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Innovative and Synergetic Data-Analyses Strategies For Small Bodies: A NEO-MAPP Contribution

Planetary Defence Conference 2021

Near Earth Object Modelling And Payloads for Protection

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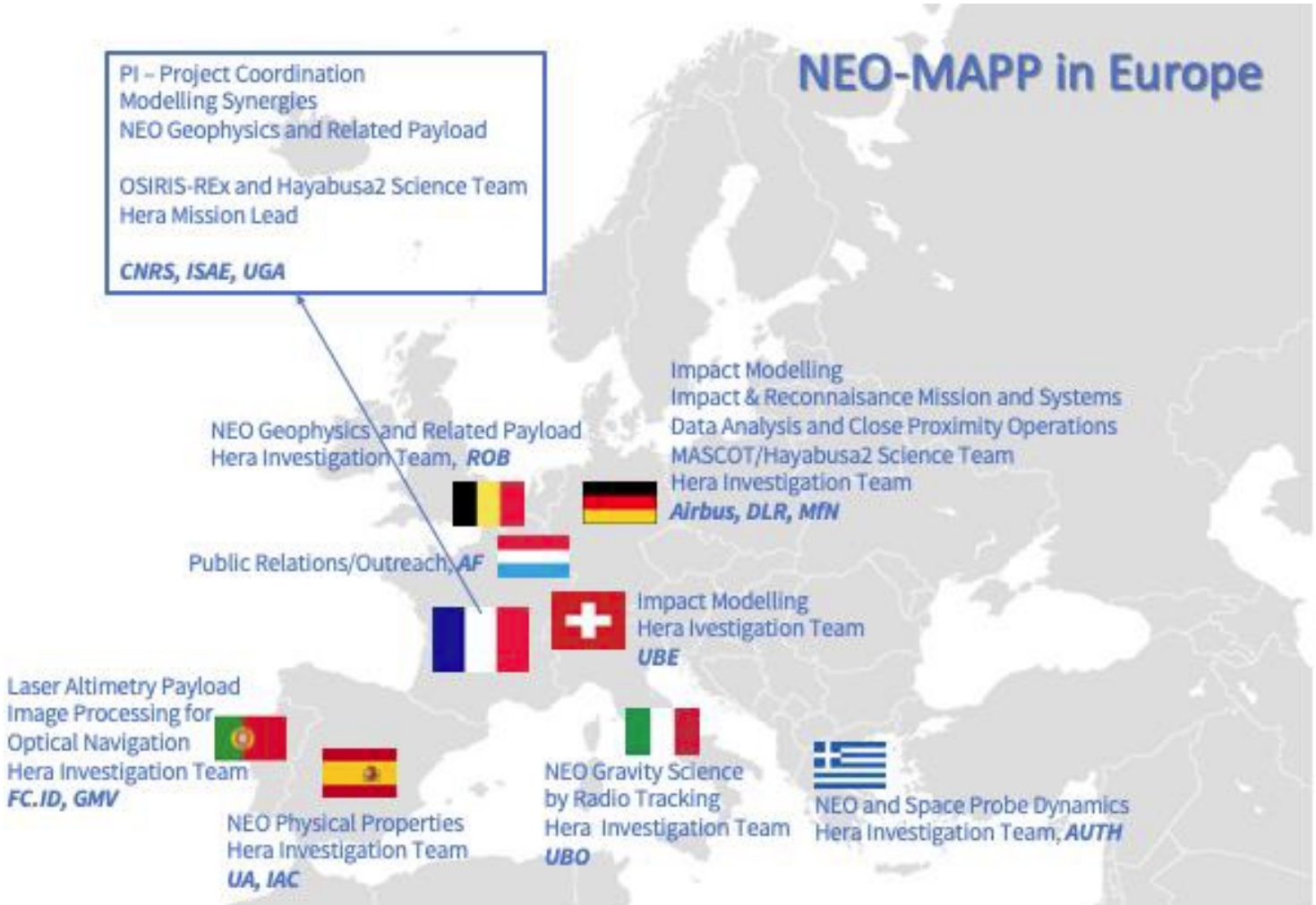
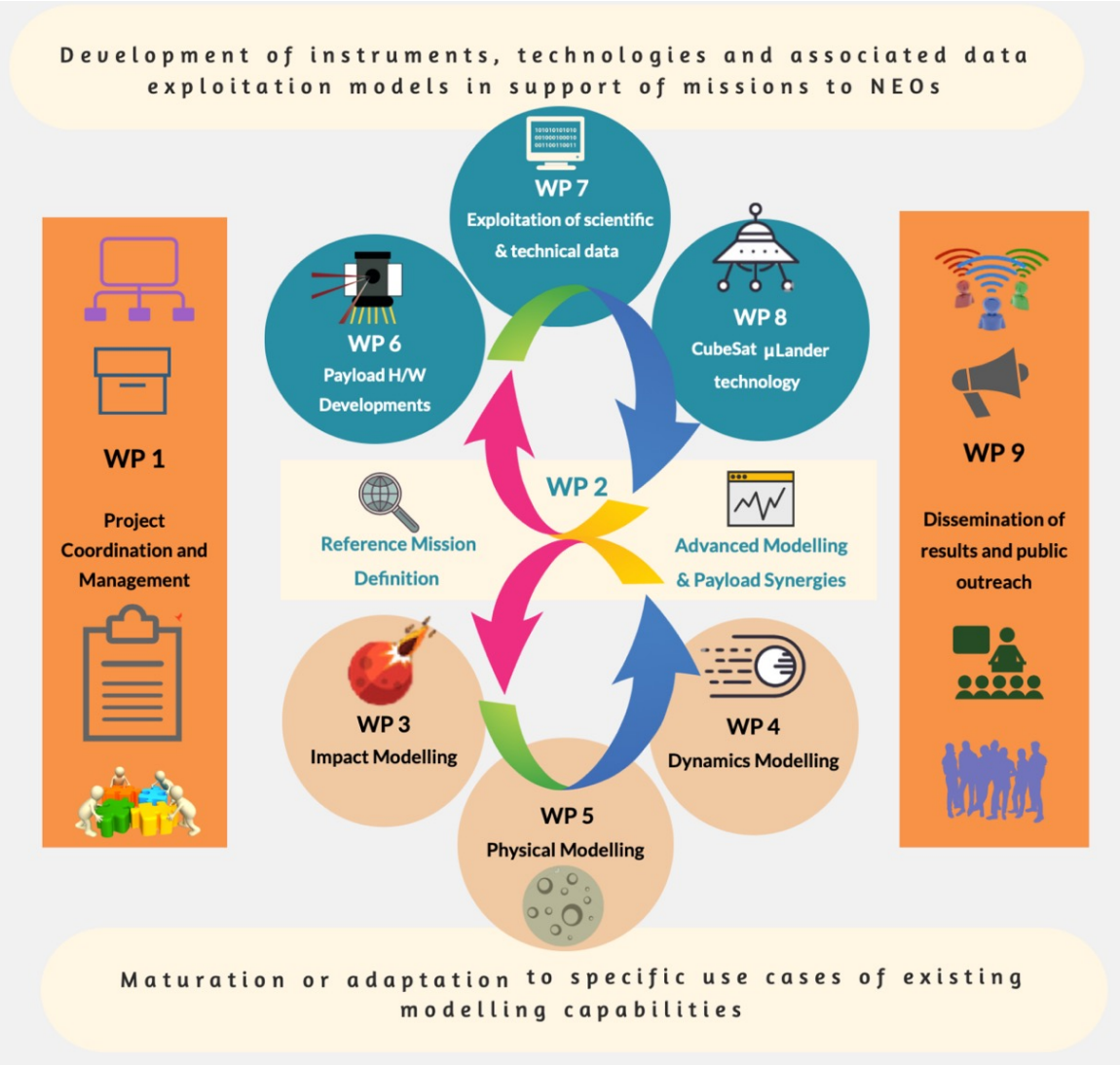
The NEO-MAPP team



The NEO-MAPP team includes the Hera Principal Investigator and 12 Hera Co-Investigators

The NEO-MAPP project (2020-2023)



NEO-MAPP is a European Commission Horizon 2020 study (H2020-SPACE-2018-2020)

Main goals of NEO-MAPP:

- Advance our **understanding of the response of NEOs to external forces** (in particular a kinetic impact or a close planetary approach)
- Provide significant advances in **the associated measurements by a spacecraft** (including those necessary for the physical and dynamical characterization in general).

For more information see NEO-MAPP overview talk by P. Michel

Rationale for this particular study (NEO-MAPP 'WP7')

- Currently data exploitation software and techniques associated to different instruments have varying levels of maturity. In addition, there are **very limited synergies between the instruments and little or no co-processing of data**.

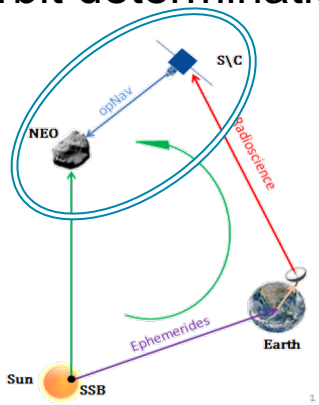
- As part of NEO-MAPP, we have identified **key data products** that are critical for the success of future planetary defence space missions and for improving our understanding of NEOs.

- We are defining **innovative and synergetic measurement strategies** focused around these data products.

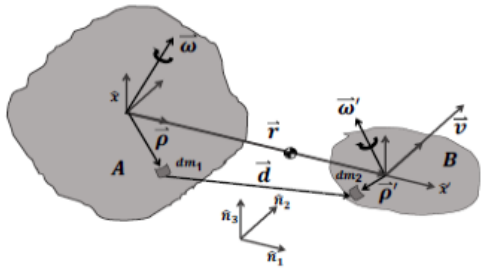
- **We combine multiple payloads in order to maximize the exploitation of scientific and technical data, increase the scientific return of future asteroid space missions, and improve our understanding of NEOs.**

Key data products

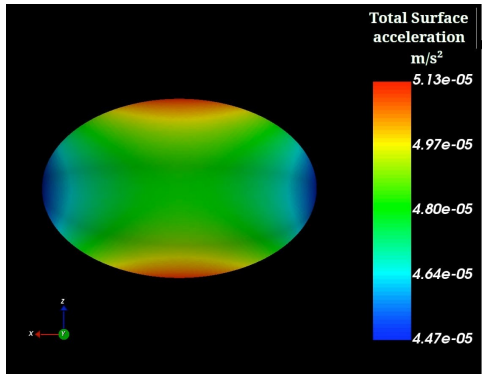
Orbit determination



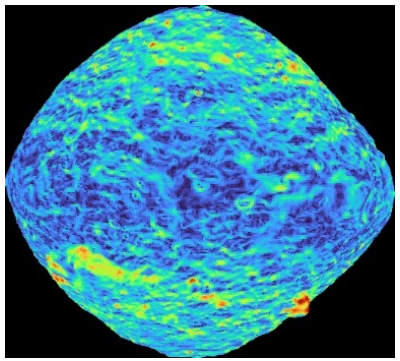
Dynamical state



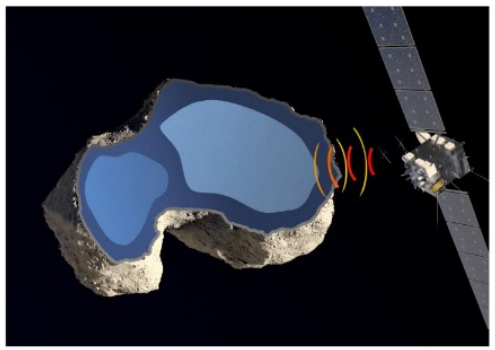
Gravity field



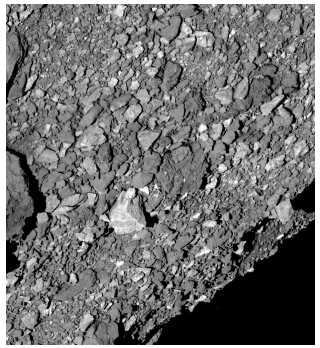
Shape and topography



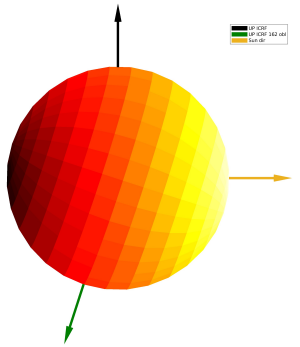
Internal structure



Mechanical properties



Thermal properties



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Synergies between instruments and data products

Our **multi-instrument approach** includes, but is not limited to, the novel instruments under development as part of the NEO-MAPP project. We also consider mature instruments with full flight heritage, or relevant instruments that are being developed as the framework of other projects.

Instruments under development as part of NEO-MAPP

Additional instruments that will also be considered in the study

	Orbit	Dynamic	Shape	Gravity	Interior	Mechanic	Thermal
High Freq Radar	1*	1*	1*	1*	1	2	2
RS: S/C to S/C	1	1*		1	x	2	
Lidar	1*	1	1	1*	x	2	x
Seismometer					1	1	x
Gravimeter	1*	1*		1	x	x	x
Camera	1	1	1		x	2	2
LF bistatic radar	1*	2		1*	1	2	x
Accelerometer					x	1	x
Rotational sensor		1			x		
TIR mapper					x	2	1
RS: G to S/C	1	1		1	x		x

Preliminary indication of how each instrument could contribute to the different data products

"1" Instrument able to provide the data product. ("1" when data processing is currently prospective only / no final performances or operation requirement evaluation)*

"2" Instrument able to contribute through synergies only - not capable providing the data product directly

"x" Contribution to the data product via another product

Synergies between data products

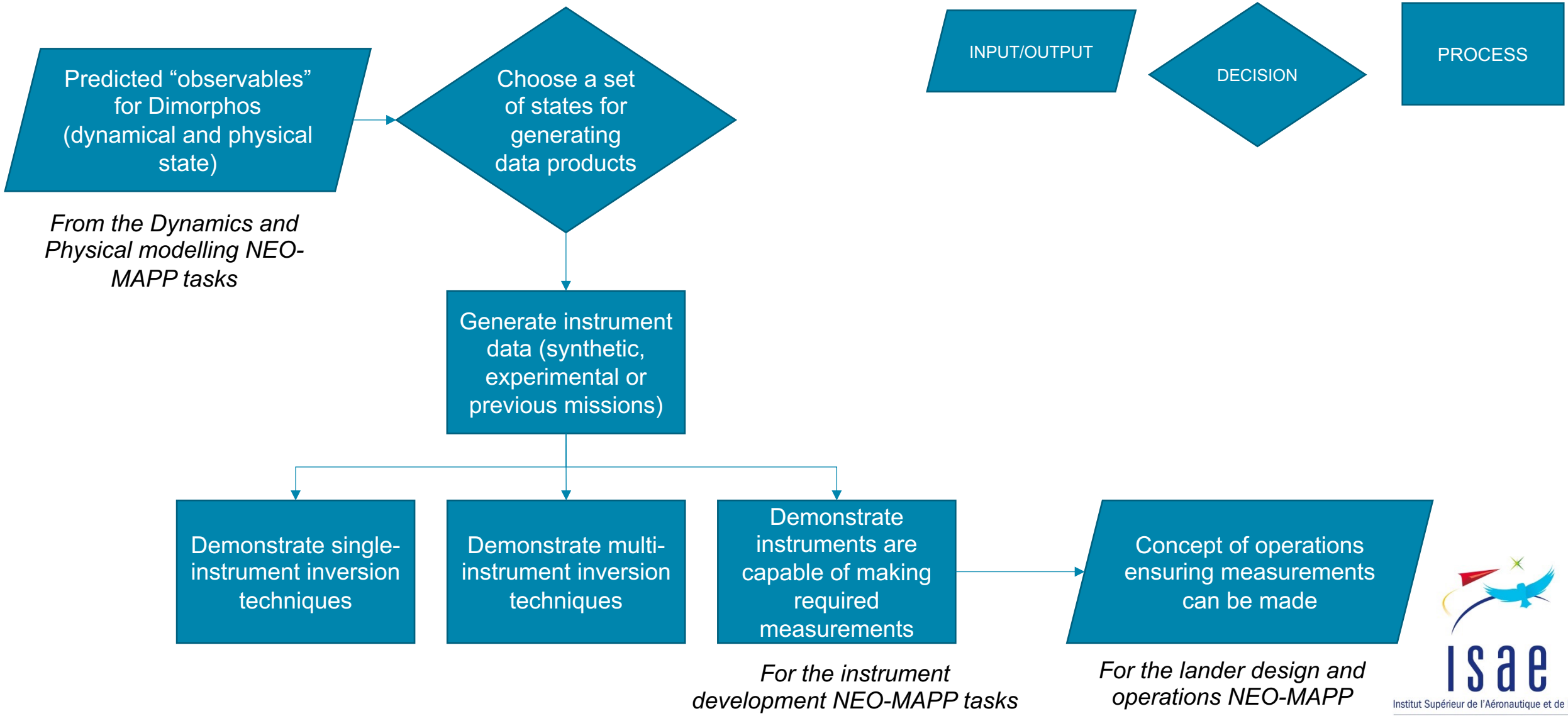
Multi-product synergies are also considered to increase efficiency of the data processing.
A given product can use other data products as input without reprocessing of initial data (for example, the deep interior processing uses gravity field as an input without reprocessing the gravimeter data with specific processing).

	Orbit	Dynamic	Shape	Gravity	Interior	Mechanic	Thermal
Orbit		1	1	1			1
Dynamical	2		2	2	2	2	2
Shape	2	1		2	1	2	1
Gravity	1	2			2		
Interior		2		2		2	2
Mechanical					2		1
Thermal					2		

"1" Data product is required to produce another data product

"2" Data product provides added value to the other data product

NEO-MAPP data processing work flow



Summary

- NEO-MAPP is a European Commission Horizon 2020 study (H2020-SPACE-2018-2020) involving teams from multiple European countries

- As part of the NEO-MAPP project we define **innovative and synergetic measurement strategies** focused around several key data products.

- Our goal is to maximize the exploitation of scientific and technical data, increase the scientific return of future asteroid space missions, and improve our understanding of NEOs.

- This is **a large and challenging task** with a strong focus on synergies between instrument teams, data processing teams and those working on different data products.

- There will be **close links with the Hera WG4 "Data Analyses" working group** to ensure that the wider community has the opportunity to be involved in this work