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The continuum of small bodies: scientic challenges addressed by the new ground large telescopes

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The past decade has ratified the end of a clear distinction between rocky and icy small bodies. New evidence suggests that planetesimal mixing and thermal processing in the early solar system have been much more strong than previously thought, and that a ?continuum? of small bodies exists, from the Near-Earth Objects (NEOs) to the Trans-Neptunian Objects (TNOs). Hence it is nowadays evident that the study of each population of small bodies cannot disregard the physical and dynamical links existing with the other populations. These interrelations are particularly interesting, as in the long run they will allow us to prove or disprove the different scenarios that are proposed for the formation and evolution of the solar system itself, where small bodies are widely considered to be “closest” to the formation era of the planetary system.
Ground-based observations are essential to obtain the necessary general overview of the planetary complex, by investigating a large number of small bodies and assessing a number of scientific aims and goals, impossible to be achieved from space. In an era in which single small bodies have been or are being explored with in situ, ad hoc space missions (Rosetta, Dawn, Hayabusa-2), ground-based observations give the complementary data needed in defining constraints on the general and fundamental questions on formation and evolution of a planetary system around a standard star.
8-meters class telescopes have been successfully exploited to improve the knowledge of the physical properties of small bodies in our planetary system. Further measurements and data from Large, Very Large and Extremely Large telescopes, to which researchers will have access in the future years, will allow us to push forward a number of scientific tasks and gain important breakthroughs in several different fields: e.g. i) the inventory of the planetary system, throughout the discovery of very distant and rather small planetesimal-like objects, ii) the investigation of the processes of formation and evolution in the early phases of our planetary system (e.g., the radial mixing process), throughout the knowledge of the fundamental parameters distribution (size, albedo, shape, rotation, mass, density, thermal properties) of the many small body families and groups in our planetary system, iii) the study of the astrobiology context, throughout the investigation of the water on Earth and the search of prebiotic compounds in primordial small bodies.

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