NEO services @SSDC

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and the NEOROCKS team

May 2023 IVOA Interop Meeting
Solar System Interest Group Session

Agenzia Spaziale Italiana

Space Science Data Center

Agenzia Spaziale Italiana

NEO ROCKS

Near Earth Object Rapid Observation, Characterization and Key Simulations

Horizon 2020
Grant Agreement No 870403

NEOROCKS will address the challenge of improving our knowledge on the physical characterization of the Near Earth Objects (NEOs) population and of the implications for their origin and evolution as well as for planetary defense

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NeoSpace

Astronomical Institute of the Czech Academy of Sciences

INAF

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l'Observatoire de Paris

Observatoire de la Côte d'Azur – Université Côte d'Azur

SpaceDyS

deimos elecnor group

Agenzia Spaziale Italiana

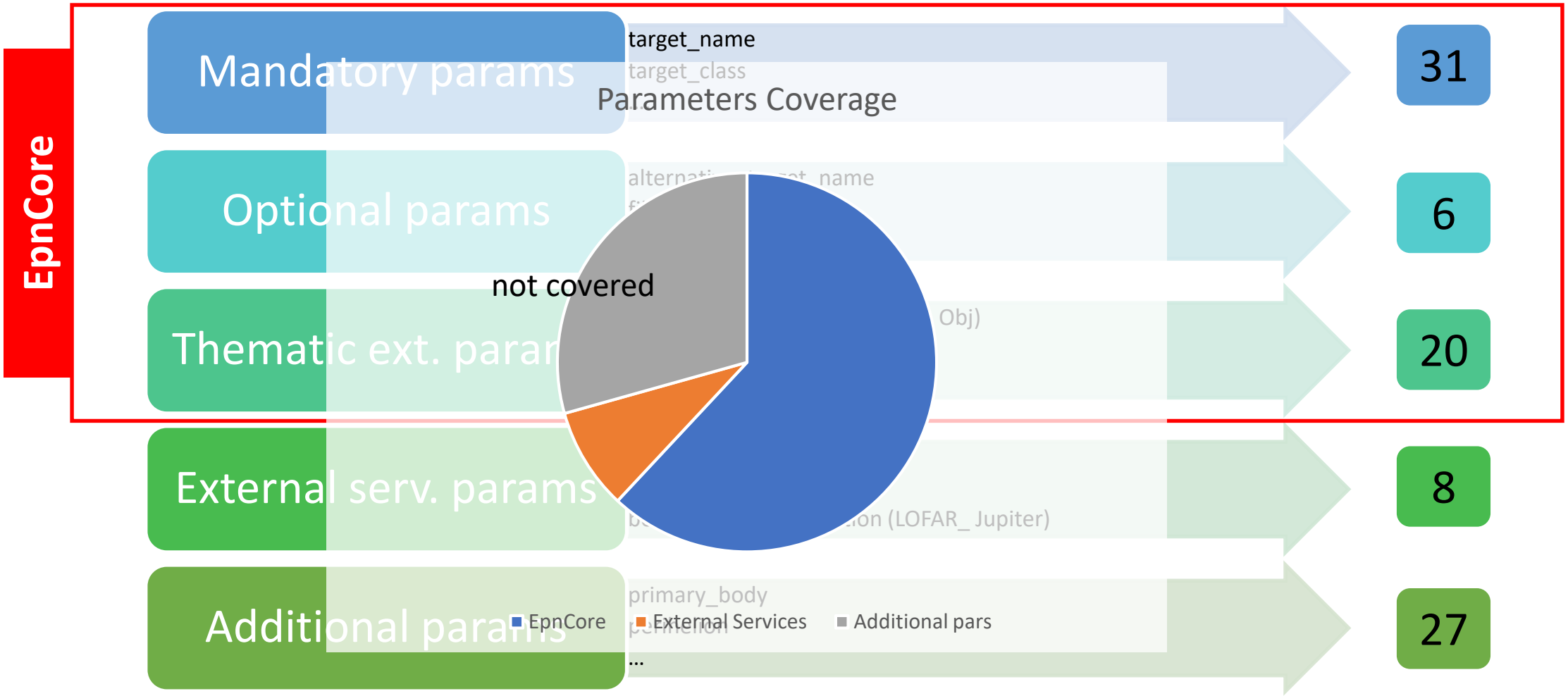
RESOLVO Responsible Solutions

Dipartimento di Fisica e Astronomia Galileo Galilei – Università degli Studi di Padova

NEOROCKS: data management

Only 20% of the known NEO population has been characterized	• Physical characterization requires availability of large aperture telescopes
Direct link between orbital and physical characterization	• Continuously analyzing the detections • For each object identified, the astrometric follow-up and the associated orbit improvements are activated
Ground-based and space-based data to be made available through a centralized access	• Long-term archiving, maintenance and evolution of the corresponding data products

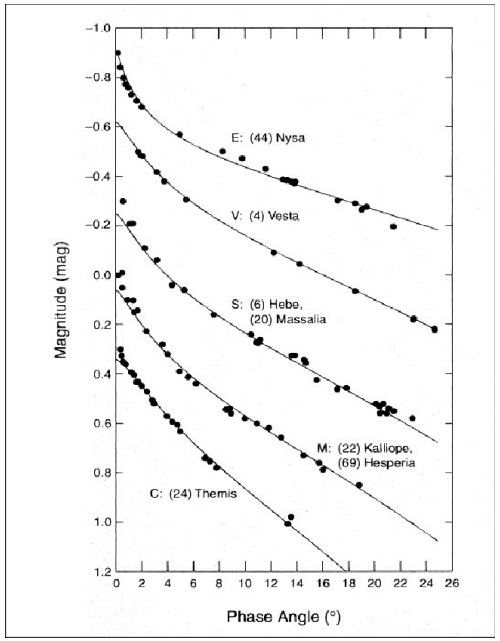
EpnCore derivation



Open Questions – New data products

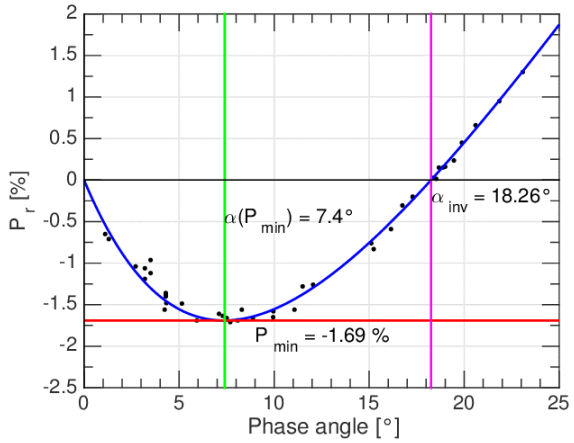
Phase curve

- dataproduct_type= ts (time_series)?
- processing_level= 5 (derived)



Polarization curve

- dataproduct_type= ts (time_series)?
- processing_level= 5 (derived)



Possible implementation:

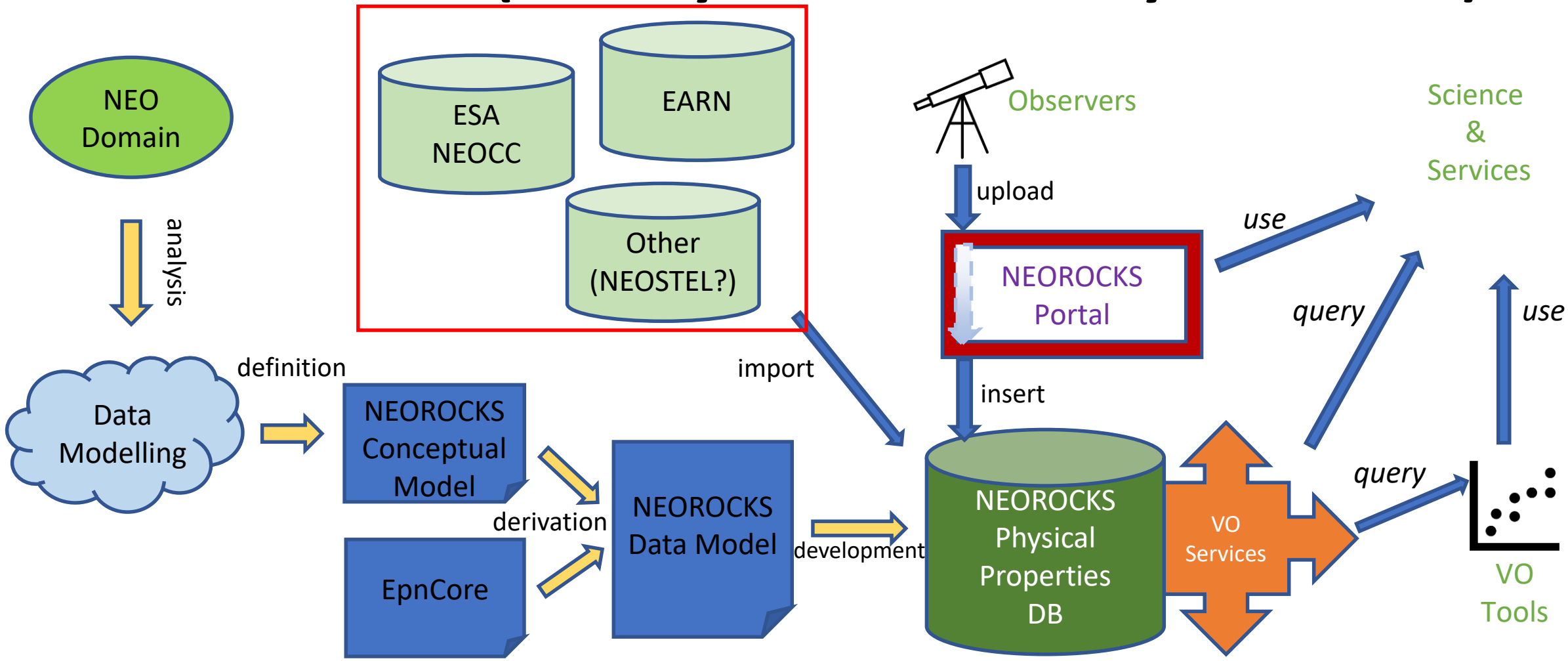
1. Combine UCD into measurement_type
   - phot.mag#pos.phaseAng (phase curve)
   - phys.polarization#pos.phase (polarization curve)

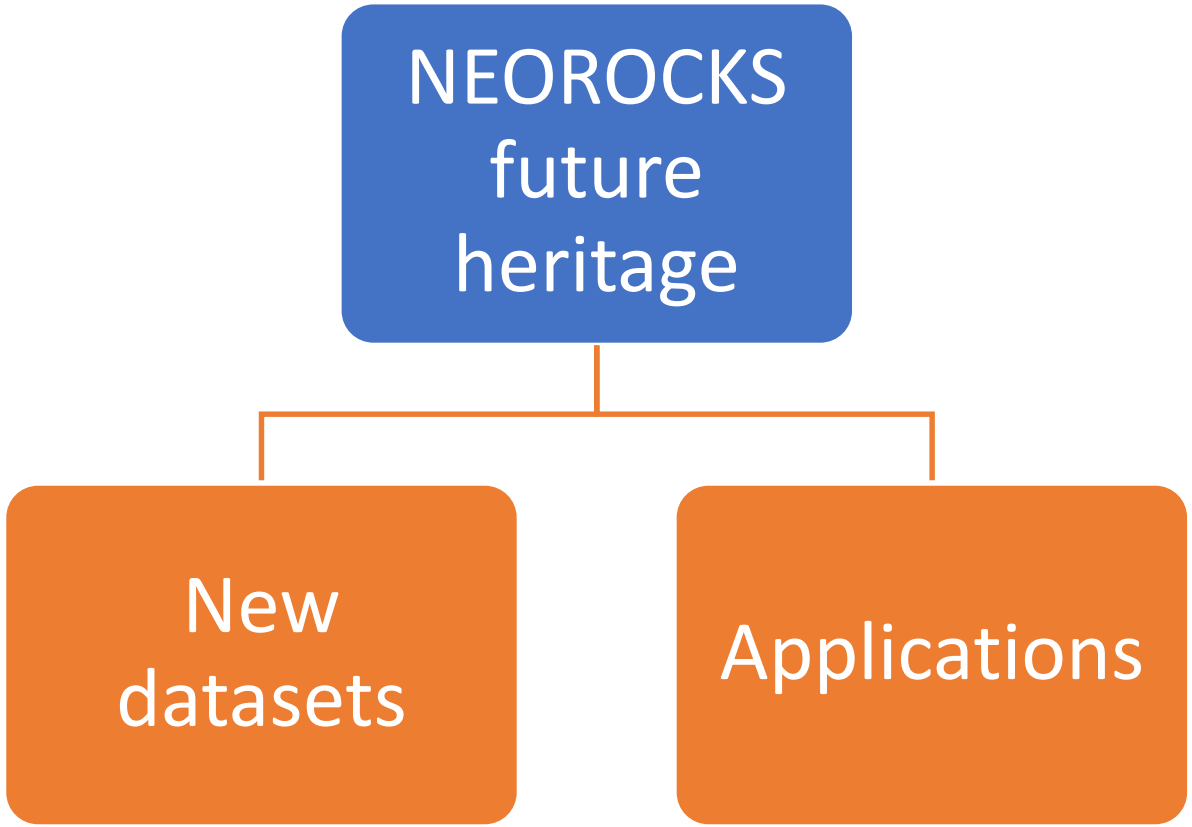
2. Single observation file having two axes
   - Y:phot.mag, X:pos.phaseAng (phase curve)
   - Y:phys.polarization, X:pos.phase (polarization curve)

Photometric band can be specified in Y with
phot.mag;em.opt.<possibly filter>

A new dataproduct_type can be evaluated

NEOROCKS (or "My FAIR Planetary Defense")




NEOROCKS future heritage
New datasets
Applications

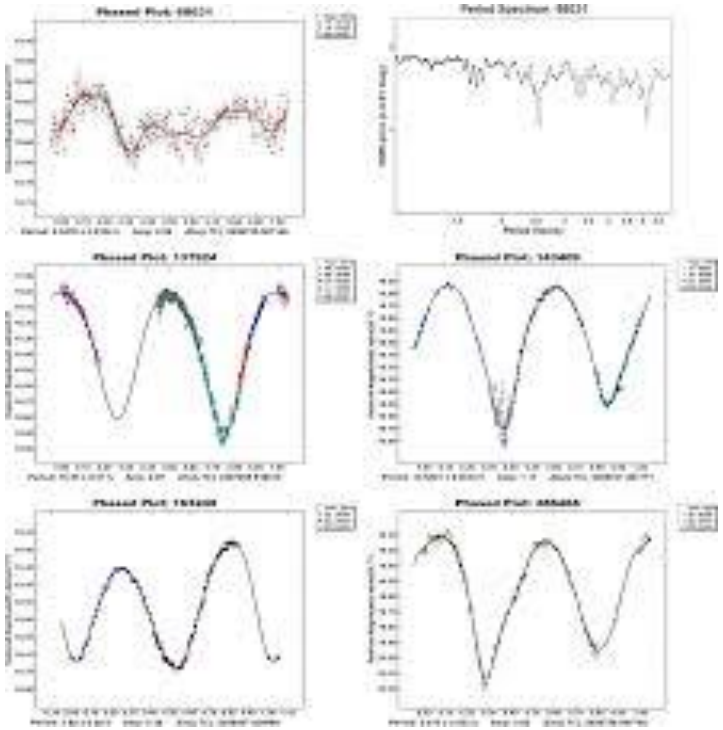
New datasets

Adding new datasets to the already standardizes NEOROCKS database it would be possible to obtain important physical information (e.g. orbital period, taxonomy) of the detected NEOs in a rapid and efficient way

NEOSTEL

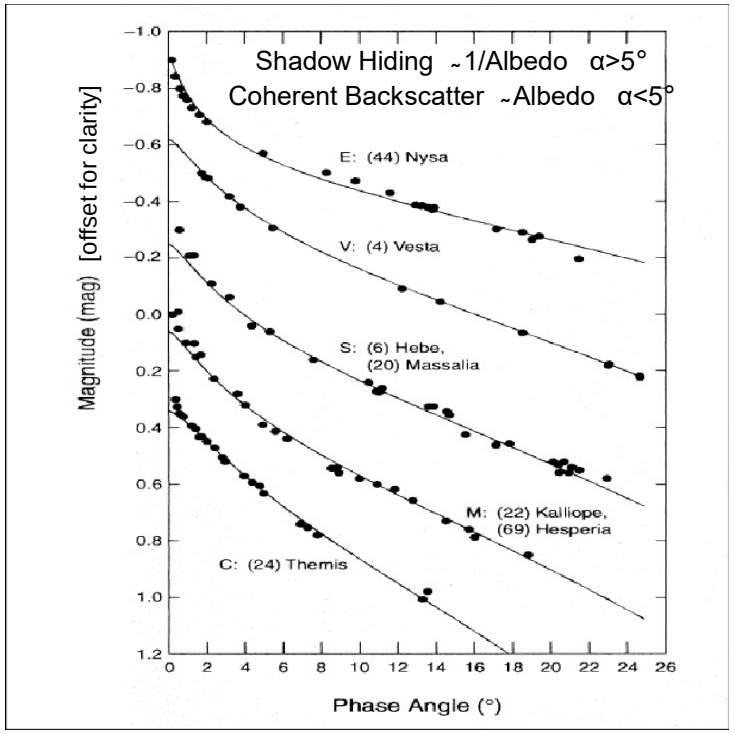
The Near Earth Object Survey TELescope (NEOSTEL) is a 1-metre class telescope with a 6.7°x6.7° field of view able to perform a complete scan of the observable sky down to V=21.5 every 2-3 nights in order to detect NEO sized 40 metres and above a few weeks before they impact Earth.

LIGHT CURVES



Orbital Period
Binary System Identification

PHASE CURVES

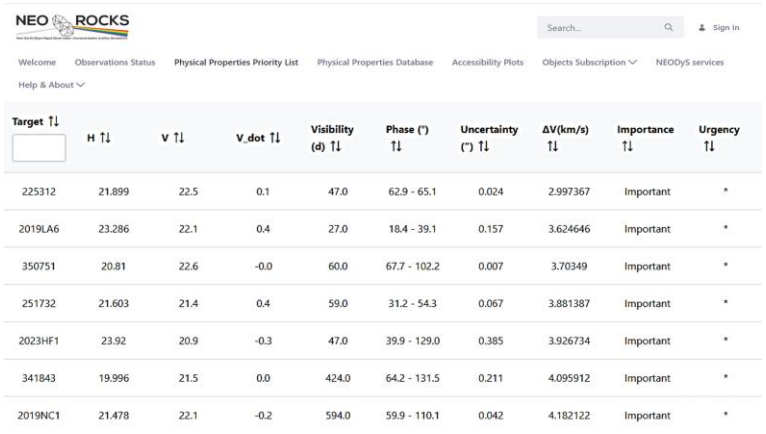


Taxonomy Classification
Surface Features

Applications

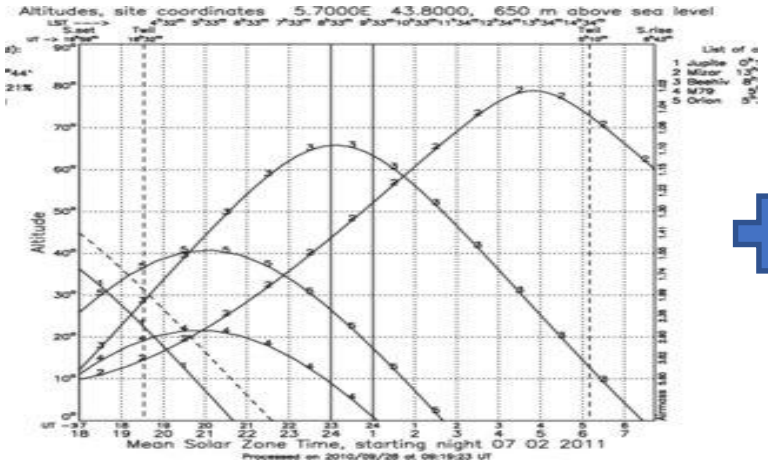
The FAIR-based NEOROCKS database, eventually enlarged with new datasets, would be ready for some useful and innovative applications

Observation planner

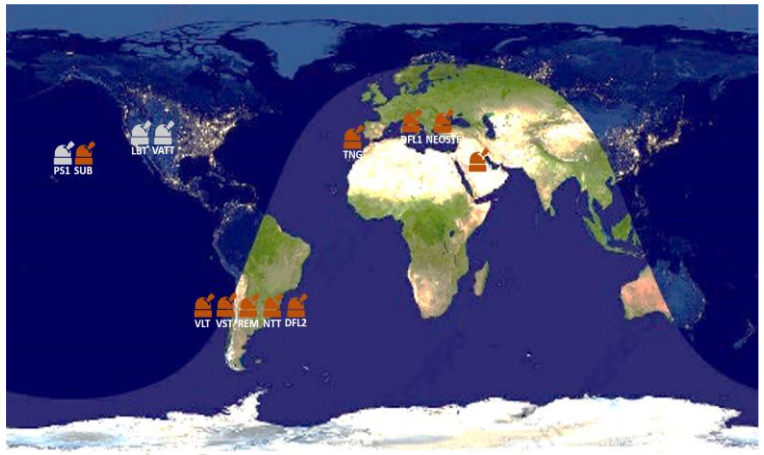


Target	H	V	V_dot	Visibility (d)	Phase (°)	Uncertainty (")	ΔV(km/s)	Importance	Urgency
225312	21.899	22.5	0.1	47.0	62.9 - 65.1	0.024	2.997367	Important	*
2019LA6	23.286	22.1	0.4	27.0	18.4 - 39.1	0.157	3.624646	Important	*
350751	20.81	22.6	-0.0	60.0	67.7 - 102.2	0.007	3.70349	Important	*
251732	21.603	21.4	0.4	59.0	31.2 - 54.3	0.067	3.881387	Important	*
2023HF1	23.92	20.9	-0.3	47.0	39.9 - 129.0	0.385	3.926734	Important	*
341843	19.996	21.5	0.0	424.0	64.2 - 131.5	0.211	4.095912	Important	*
2019NC1	21.478	22.1	-0.2	594.0	59.9 - 110.1	0.042	4.182122	Important	*

Priority List
(taking into account data already present in the db)

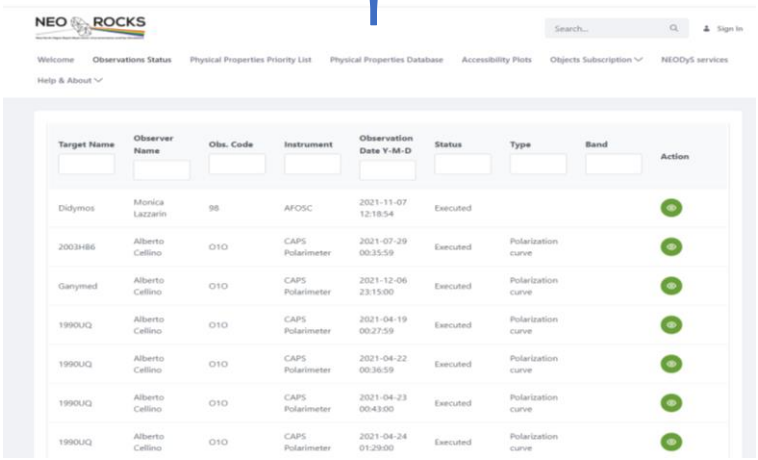


Visibility Plot



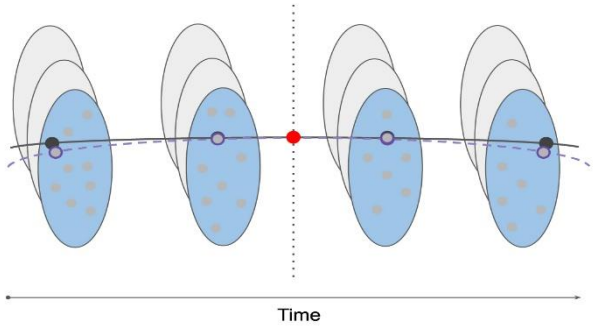
Telescope Status

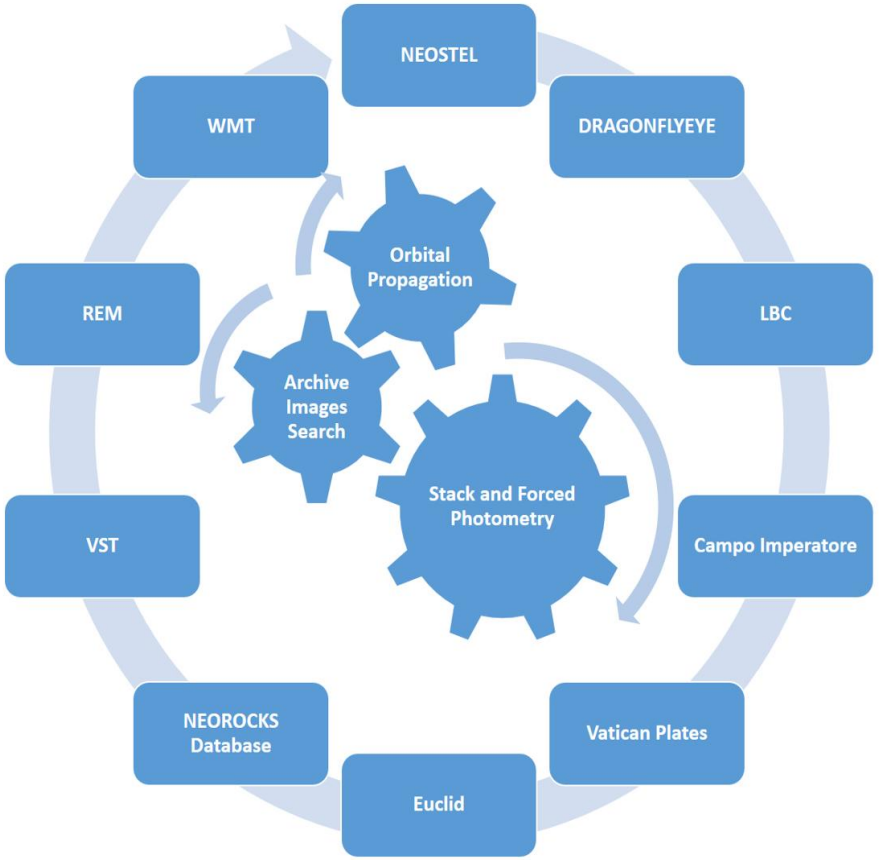
Observation Planner



Precovery

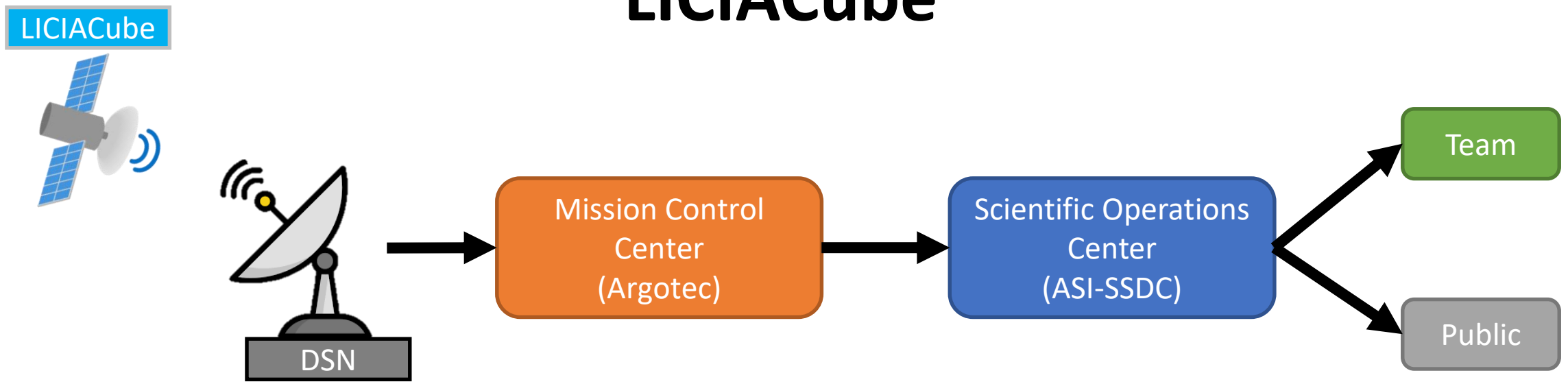
- Precovery is the process of searching for observations in images taken before the object was discovered
- It's useful for extending the observational arc of discovered objects by improving their orbit as well as providing important physical information
- A method for precovery is to propagate the orbit to all times, check the position against all available observations and perform a forced photometry to find the object and define its coordinates





Other NEO projects

LICIACube



SSDC is responsible for the Scientific Operations Center (SOC) and for all that regards data formatting, processing and dissemination

The archive has been designed and built as PDS4 compliant and we are willing to collaborate with the DM WG for PDS

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The SSDC Role in the LICIACube Mission: Data Management and the MATISSE Tool

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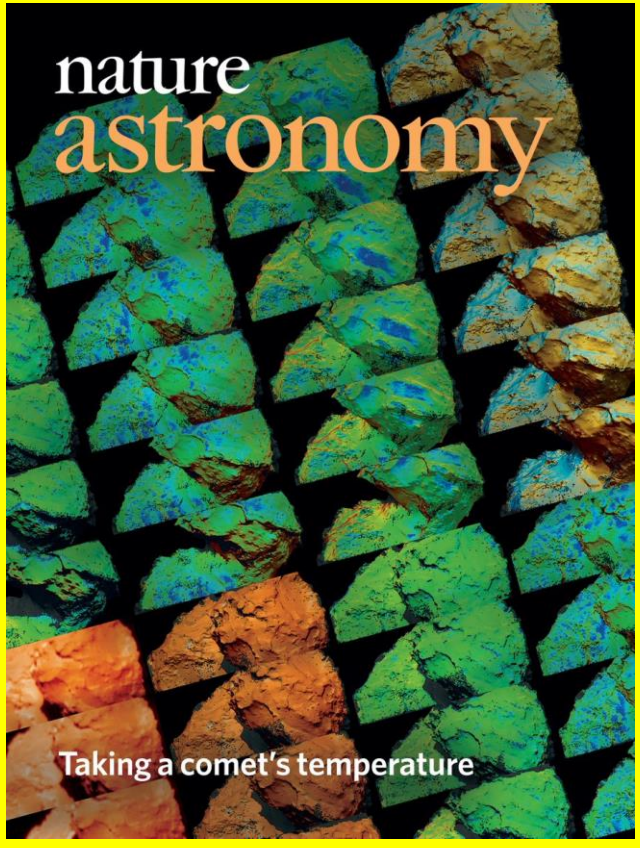
Abstract

Light Italian Cubesat for Imaging of Asteroids (LICIACube) is an Italian mission managed by the Italian Space Agency (ASI) and part of the NASA Double Asteroid Redirection Test (DART) planetary defense mission. Its main goals are to document the effects of the DART impact on Dimorphos, the secondary member of the (65803)

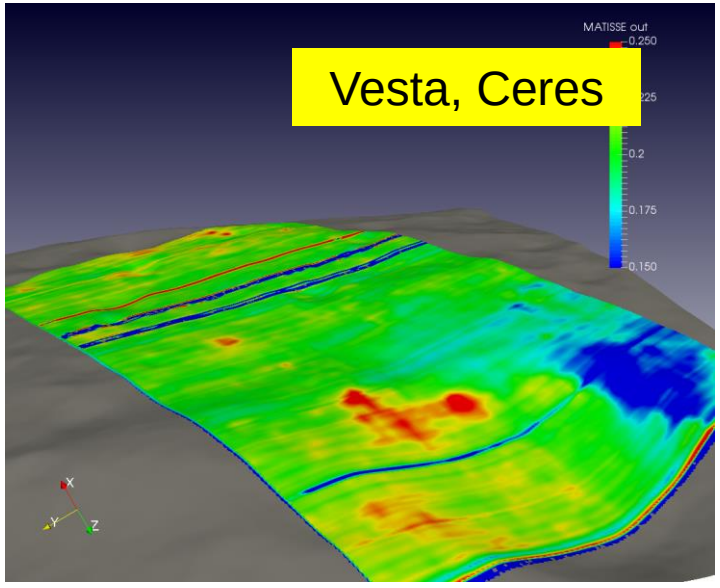
MATISSE

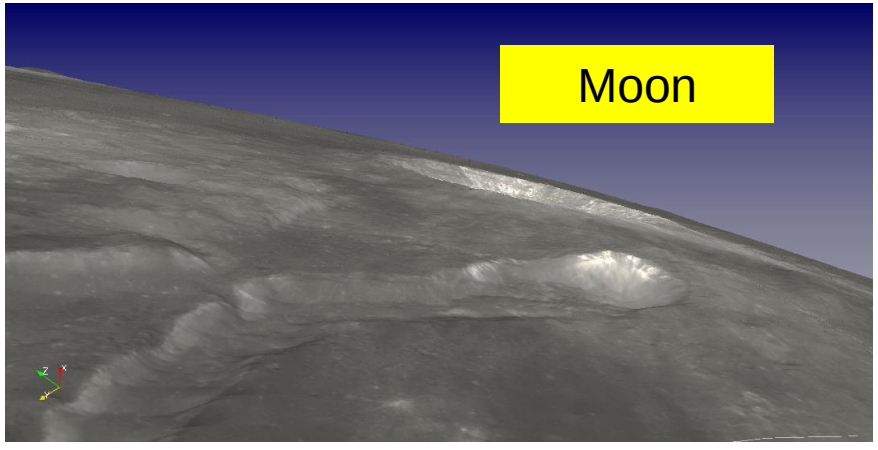
Since its first version in 2013 the tool has grown, improving its scientific capabilities and including new targets, missions and instruments

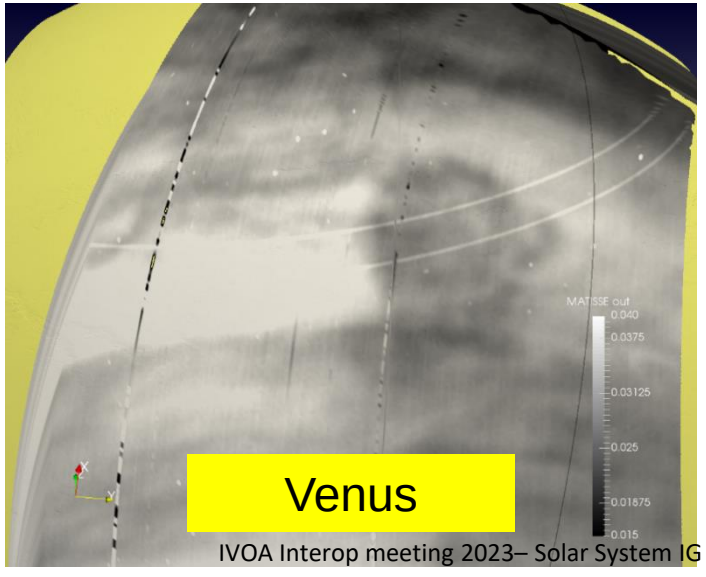
CRISM & MARSIS Mars, VIRTIS Venus, MDIS Mercury called by external services (EPN-TAP, PlanetServer, NASA ODE REST)



July 2019 Nature Astronomy cover!







Thank you

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