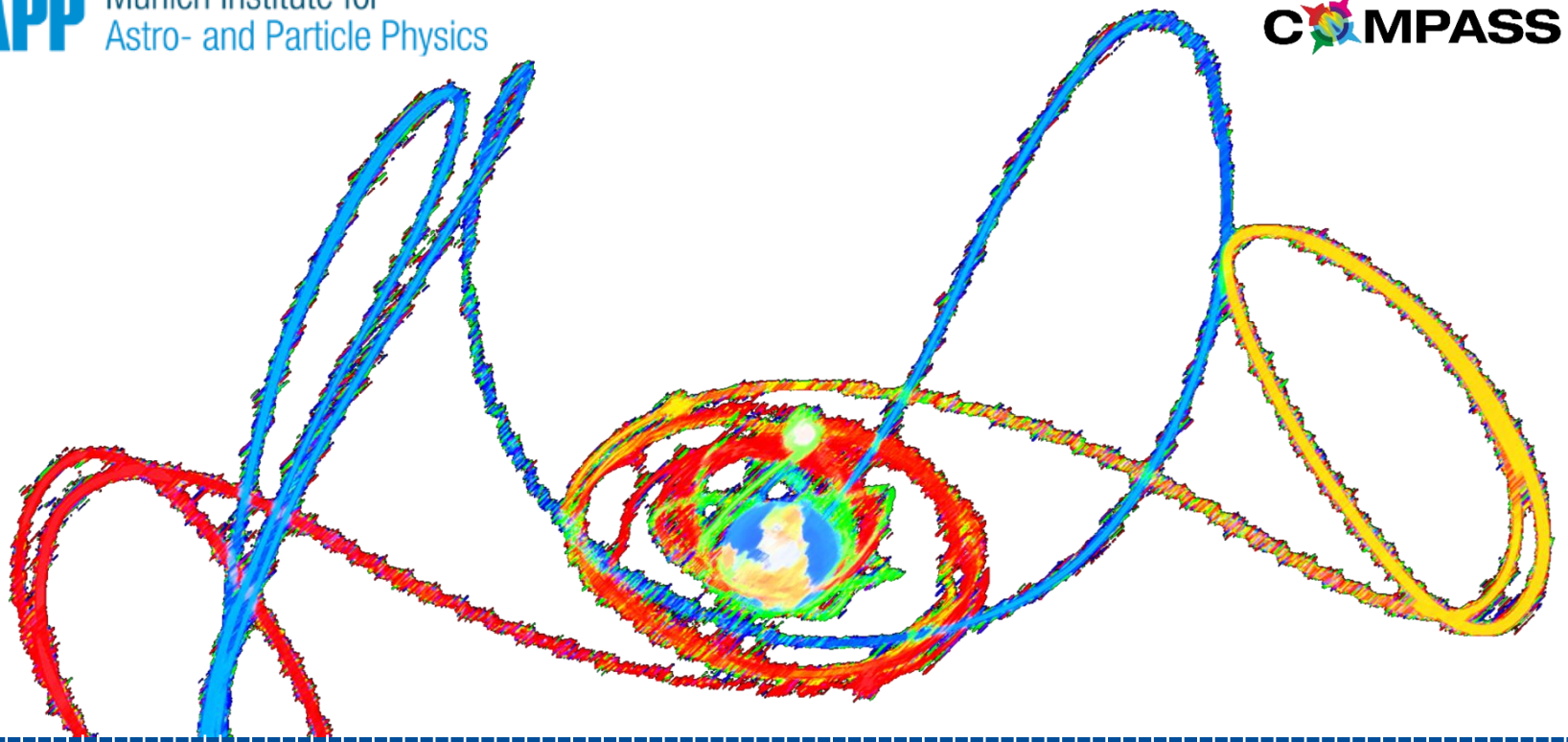
MIAPP Munich Institute for Astro- and Particle Physics

COMPASS erc



Asteroid missions

Camilla Colombo, Robert Jedicke, Detlef Koschny, Richard Wainscoat, Andreas Burkert

Near-Earth Objects: Properties, Detection, Resources, Impacts and Defending Earth

14 May - 8 June 2018, Munich Institute for Astro- and Particle Physics (MIAPP)

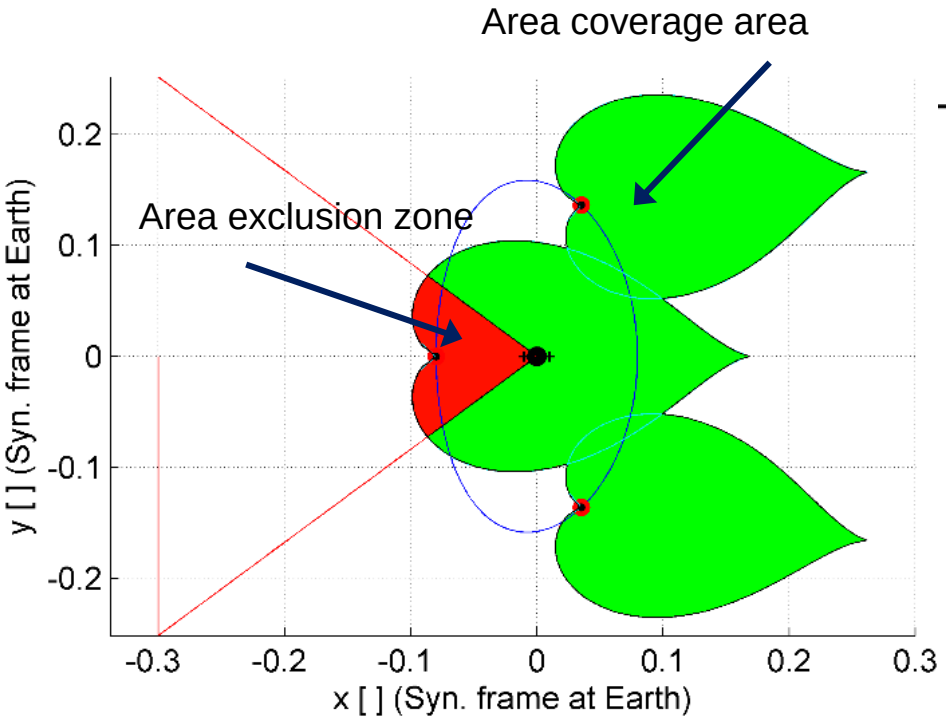
Some questions…

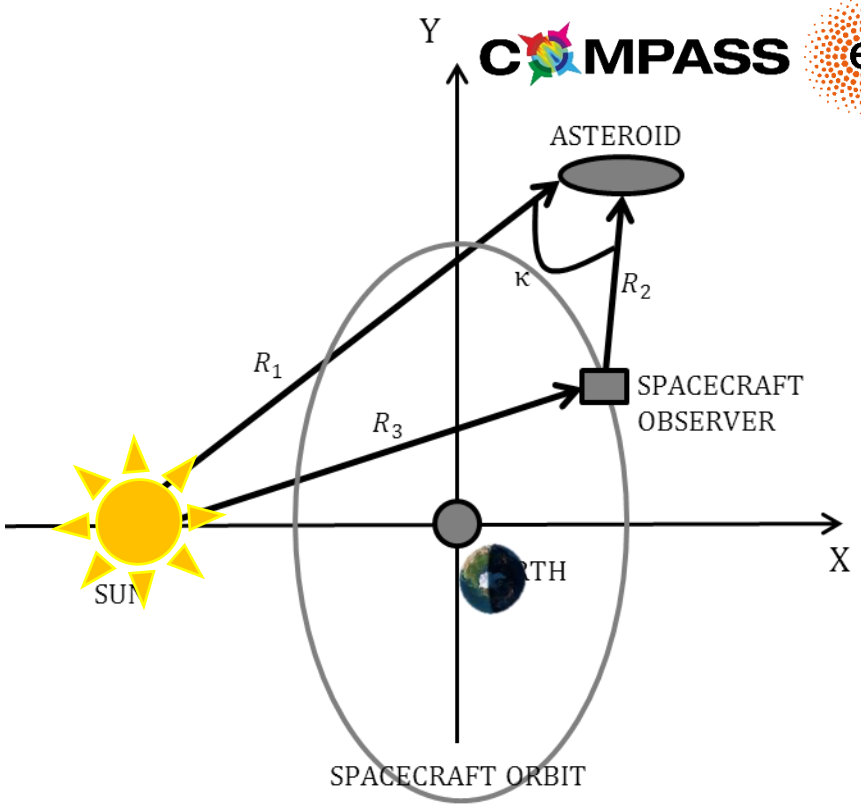
- Description of missions proposed or planned or flown
- What science can we do at asteroids, tour, in-situ studies, sample return
- How do we select an asteroid deflection method as a function of asteroid parameters?

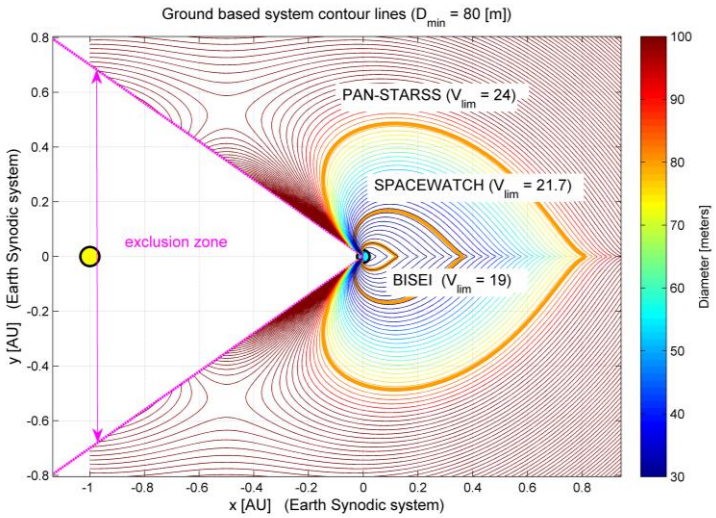
Asteroid missions

Monitoring of NEOs from space

NEOs monitoring from Distant Retrograde Orbits







- *Stramacchia M., Colombo C., Bernelli-Zazzera F., "Distant Retrograde Orbits for Space-based Near Earth Objects Detection", Advances in Space Research, Volume 58, Issue 6, 15 September 2016, Pages 967–988.*

Asteroid missions

Statement on Asteroid Orbit Deflection Demonstrations

Agreed at the 6th SMPAG meeting, Feb 2016

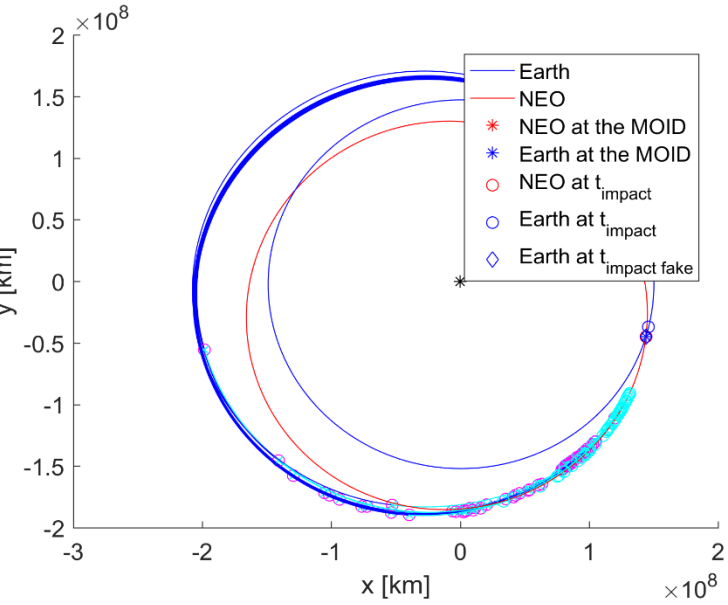
- Given the degree of international interest in asteroid research and awareness of the impact hazard, advantage should be taken of opportunities to investigate asteroid deflection physics, techniques and effects as a part of science and technology demonstration missions. While general science and technology efforts are vital, the Space Mission Planning Advisory Group (SMPAG) has identified the need to gain sufficient confidence in the viability of any proposed technique to deflect an asteroid from an impact trajectory. Therefore the performance of the deflection technique to be utilized must have been actively demonstrated in a realistic planetary defence scenario to increase the current level of confidence.
- The SMPAG encourages actual demonstration of the kinetic impactor technique with a space mission, as it appears at this point in time to be the most technologically mature method of asteroid deflection. SMPAG also supports the investigation of the gravity tractor technique for demonstration as a part of any space mission using ion or other low-thrust propulsion technology planned to visit an asteroid. SMPAG also encourages the investigation and technology maturation of other potential deflection and impact mitigation techniques to determine their viability, particularly in combination with other missions.

➢ *https://www.cosmos.esa.int/web/smpag/statement-on-asteroid-orbit-deflection-demonstration*

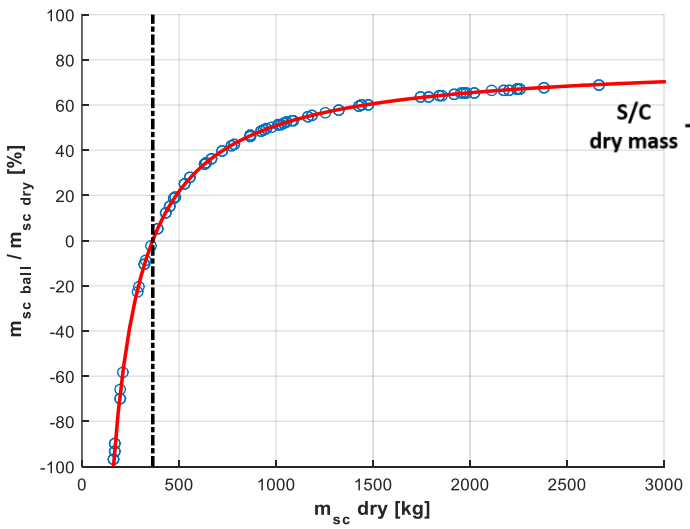
Asteroid missions

Mission analysis for potential threat scenarios: kinetic impactor

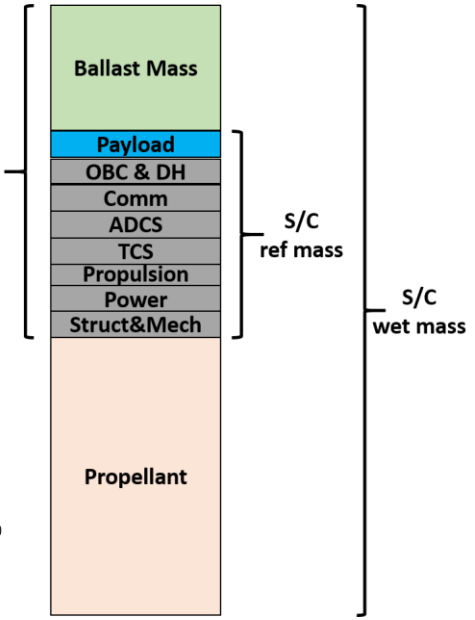
Synthetic case: 2010 RF12 like NEO (direct impact and resonant impact)



Sample of deflection trajectories



Ballast mass percentage as function of S/C dry mass



Spacecraft mass budget definitions

Minimum feasible S/C dry mass is about 370 kg, which corresponds to about 840 kg once equipped with propellant needed to perform orbital transfer

➢ *Colombo et al. IAC, 2017.*