Exploring the diversity of near-Earth asteroids: what's next?

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The study of near-Earth asteroids (NEAs) has revealed a great diversity in their physical properties, partly mirroring the wide variety observed in the asteroid population of the main belt. This diversity appears to contrast with a more limited range of compositions evident from meteorite collections, suggesting that meteorites may not fully represent the broader spectrum of asteroid properties. In this context, future space missions should prioritize the exploration of asteroids with different physical characteristics, especially in terms of internal structure and taxonomic type. This will offer new insights into the early stages of planetary formation and the processes governing the evolution of small bodies in the solar system.

Several upcoming missions are set to broaden our understanding of NEAs by focusing on a diverse range of targets. These include the Hayabusa2# extended mission and the OSIRIS-APEX follow-up of OSIRIS-Rex, as well as the planned missions Ramses, Tianwen-2 and Destiny+. Furthermore, CubeSat missions in deep space can represent a cost-effective and agile approach to maximize the number of asteroid visits, enabling us to explore these diverse bodies at an unprecedented scale.

In this contribution, I will present preliminary results from spectroscopic and photometric ground-based observations of asteroids Torifune and 1998 KY26, the next targets of Hayabusa2#. Additionally, I will discuss the role of upcoming CubeSat missions in targeting NEAs with distinct properties, addressing the need to explore a wider range of asteroids to refine our models of solar system formation and evolution, and to improve our understanding of the links between meteorites and their parent bodies.