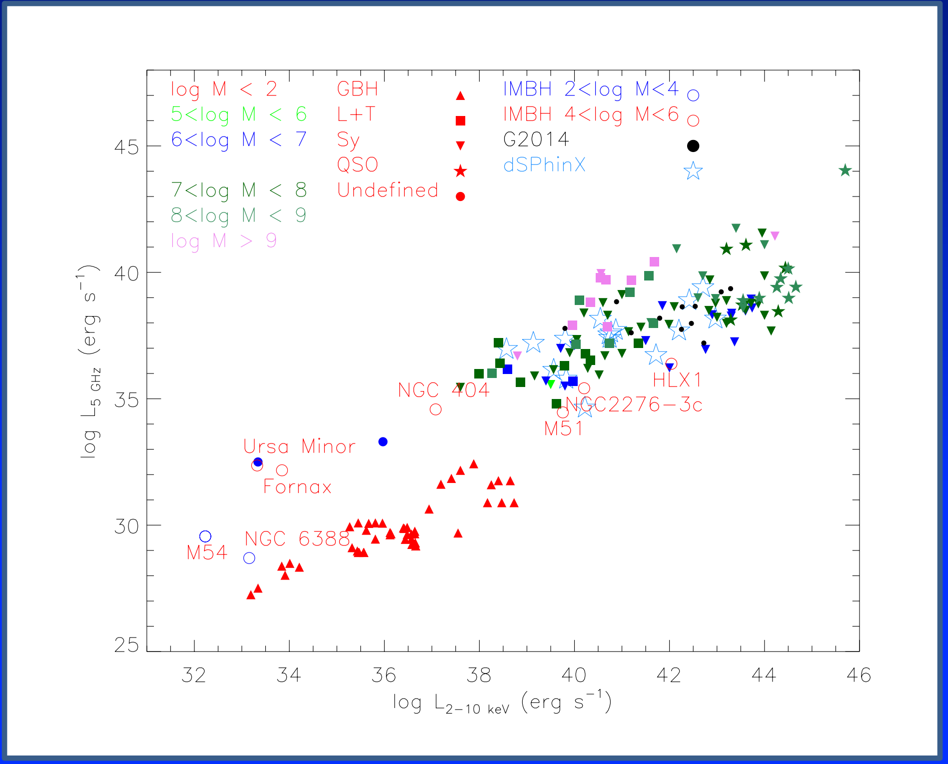
Local Universe and dwarfs (matching local scientific interests)

Local scientific interests in Dwarfs and Local Universe
Infrared sources

THE SCIENCE CASE

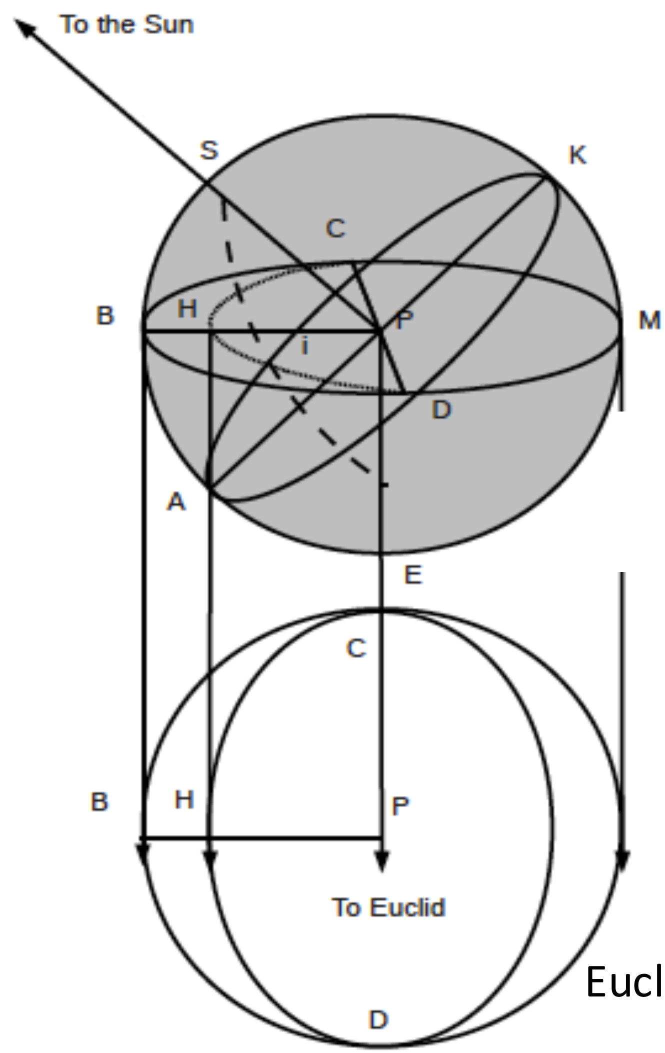
Right now:

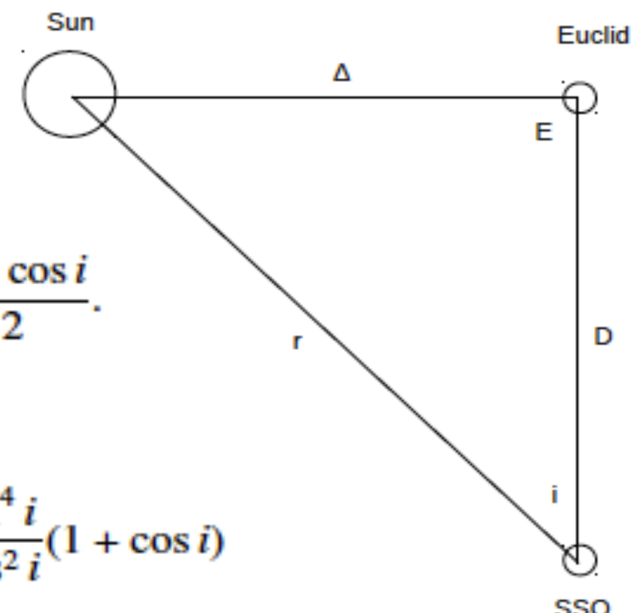
Outlined the work scheme for SSOs studies



VIS and NISP image simulations planned. Scheme outlined in a recentl submitted paper: correlations between X-rays (eRosita)/Radio (SKA)/Optical(Euclid) necessary for pinpointing IMBHs in dwarfs. Large numbers are important!

SSOs in collaboration with ESA (EUCLID) SOC. Study and mapping the SSO distribution, motion, and characteristics https://wiki.cosmos.esa.int/euclid/index.php/EC_SWG_PT





$$\phi(i) = \frac{S}{\pi R^2} = \frac{1 + \cos i}{2}.$$

$$F'_{\nu_1,\nu_2} = \frac{L_{\nu_1,\nu_2}}{32\pi}\frac{AR^2}{\Delta^4}\frac{\sin^4 i}{\cos^2 i}(1 + \cos i)$$

$$L_{\nu_1,\nu_2} = \int_{\nu_1}^{\nu_2} F(\nu)\Phi(\nu)d\nu.$$

Expected Magnitude as a function of i to be compared with the Euclid limiting Magnitude.

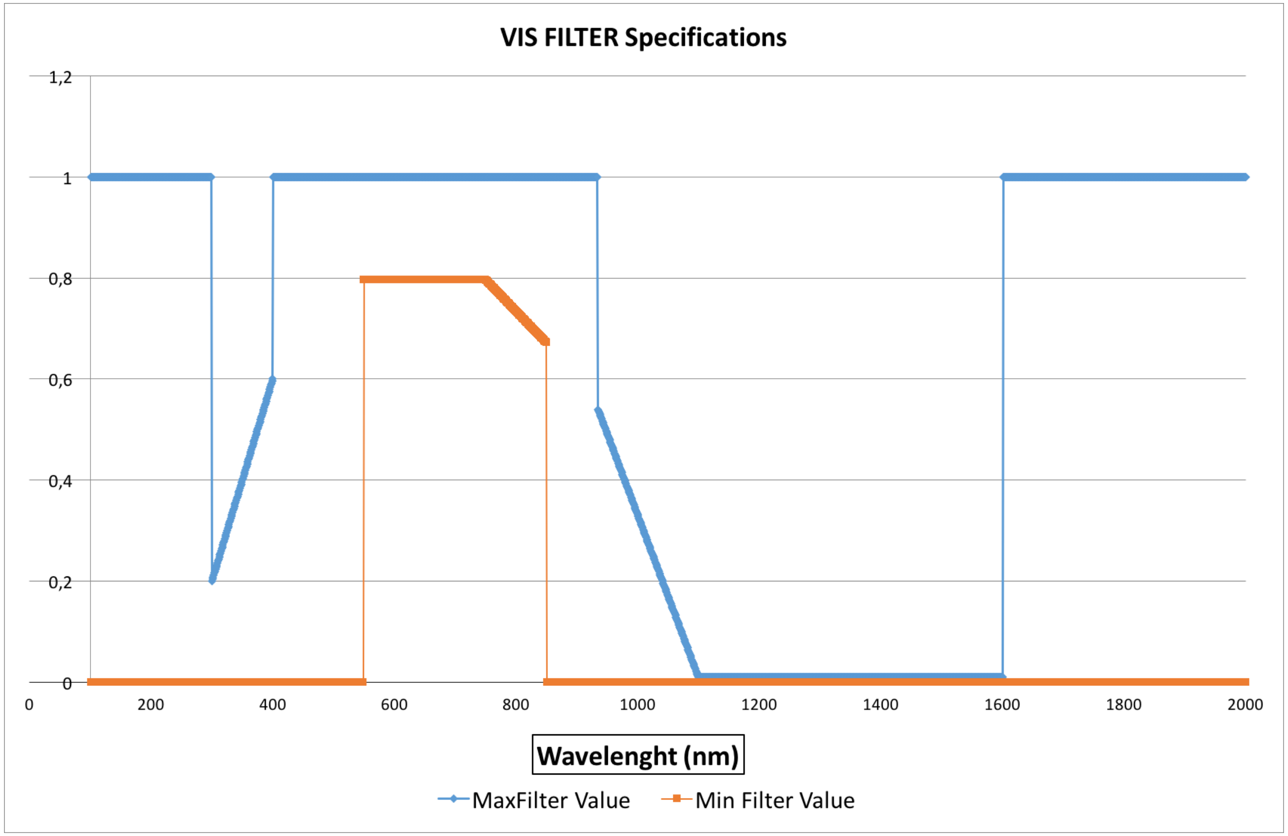
Softwares for detections

Euclid (VIS, NISP) Passa Band Filter

Fig. 1.— A SSO shining towards the Euclid satellite

$$F(\nu) = BB_{Sun}(\nu, T) = 5777\ K$$

$\Phi(\nu)$



NEO, NEAR EARTH OBJECTS

Nearby objects closer than 1.8 UA

MBO, MAIN BELT OBJECTS

the inner-Main Belt (IMB, those objects with 1.8 AU $< a <$ 2.5 AU), the middle-Main Belt (MMB, objects with 2.5 AU $< a <$ 2.82 AU), and the outer-Main Belt (OMB, objects with 2.82 AU $< a <$ 3.6 AU).

TNO, TRANS NEPTUNIAN OBJECTS

With distances greater than 30 AU up to 70-80 AU

OO, OORT OBJECTS

From 2000 to 100000 AU

WISE (and NEOWISE enhancement) detected SS objects within 2.8 AU (From Masiero et al., arXiv: 1109.409v1

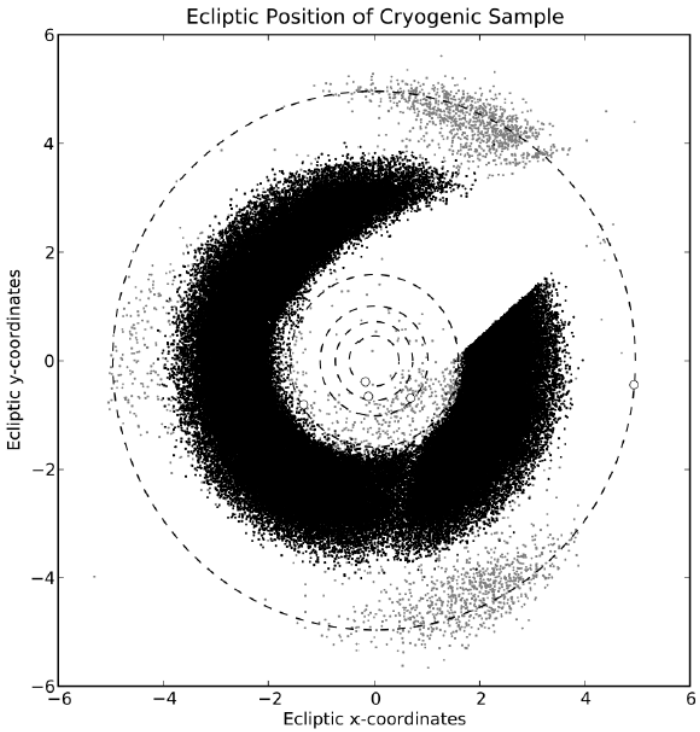


Fig. 1.— Top-down view of the inner Solar system showing the location of all objects observed during the fully-cryogenic mission. Positions were propagated to 2010 August 5, the date of the exhaustion of coolant from the secondary tank. Black points indicate MBAs while grey points are all other Solar system objects. Axes' units are AU.

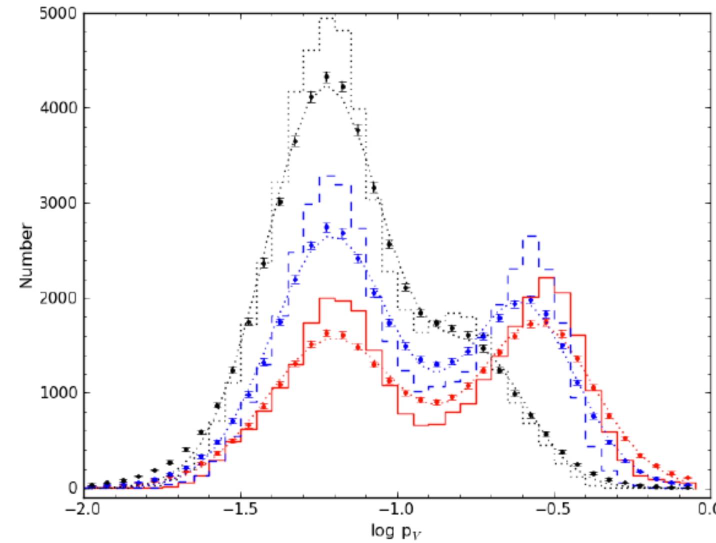
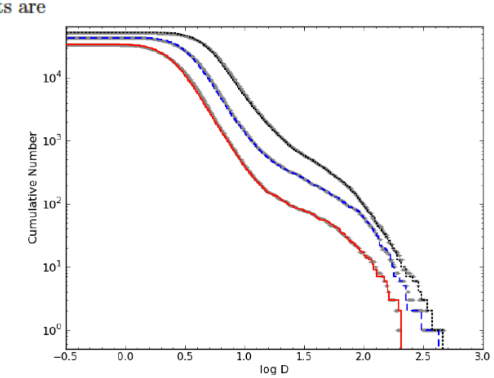
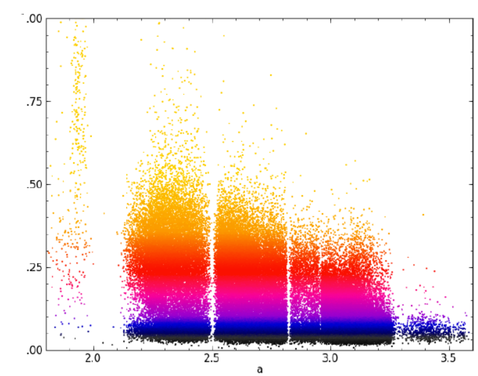


Fig. 8.— Preliminary raw differential albedo distributions for all inner-, middle-, and outer-Main Belt asteroids, shown as red solid, blue dashed, and black dotted histograms respectively. The points show Monte Carlo simulations of the albedos and their error bars, and the smooth curves the best fitting double-Gaussian distributions.

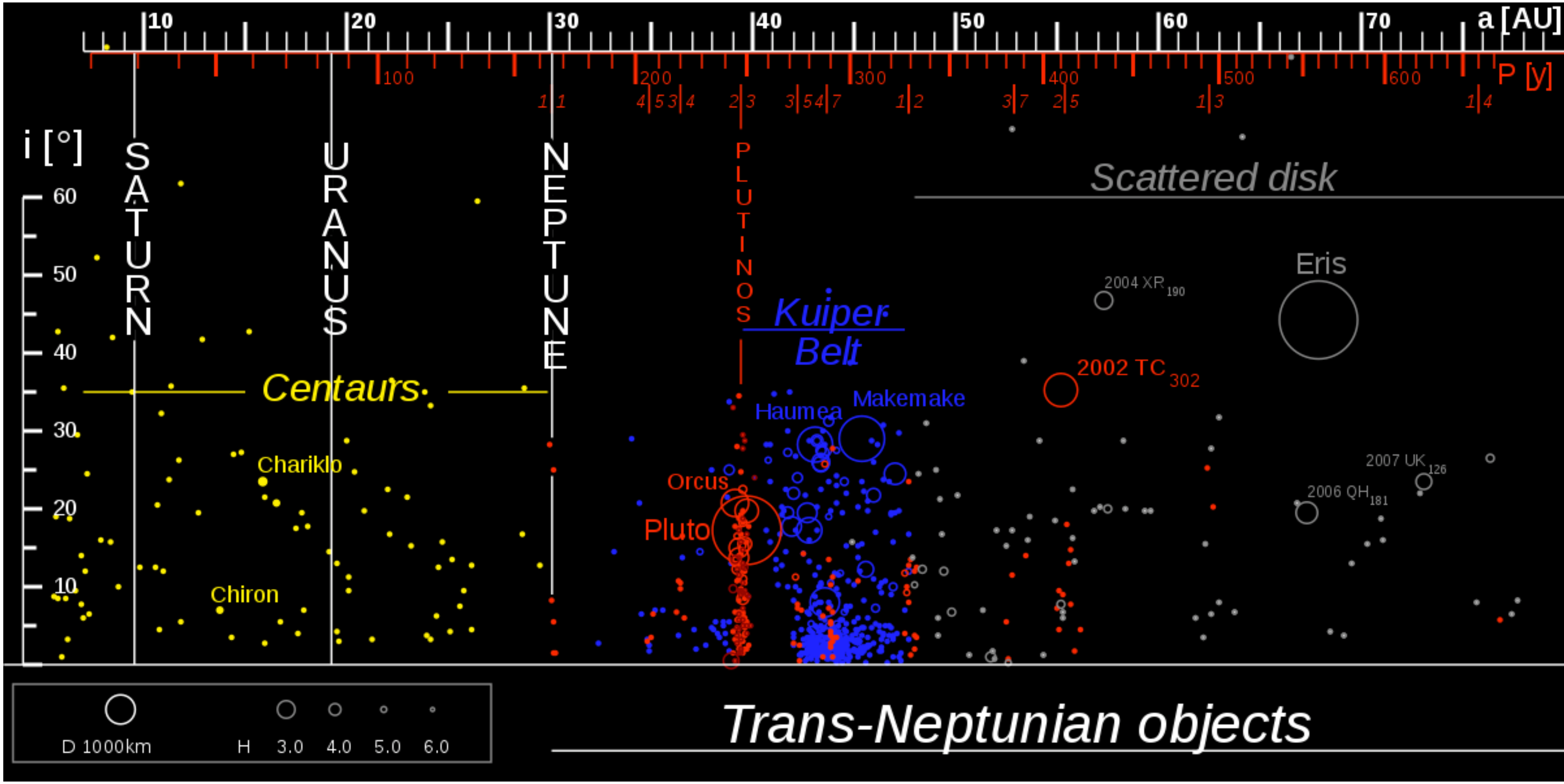
value in the PRAD as one moves out in the Main Belt. The mean albedo of the bright peak for the Gaussian describing each population is: $\mu_{IMB} = 0.28$, $\mu_{MMB} = 0.25$, and $\mu_{OMB} = 0.17$, with

All distributions are available for Monte Carlo simulations



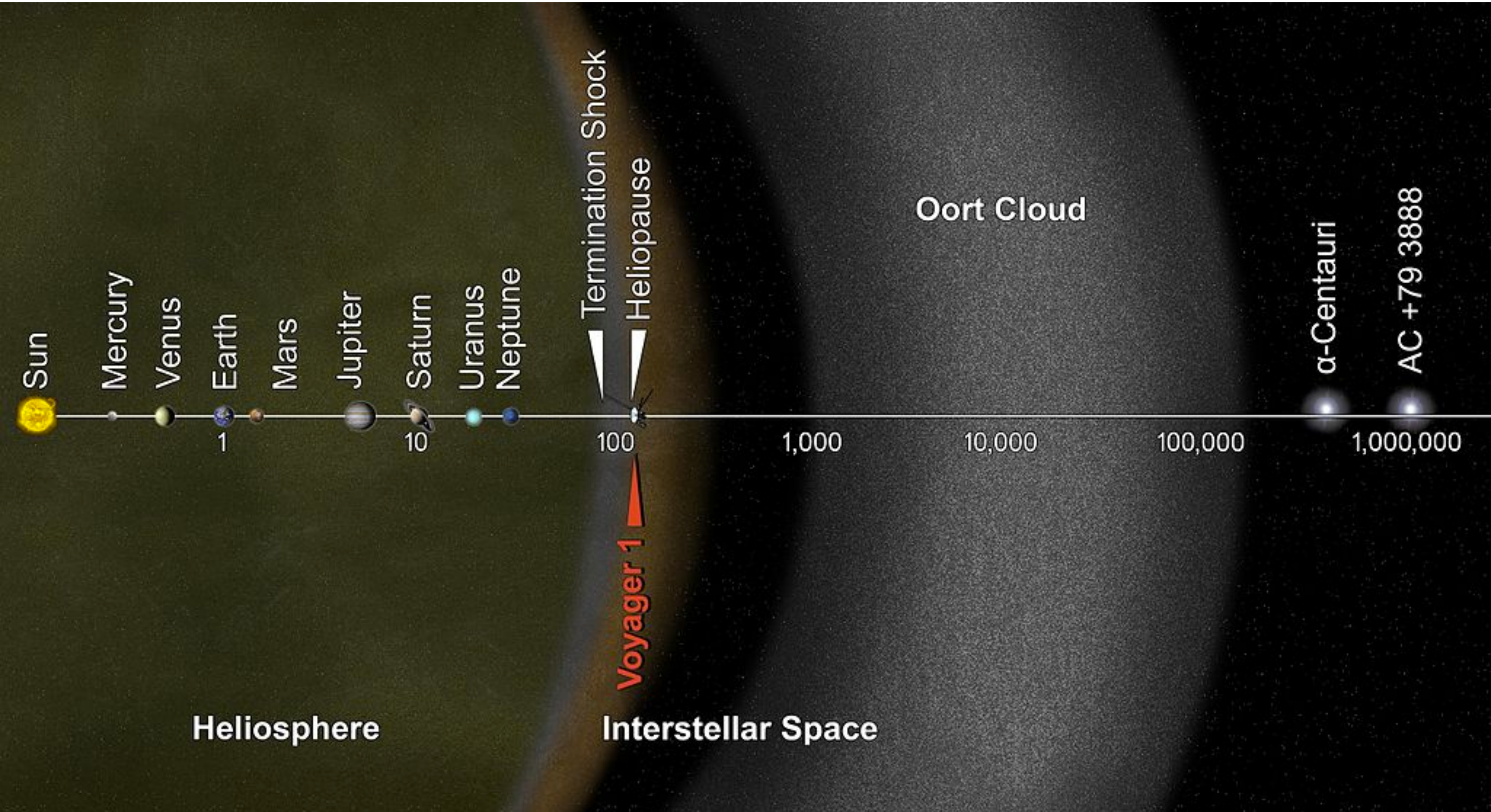


Trans Neptunian Objects

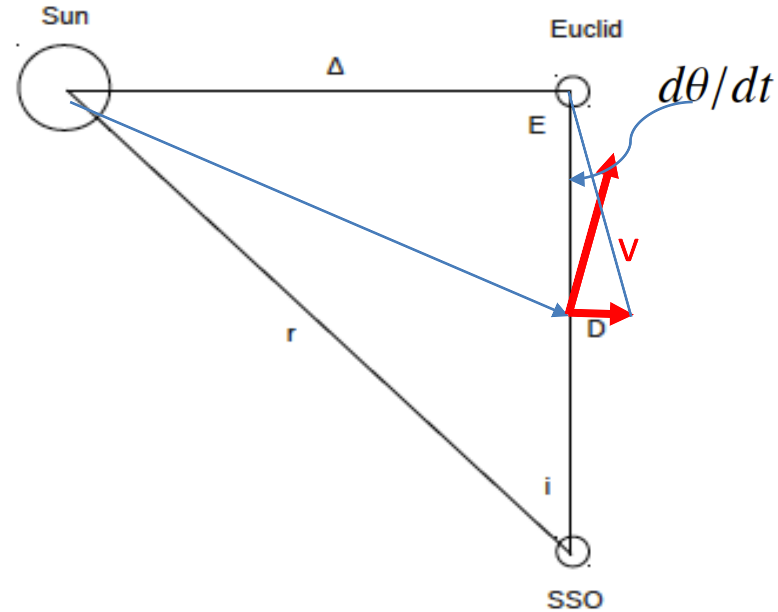


Oort cloud

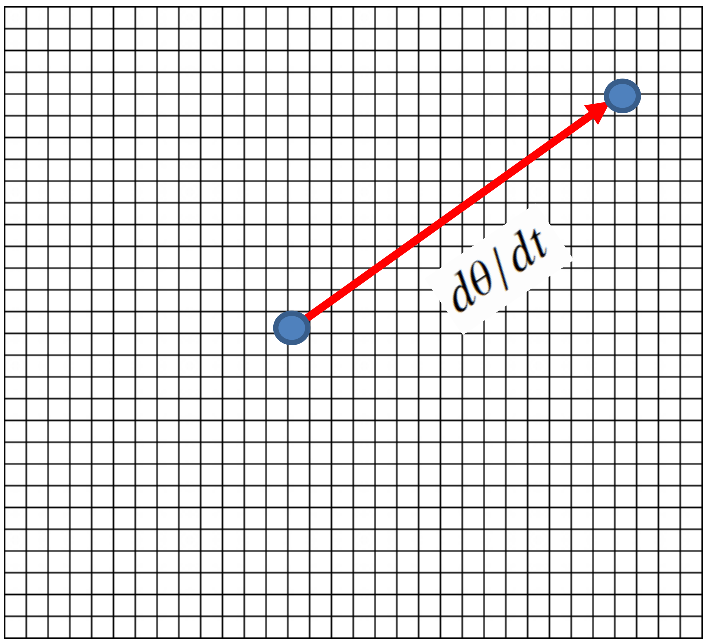
Probably the nursery of comets and icy objects which extends from 2000 – 5000 up to 50000 AU from the Sun.



Euclid's view
Geometrical constraints.



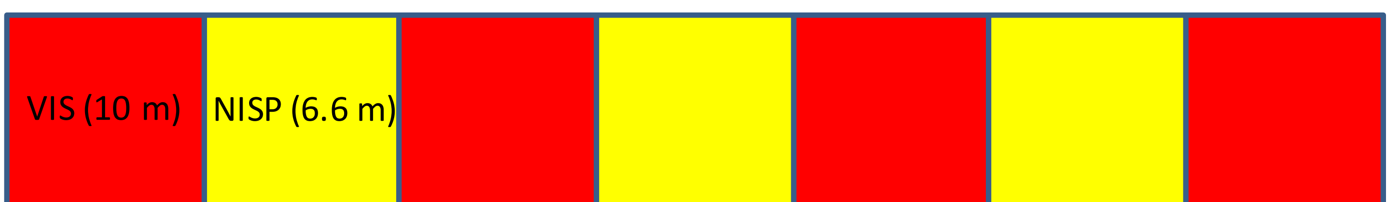
A moving SSO produces straight trajectories of illuminated pixels.
0.1 "/pxl (VIS), 0.3 "/pxl (NISP).



$$v_{\perp} = \sqrt{\frac{GM}{\Delta}} \sin^{1/2} i \cos i,$$

$$\frac{d\theta}{dt} \simeq 0.041 \frac{''}{s} \sin^{3/2} i$$

Pxl centroid shift down to 20/1000 of pixels!



$$D_{VIS}(1h) \leq 1800\ AU$$

Geometrical constraints (depending on SSO position, CCD characteristics and Euclid acquiring strategy) and photometrical constraints (depending also on Albedo and Physical size) will results on Observability Map

Detection Algorithms (Nice workshop on next autumn) with ESA/SOC

PREVENTIVO SPESA LOCALE (IN KEURO)

Euclid Consortium Meeting (2017) X 2 staff (4 keuro)
2 Missions X 4 staff (8 keuro)
Consumables (stationery & printing expenses on dedicated astrophysical journals as ApJ, MNRAS, A&A, etc) (3keuro)

TOT: 15 keuro