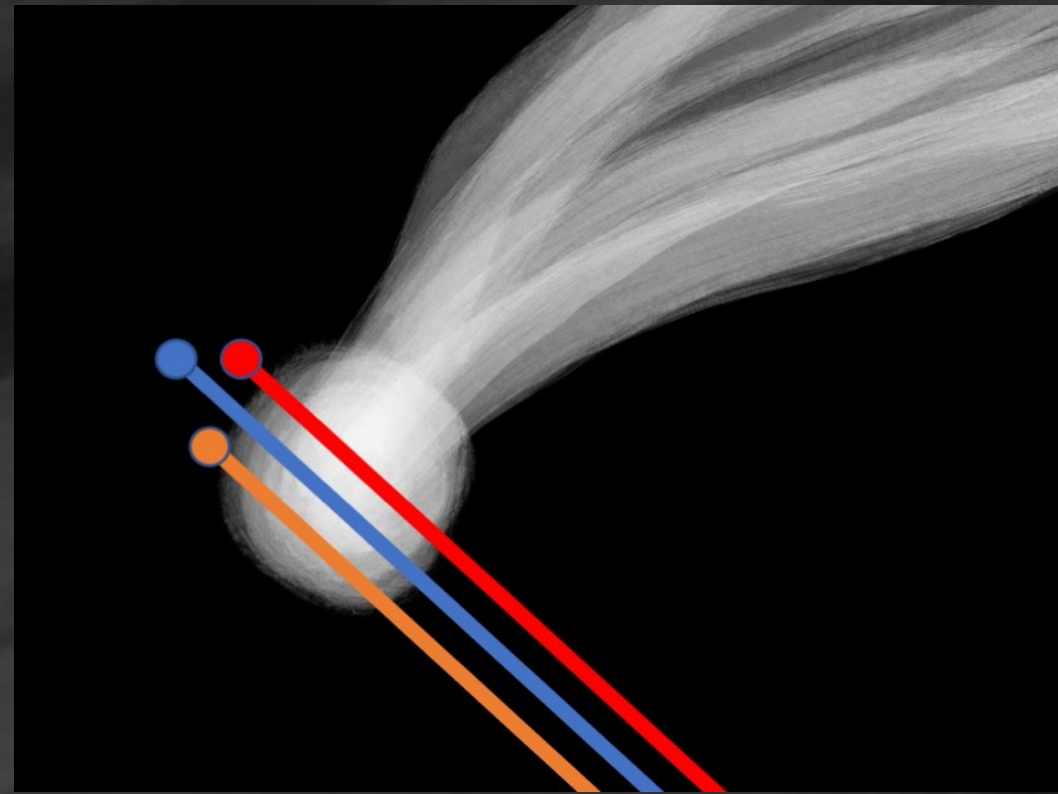


The Comet Interceptor Mission



Geraint Jones

UCL Mullard Space Science Laboratory, UK
Centre for Planetary Science at UCL/Birkbeck, UK

Colin Snodgrass

University of Edinburgh, UK

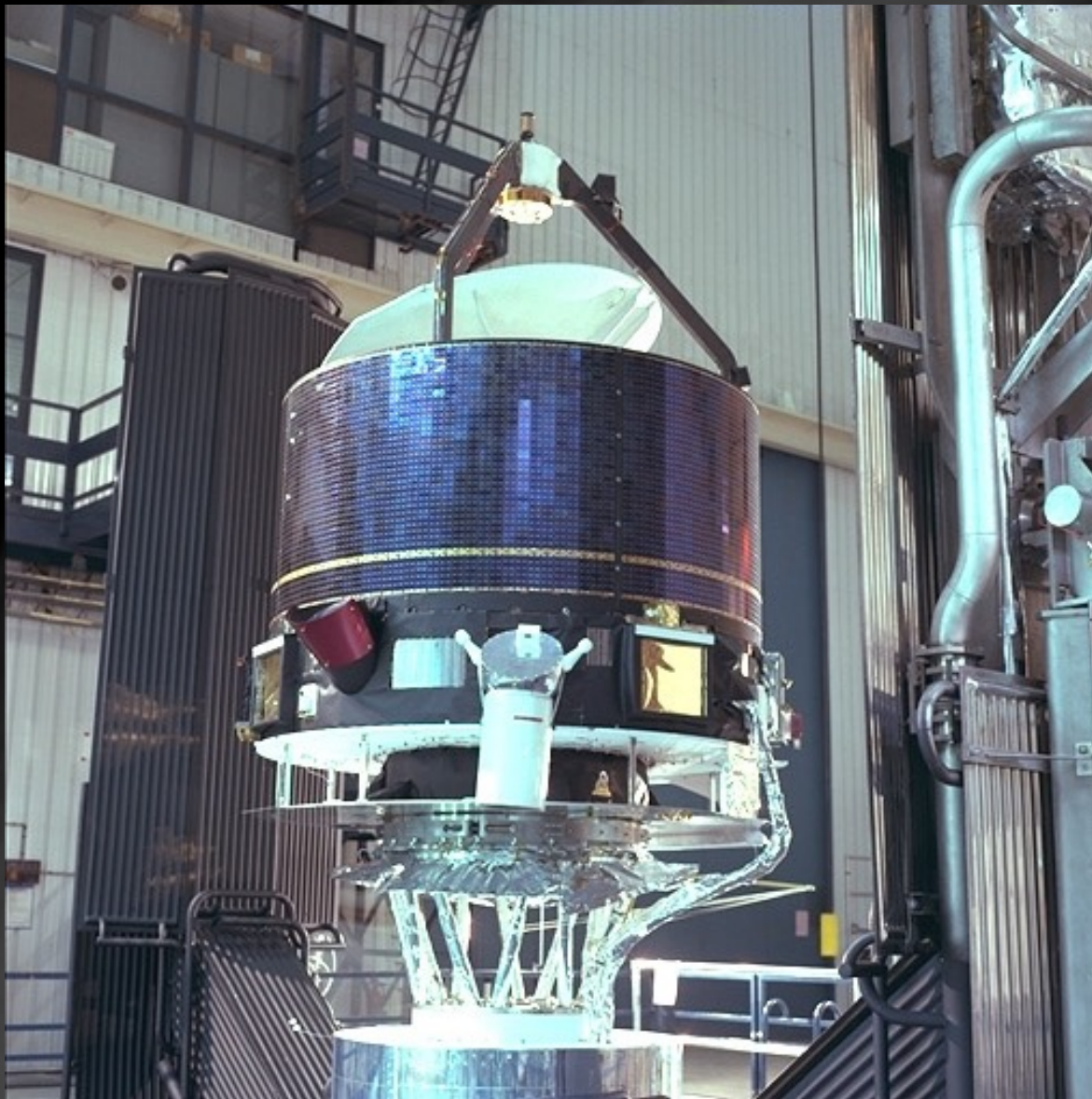
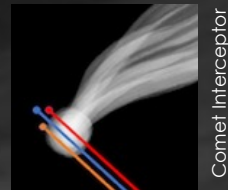
Cecilia Tubiana

INAF-IAPS, Rome, Italy

and the Comet Interceptor Team

@cometintercept

Giotto

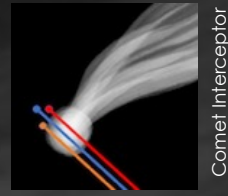


Halley's nucleus from Giotto



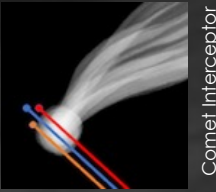
Comet Interceptor

Rosetta

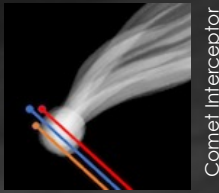


ESA F1 mission call

- In July 2018, first F-class mission call announced.
- Maximum cost to ESA at completion, excluding launch: €150M.
- ESA member states and other collaborating agencies generally fund instruments and the science teams.
- Shared launch with Ariel exoplanet telescope, to Sun-Earth L2 point, now scheduled for December 2029

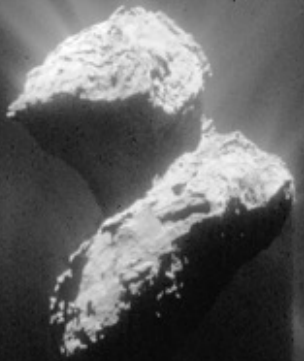


Comet Interceptor is a mission targeting a long-period comet, preferably dynamically-new, or an interstellar object.



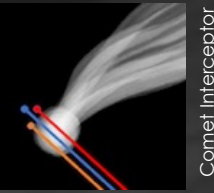
Why?

- All previous comet missions have been to objects that have passed the Sun many times
- Those comets have changed over time, and are covered in a thick layer of dust
- A dynamically-new comet is one that is probably nearing the Sun for the first time
- These are **pristine**



How?

- The only way to encounter a long period comet is to find one inbound very early
- The upcoming Vera Rubin Observatory will increase the distance at which comets are discovered inbound
- Even with advance warning, still not enough time to plan and build a spacecraft



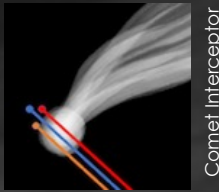
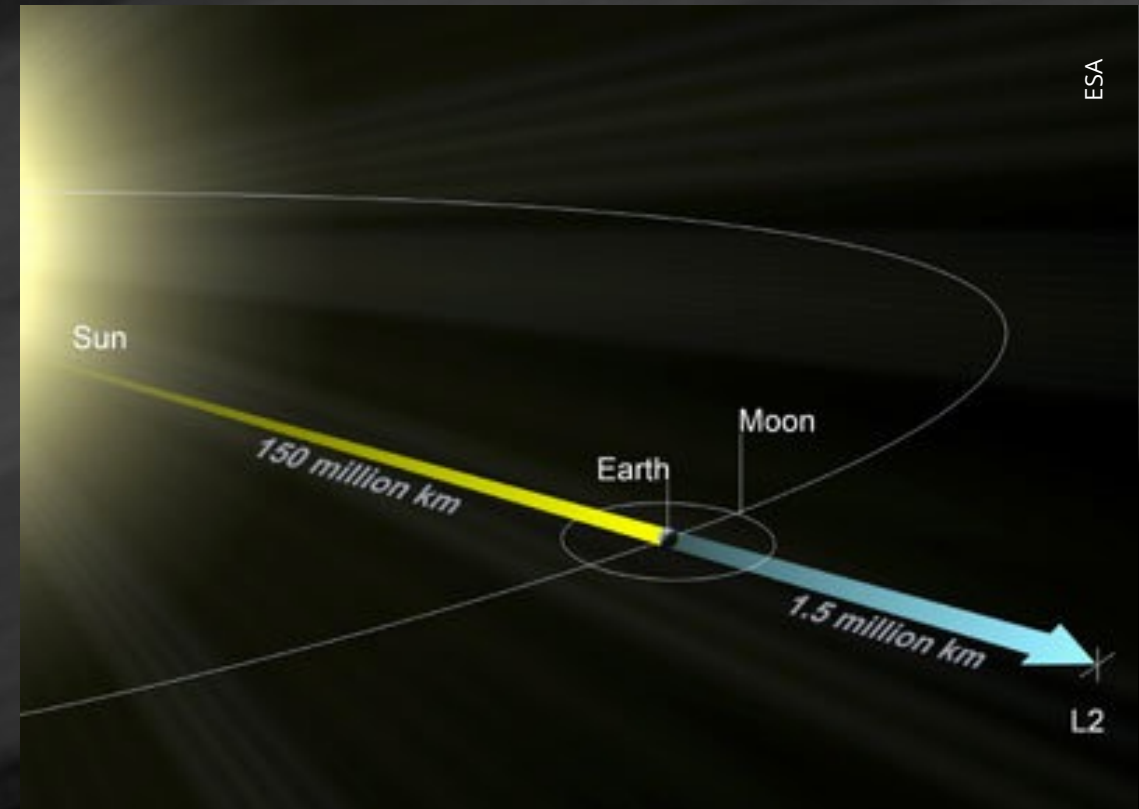
Comet Interceptor



Rubin Obs/NSF/AURA

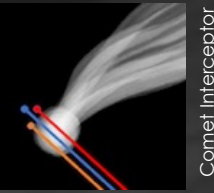
Solution: We Wait, in Space

- We build a spacecraft that can cope with all kinds of comets
- We launch it to a stable 'parking' location in space
- We can respond rapidly to new discoveries - departure from parking location 6-12 months after target discovery



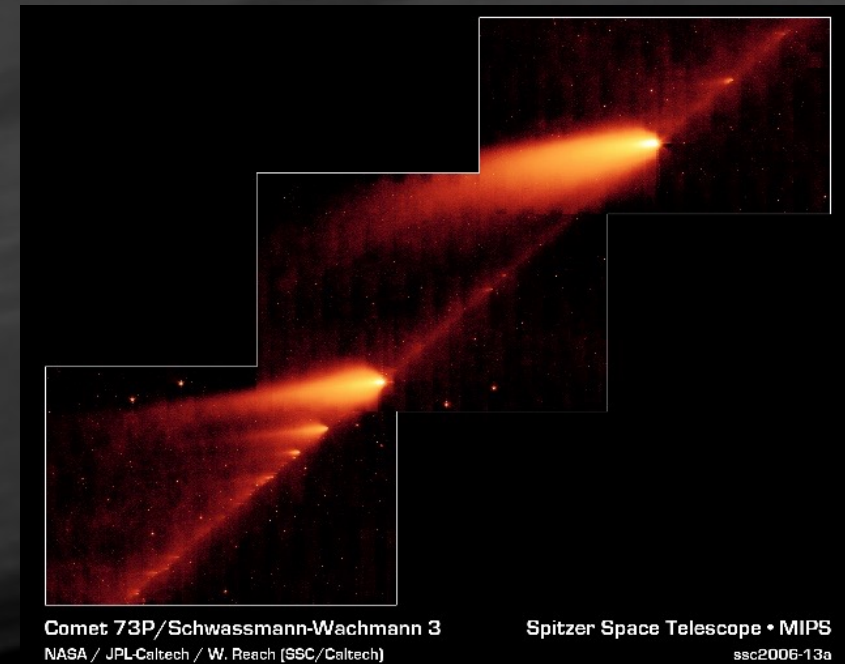
Challenges

- We may encounter comets at > 70 km/s
- We can't predict our path through the comet
- Cost limit means that entire mission should be < 5 years in duration



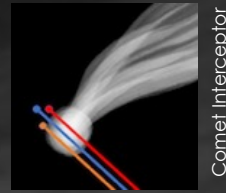
Solutions

- Limited radio link to Earth at encounter
- Dust shielding equivalent to that on Giotto
- Wait at L2 limited to ~ 3 years
- Backup short period comet targets



A mission to short period comet will carry out new science: not repeat of previous missions.

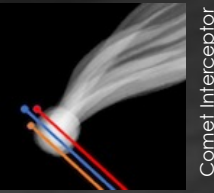
Mission Development Progress...



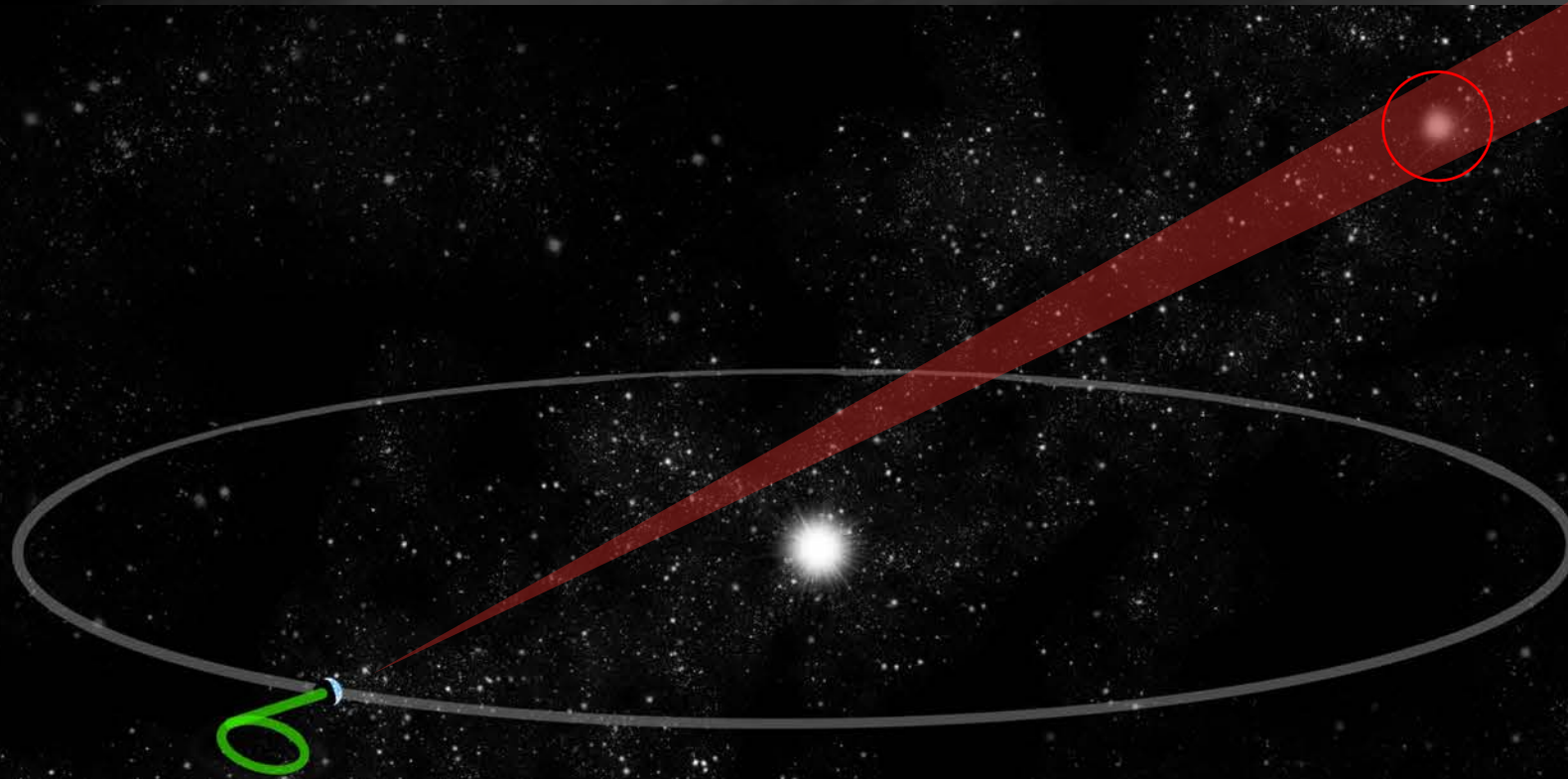
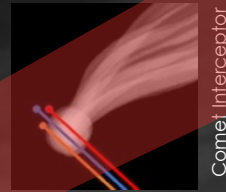
- June 2019: Study selection
- July & November 2019: ESA Concurrent Design Facility studies: mission design feasible
- February 2020: ESA approve advancement from Phase 0 to A; formal selection
- November 2020: Two industrial consortia start parallel mission studies
- March-November 2021: Full Instrument & Spacecraft level reviews (I-SRR & S-SRR)
- 2022: - Preliminary Design Review of instruments and spacecraft
 - Mission Adoption
 - Prime contractor selection
- 2029: Launch!



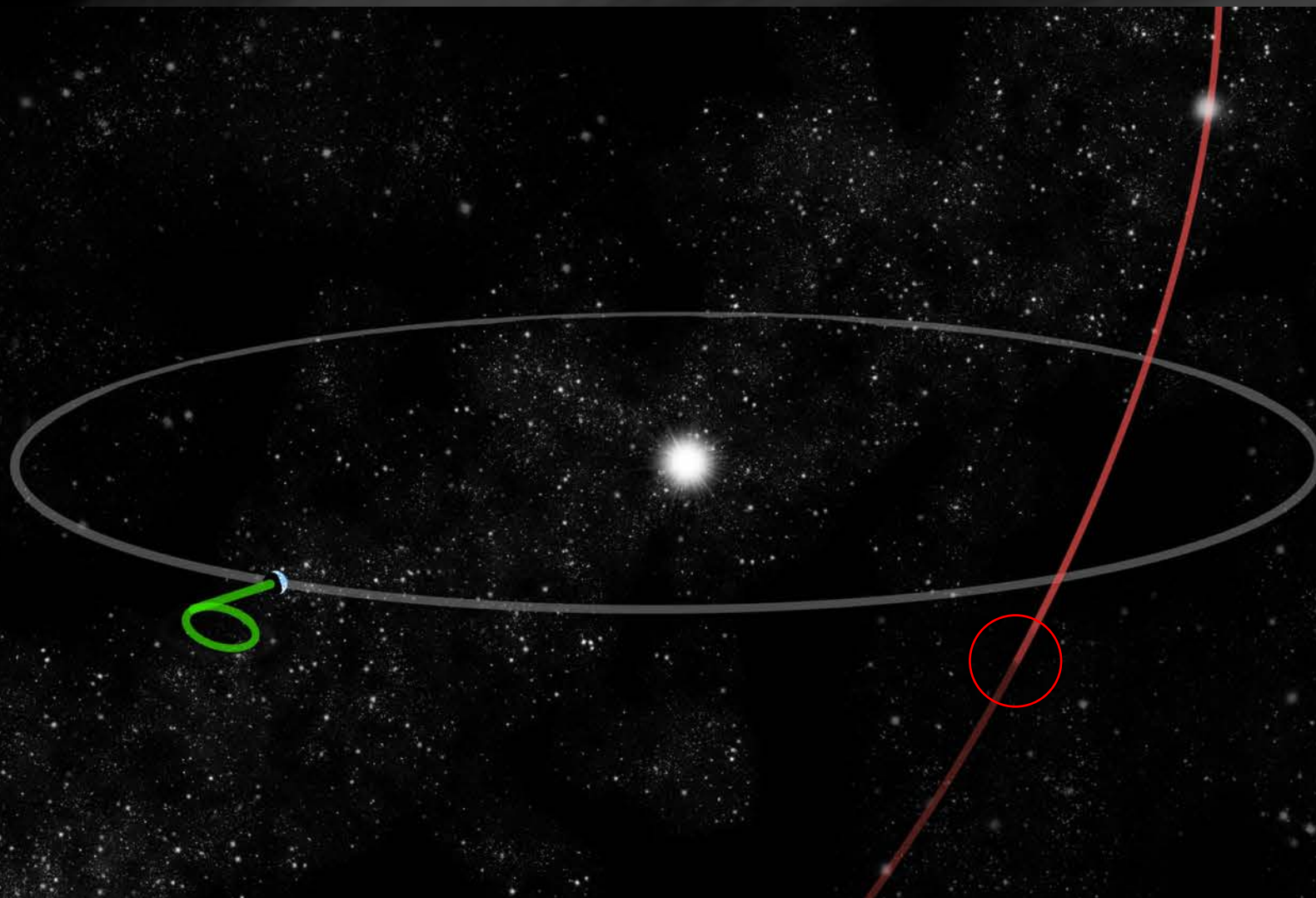
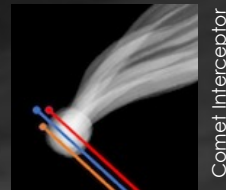
- Mission 'parked' at stable Lagrange point L2 after launch with Ariel
- Waits for up to 2-3 years for new target discovery



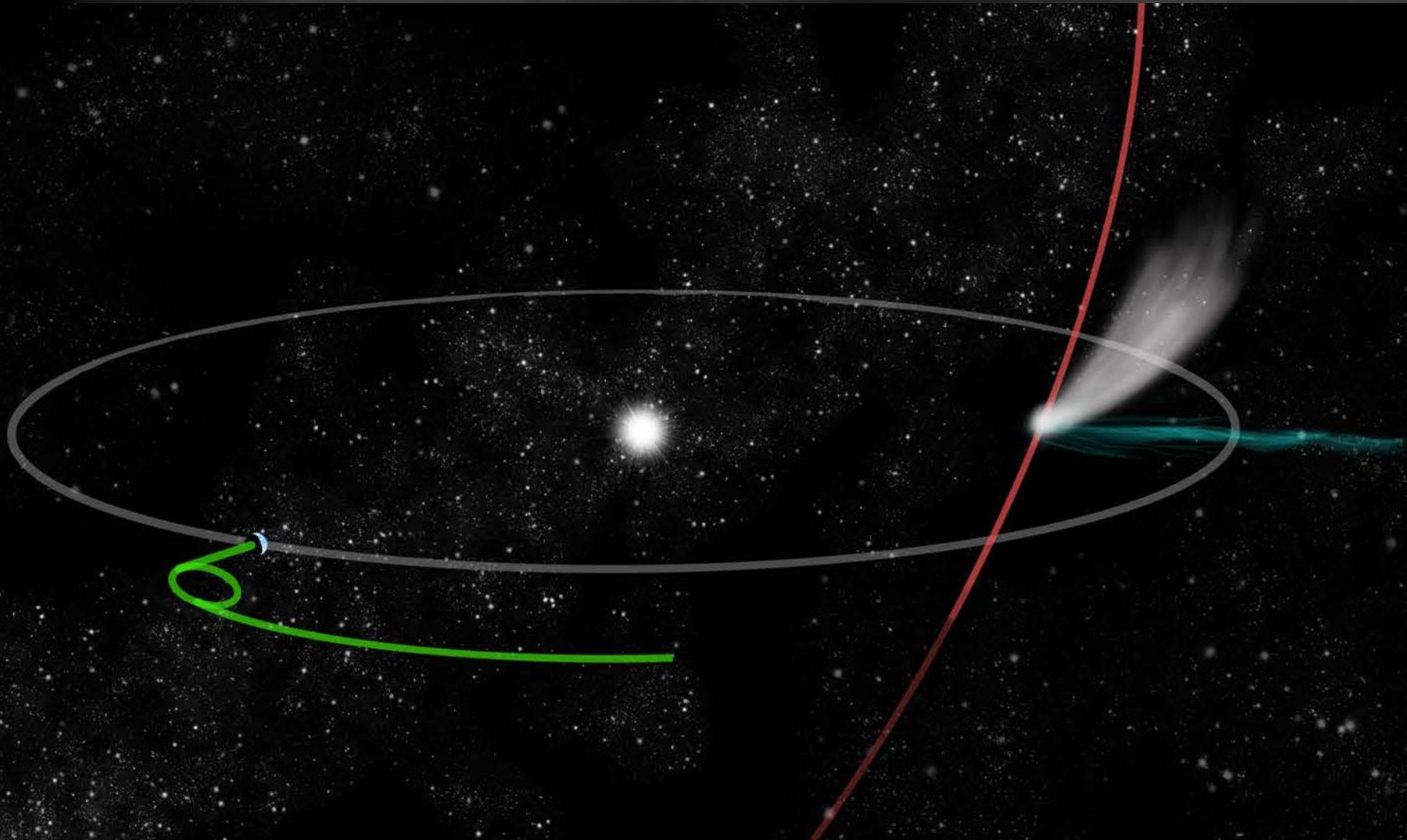
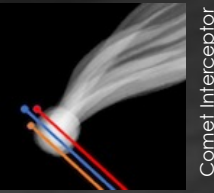
- Target discovered by a ground-based observatory



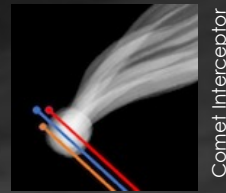
- Orbit computed and ecliptic crossing point predicted



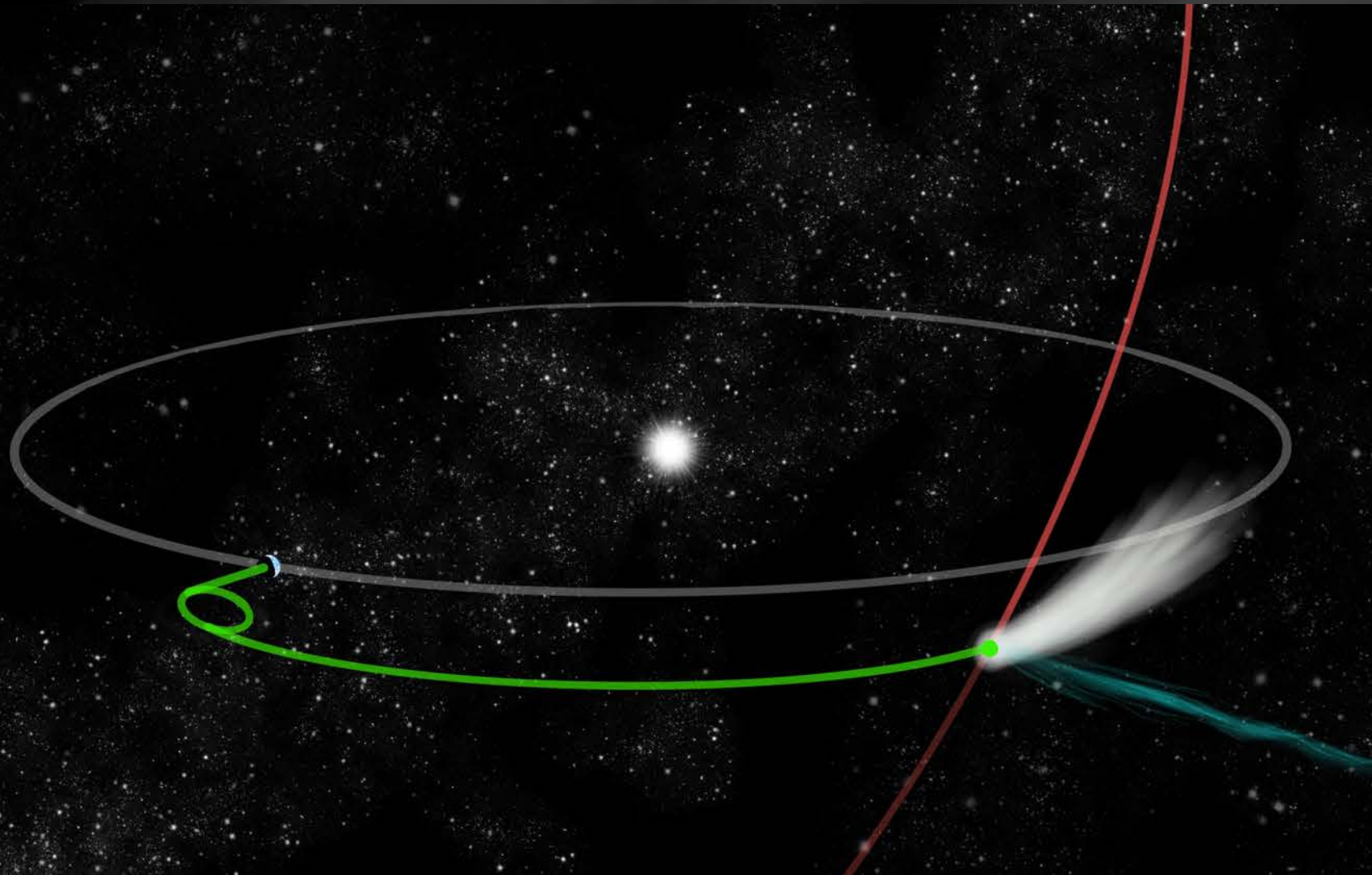
- Comet Interceptor leaves L2 to intercept comet's path



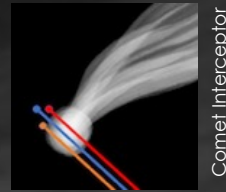
- Encounter with comet close to the ecliptic plane
- Targets like this are being found, e.g. C/2021 O3 (Pan-STARRS) and C/2021 P4 (ATLAS), found in July-August 2021, could have been reachable if mission was operating now



Comet Interceptor



A Multi-Spacecraft Mission



- A: main spacecraft

safe / distant measurements



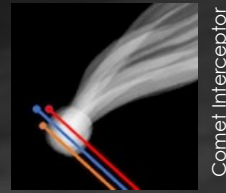
- B1: inner coma



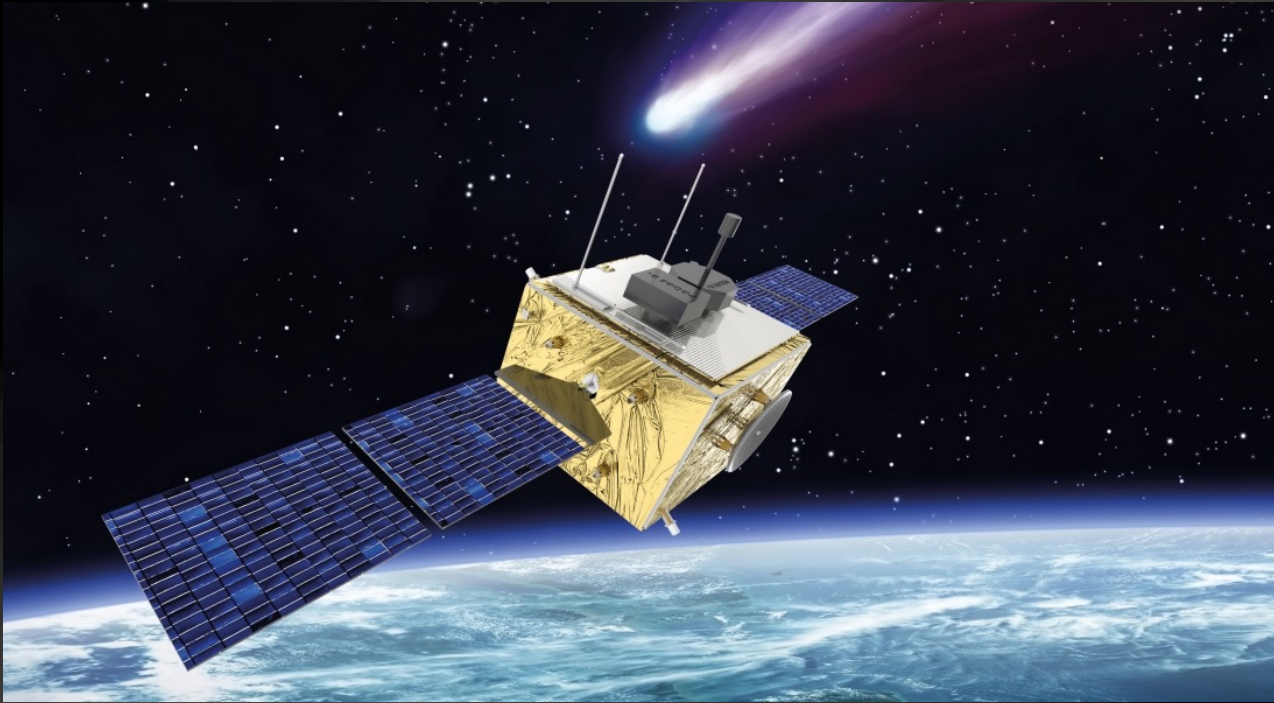
- B2: nucleus + coma

higher risk / high gain
closer approaches
to nucleus

Spacecraft Design



- Two industrial consortia contracted by ESA to design Spacecraft A and B2 (B1 provided by Japan).
- One of those two teams will be selected during 2022 to be the prime contractor.



Thales Alenia Space UK



OHB Italia

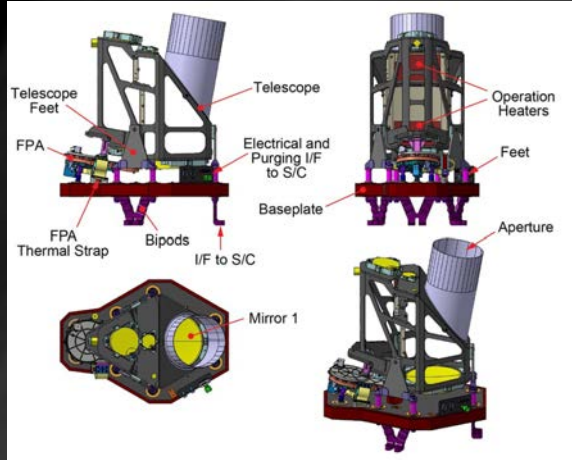
Instruments

Spacecraft A

CoCa - Comet Camera

PI: Nicolas Thomas, *University of Bern, CH*

Deputy PI: Antoine Pommerol, *University of Bern, CH*



MIRMIS - Multispectral InfraRed Molecular & Ices Sensor

PI: Neil Bowles, *University of Oxford, UK*

Co-PI: Antti Näsilä, *VTT, FI*

MANIAC - Mass Analyzer for Neutrals and Ions at Comets

PI: Martin Rubin, *University of Bern, CH*

Deputy PI: Peter Wurz, *University of Bern, CH*

Probe B1

PS - Plasma Suite

PI: Satoshi Kasahara, *The University of Tokyo, JP*

Deputy-PI: Ayako Matsuoka, *Kyoto University, JP*

WAC/ NAC - Wide Angle Camera / Narrow Angle Camera

PI: Naoya Sakatani, *Rikkyo University, JP*

Deputy-PI: Shingo Kameda, *Rikkyo University, JP*

HI - Hydrogen Imager

PI: Kazuo Yoshioka, *The University of Tokyo, JP*

Probe B2

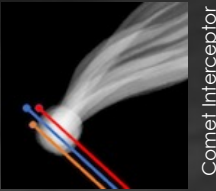
EnVisS - Entire Visible Sky

PI: Vania Da Deppo, *CNR-Institute for Photonics & Nanotechnologies, Padova, IT*

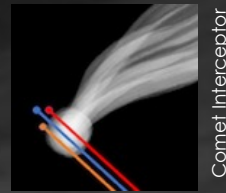
Co-PI: Luisa Lara, *IAA, Granada, ES*

OPIC - Optical Imager for Comets

PI: Mihkel Pajusalu, *Tartu Observatory, University of Tartu, ET*



Instruments



Comet Interceptor

DFP - Dust, Fields, and Plasma

PI Hanna Rothkaehl, CBK PAN, Warsaw, PL

Spacecraft A

FGM (A)

Unit Co-PI Uli Auster, TU Braunschweig, DE

LEES

Unit Co-PI: Nicolas Andre, IRAP, FR

Deputy Unit Co-PI: Lubomir Prech, Charles University, CZ

COMPLIMENT

Unit Co-PI: Pierre Henri, CNRS (LPC2E, Orléans & Lagrange, Nice), FR

Deputy Unit Co-PI: Niklas Edberg, IRF-Uppsala, SE

Deputy Unit Co-PI: Johan De Keyser, BIRA, BE

SCIENA

Unit Co-PI: Hans Nilsson, IRF-Kiruna, SE

DAPU

Unit Co-PI: Ivana Kolmasova, IAP, Prague, CZ

PSU

Unit Co-PI: Marek Morawski, CBK PAN, Warsaw, PL

DISC (**sensors on A and B2**)

Unit Co-PI Vincenzo Della Corte, INAF-IAPS, Rome, IT

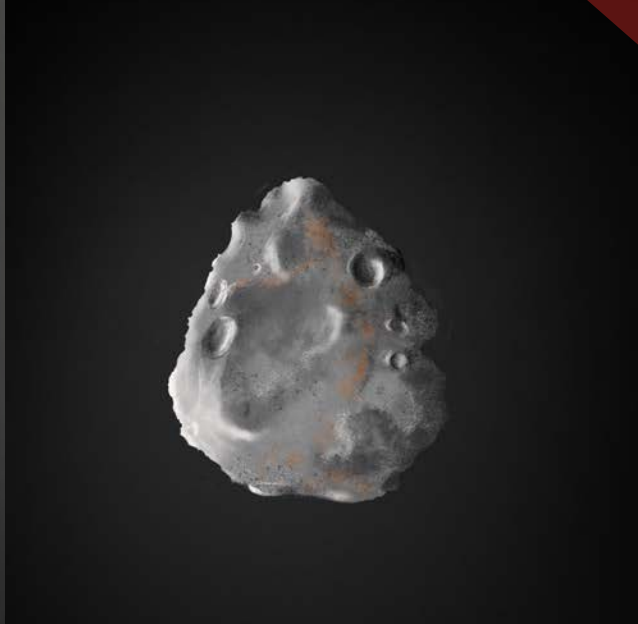
Deputy Unit Co-PI Alessandra Rotundi, University "Parthenope", Naples, IT

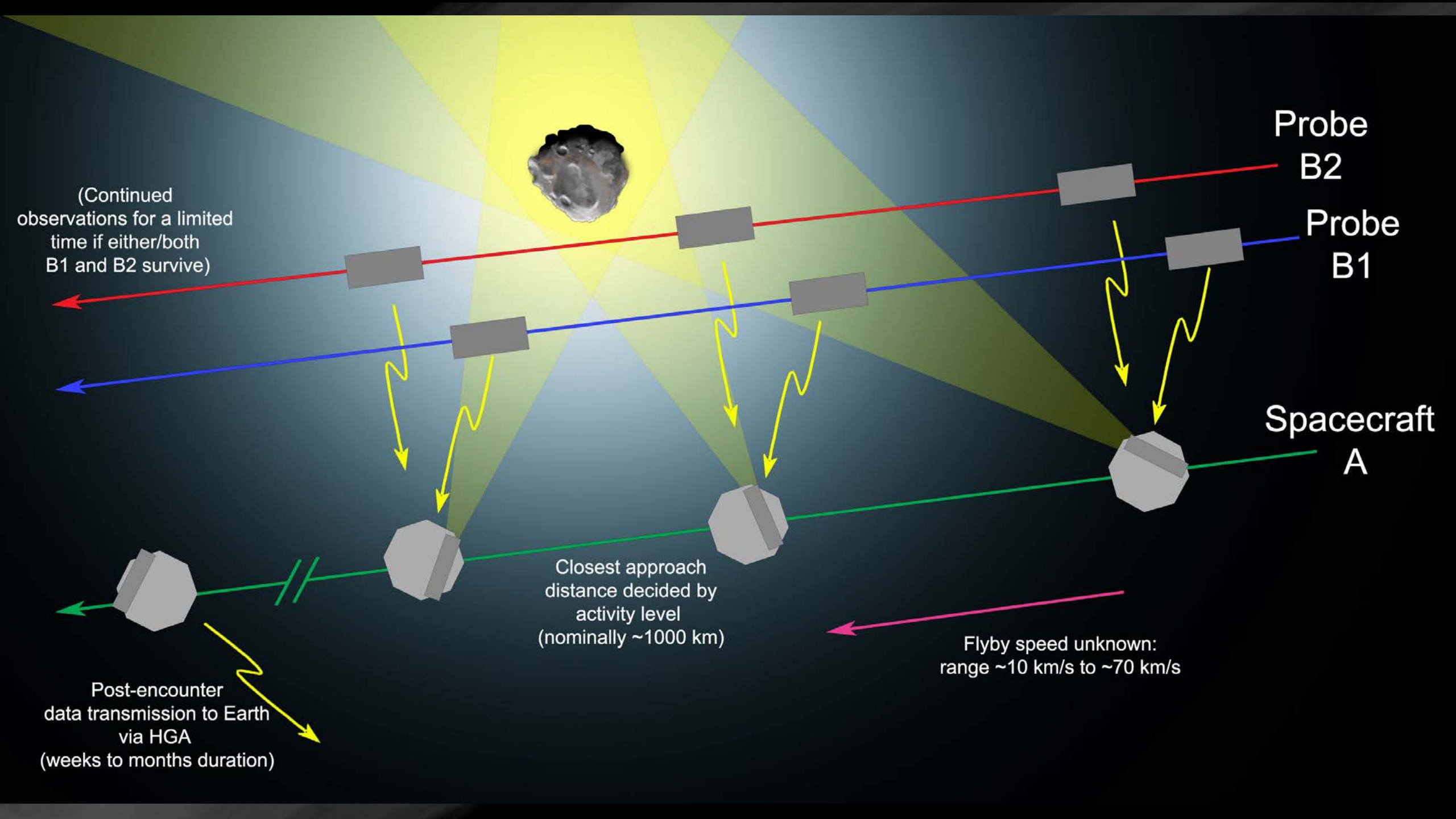
Probe B2

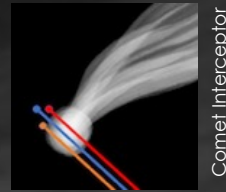
FGM (B2)

Unit Co-PI: Marina Galand, Imperial College London, UK

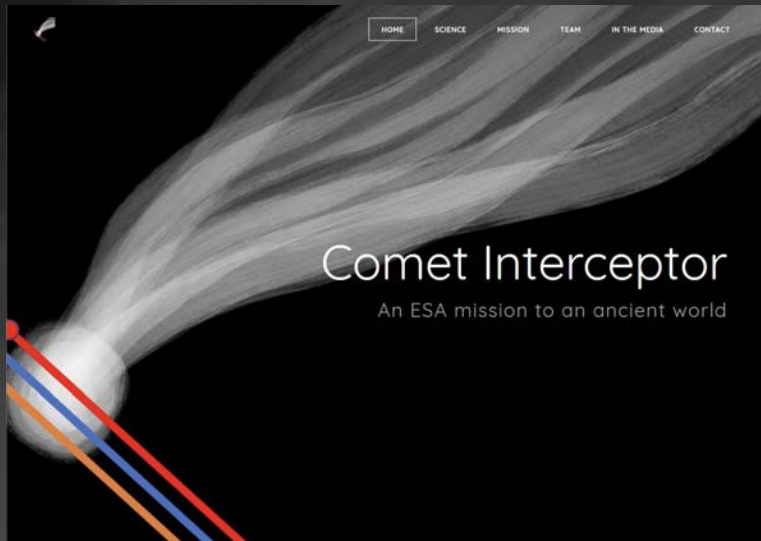
Deputy Unit Co-PI: Martin Volwerk, Space Research Institute, Austrian Academy of Sciences, Graz, AT







Comet Interceptor



<http://www.cometinterceptor.space/>



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