ESA's activities in Planetary Defence

D. Koschny and the ESA Planetary Defence Team

PDC 2021

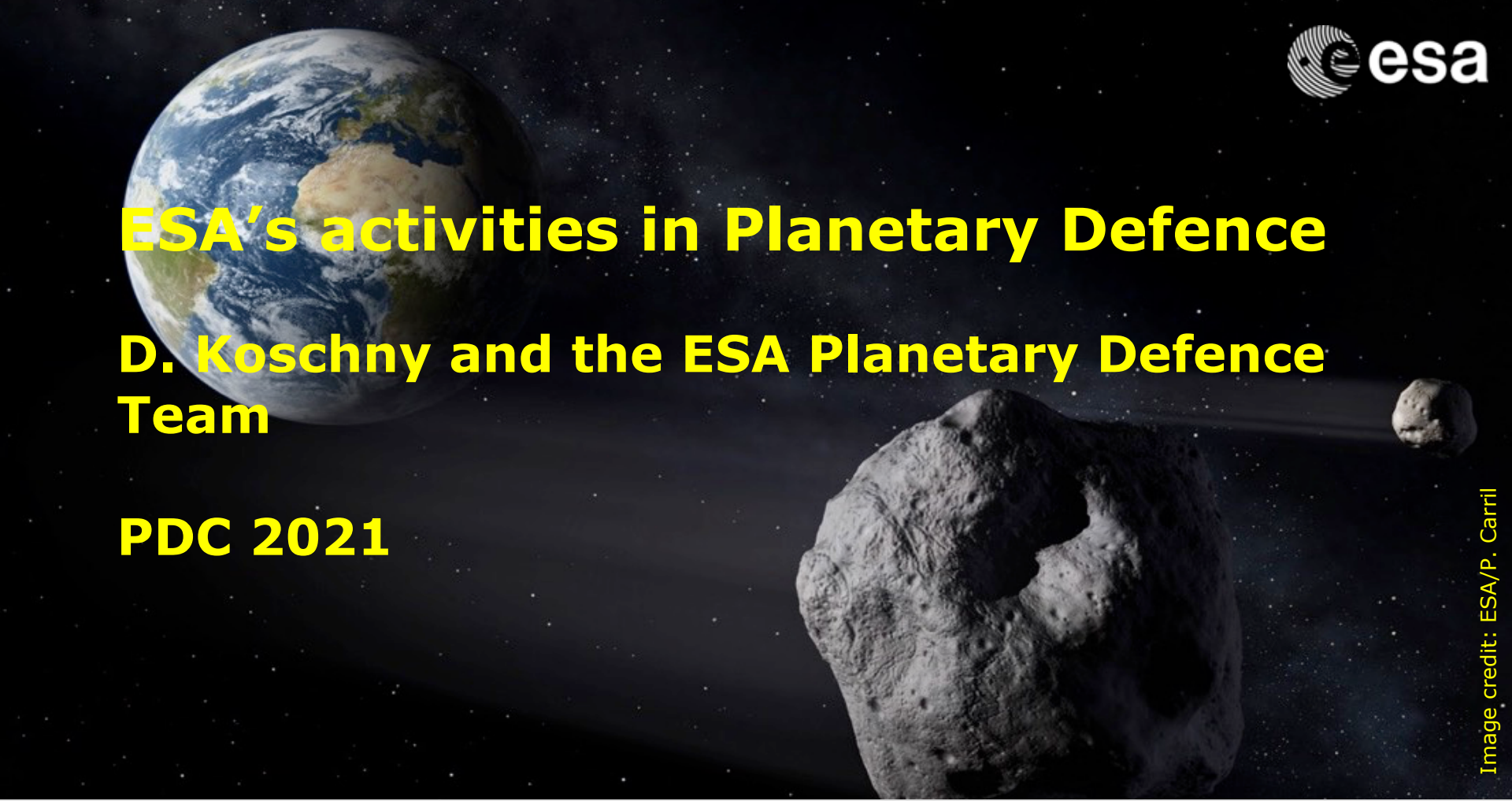


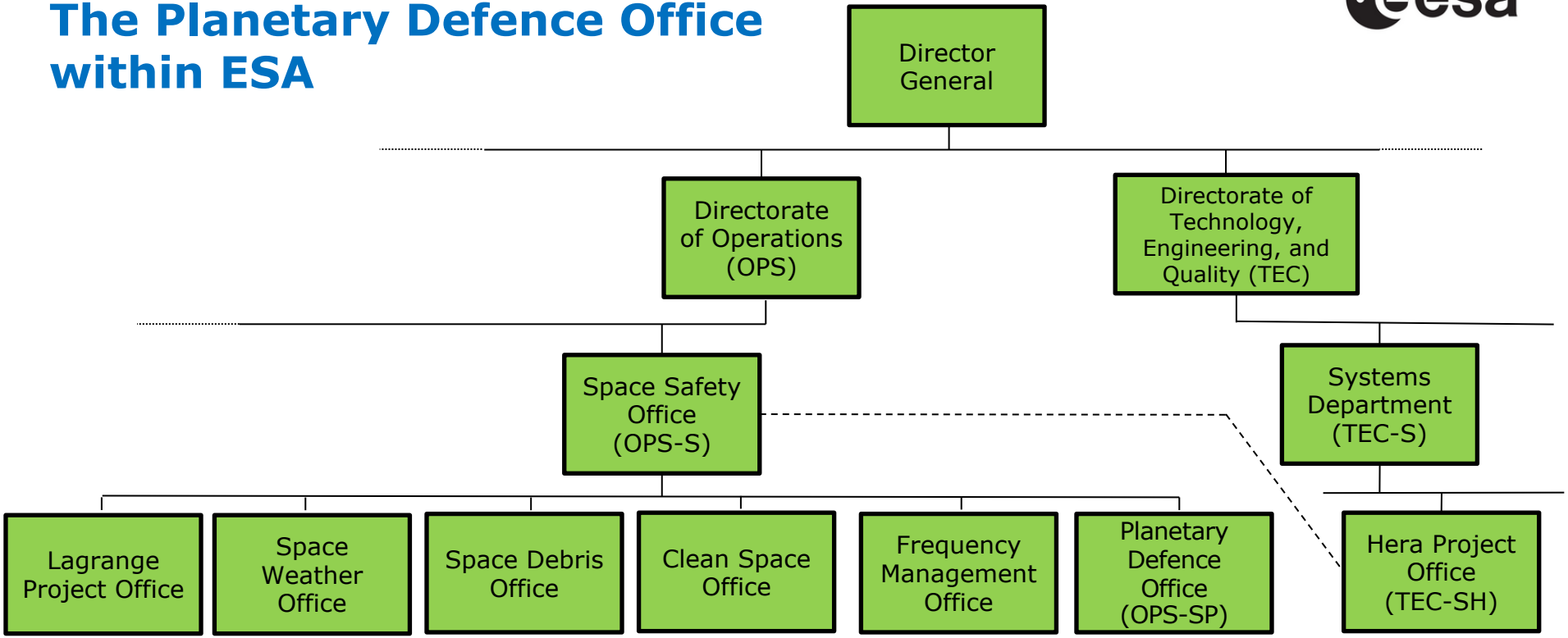
Image credit: ESA/P. Carril

Our ‘mission statement’

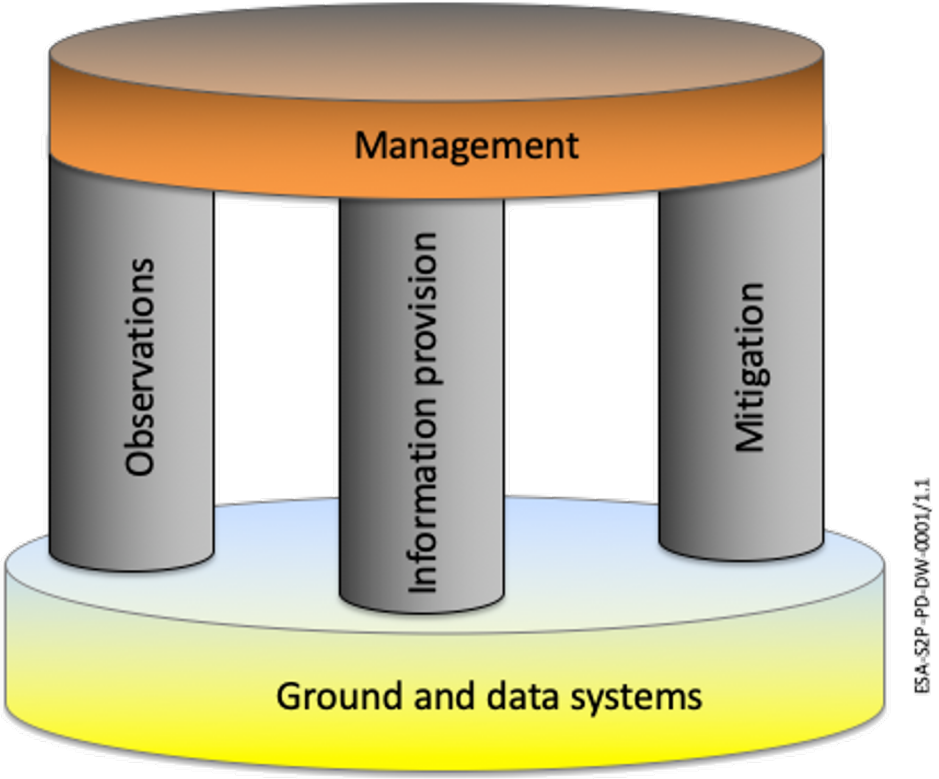
“The goal of Space Safety is [] ***the protection of our planet, humanity and assets in space and on Earth from dangers originating in Space”*** *(PB-SSA 2018(24))*

- **To be aware of situation of natural objects in space**
- **To predict possible impacts and their consequences and inform relevant parties**
- **To prepare for risk mitigation, by technological developments and on political level**

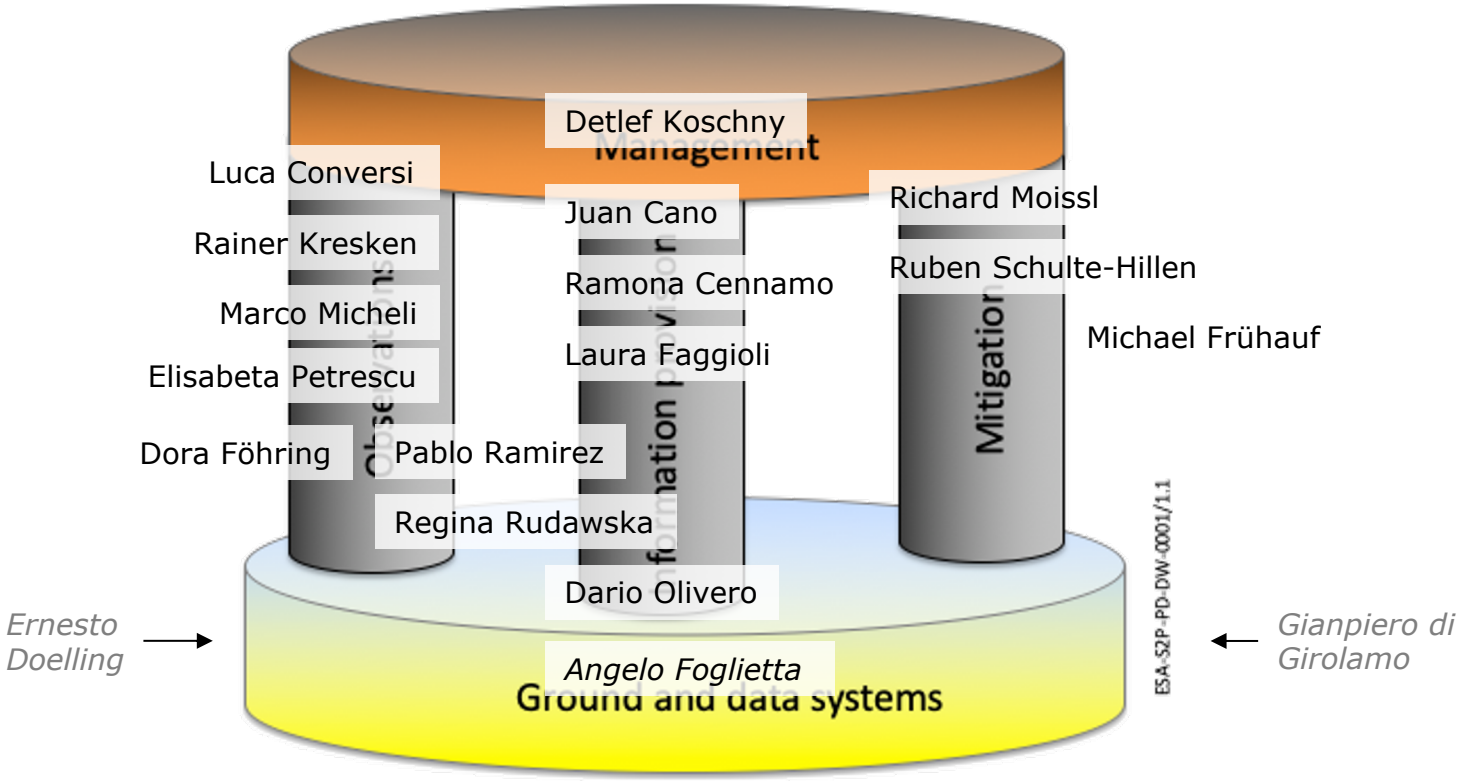
The Planetary Defence Office within ESA



The setup of the Planetary Defence Office



ESA's Planetary Defence team

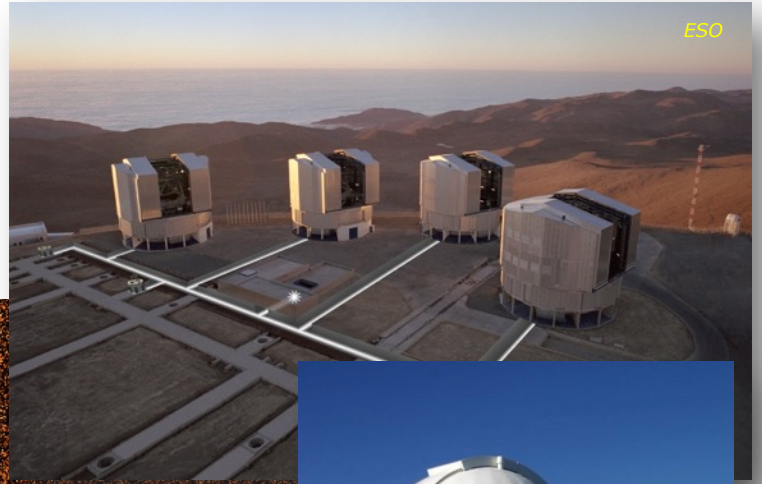


The NEO Coordination Centre

- **The 'instantiation' of the Planetary Defence team – a building at ESA's location ESRIN in Frascati close to Rome, Italy. About half of our team is located there. Computing h/w in separate building.**

Images: ESA/NEOCC

Observations



Some of the observatories we work with

Observations

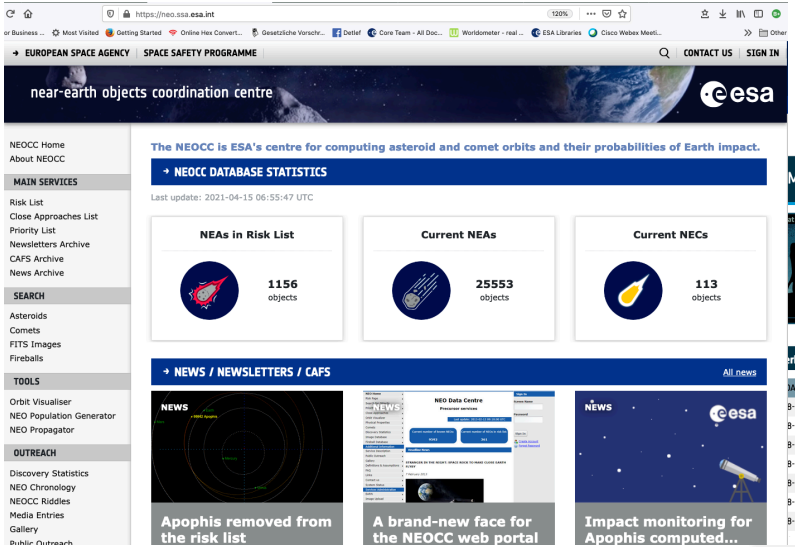
- **Conversi et al. 'ESA's NEO Coordination Centre observational network'**
- **Micheli et al. 'Recent observational highlights from ESA's NEO Coordnation Centre'**
- **Perozzi et al. 'An efficient deployment strategy for the first ESA Flyeye NEO survey telescope'**
- **Rudawska et al. 'FITS image archive at ESA's NEO Coordination Centre'**

Also check out:

- **Zolnowski et al. '6ROADS – Highly precise optical observations of NEO, fast-moving satellites and Space Debris from a worldwide telescope network**

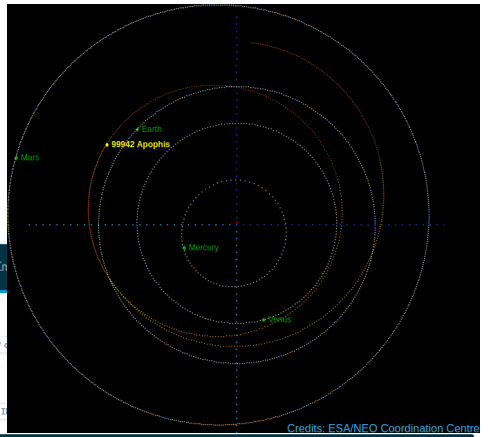
Information provision

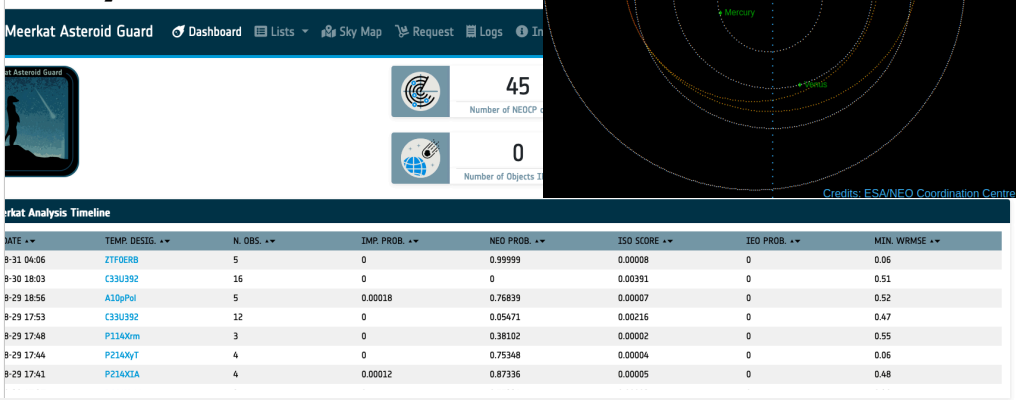
Information distribution via web portal – risk list, orbits, physical properties, Close-Encounter Fact Sheets….

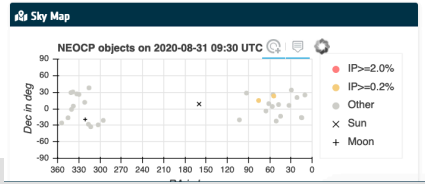


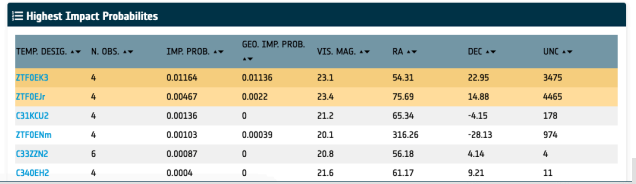
Orbit Determination and Impact Monitoring software

Many tools and scripts, notification systems…









Information provision

- Cano et al. ‘Evaluation fo an NEO close approach frequency index for public/media release purposes’
- Cano et al. ‘Recent evolutions in ESA’s NEO Coordination Centre information system
- Di Girolamo et al. ‘ESA’s planetary defence NEO Coordination Centre DevOps model-based operations’
- Frühauf et al. ‘Meerkat Asteroid Guard imminent impactor warning service of the European Space Agency’

Also check out:

- Bernardi et al. ‘New NEODyS tools for the EU-funded NEOROCKS project’

Mitigation

space situational awareness

→ NEAR-EARTH OBJECTS

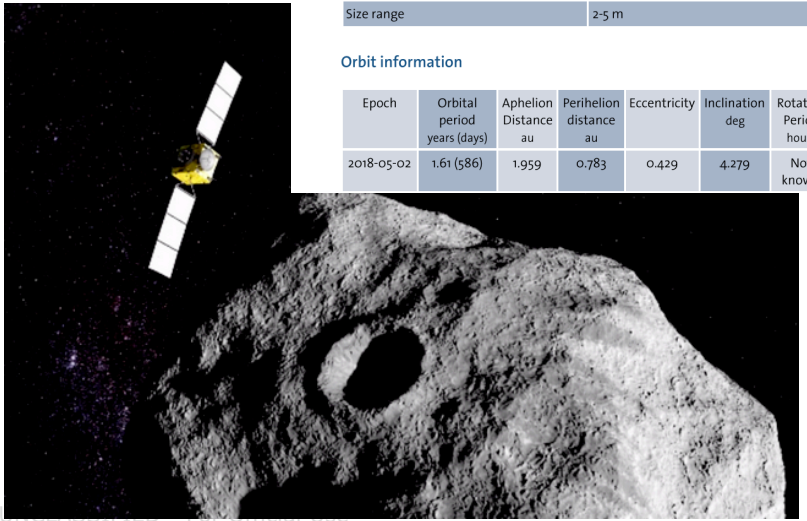
Close approach fact sheet for asteroid 2018 LA

A small asteroid impacted the Earth on 02 June 2018.

Impact date	2018-06-02
Impact time	~16:45 UTC
Minimum distance from Earth surface	The object impacted the Earth
Fly-by speed	17.0 km/s
Size range	2-5 m

Orbit information

Epoch	Orbital period years (days)	Aphelion Distance au	Perihelion distance au	Eccentricity	Inclination deg	Rotation Period hours
2018-05-02	1.61 (586)	1.959	0.783	0.429	4.279	Not known



The medium-sized asteroid 2012TC4 had a close approach with the Earth on 12 October 2017. The minimum distance was outside the geostationary ring. This is a special-interest event.

Flyby information:
Flyby date: 2017-10-12
Closest approach time: 05:41 UTC +/- 0 s
Flyby distance from Earth surface: 43832 km +/- 1 km
Flyby speed: 7.26 km/s
Size range: 13.0 m to 30.0 m
Discovery date: 2012-10-04
Discovery site: Haleakala

Orbit information:
The flyby caused a change in the orbit elements.
Date before and after flyby: Before = 2017-09-12, after = 2017-22-12
Orbital periods in years/days: Before = 0.005/1.67, after= 0.006/2.06
Aphelion distances in au: Before = 1.878, after = 2.275
Perihelion distances in au: Before = 0.934, after = 0.965
Eccentricities: Before = 0.336, after = 2017-22-12
Inclinations in deg: Before = 0.857, after = 0.536

Mitigation Information:
No mitigation actions required for this object.
Days since closest approach: -1203
Cumulative impact probability: 0
Composition (Taxonomic type): Unknown
Rotation period in hours: 0.204

Other information:
Peak brightness magnitude: 12.7
Date of previous encounter: 2012-20-12
Date of next encounter: 2050-10-19
Encounter peculiarities: An international observation campaign devoted to the very close flyby of 2012TC4 had been organised.

United Nations COPUOS/OOSA

Inform in case of credible threat

Parent Government Delegates

Determine Impact time, location and severity

Potential deflection mission plans

International Asteroid Warning Network (IAWN) — P_i >1% — S > 50m — Space Missions Planning Advisory Group (SMPAG)

Observers, analysts, modelers...

Space Agencies and Offices

And there is an international context

Mitigation

- **Drolshagen et al. ‘Scope, objectives and first results of the Space Mission Planning Advisory Group (SMPAG)’**
- **… and we are preparing our ‘Close Approaches Fact Sheet’ and the ‘Automated Impact and Close Approach Message’ as part of the exercise**
- **And of course look at all the Hera talks**


esa
Image credit: ESA/P. Carril