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Study of the Small Solar System Bodies with LSST

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Our work relates to the general framework of improving our understanding of the formation and evolution (including the modern-time circulation of materials) of our Solar System. To address these questions, we focus on the various populations of small bodies of the Solar System [SSSBs] (Near Earth asteroids [NEAs], Asteroids, Centaurs, Trans-Neptunian Objects [TNOs]). Because of their large numbers, the physical, compositional and dynamical characteristics of these populations hold statistically significant clues on their origin and evolution, acting as tracers of the Solar System. Moreover, even if they contain a small fraction of the total mass of the Solar System, these small bodies are to the Solar System the equivalent of the radioactive isotopes to the study of rocks.

An exhaustive study of the various populations of SSSBs resides in the search for their physical, compositional and, for some, mineralogical properties. Connecting the physics to the dynamics of these objects can answer fundamental questions related to cosmogony and our civilisation, such as: how, if at all, did the SSSBs contribute to the emergence of life on Earth ? What were the conditions that allowed the formation of our Solar System ? What was the structure of the planetesimals that made the terrestrial planets? What is the link between organic materials identified in interplanetary space and life on Earth? What is the link between SSSBs and meteoroid streams? How do meteoroids influence the Earth's atmosphere?

The LSST astrometric and photometric harvest, its 10 years duration, and its unprecedented discovery of new and faint objects will provide the most complete view of the Solar System ever achieved, near and far, and huge advances in many of the fields cited above. It will be complete for objects down to sub-kilometre size between the Earth and Jupiter and significantly sample more distant objects with an orbital period longer than 10 years, such as Trojan, Centaurs and TNOs. LSST will also be an exceptional platform to search for peculiar objects such as binary objects, active comets or asteroids, interstellar objects, smaller bodies on their course to collide with the Earth, and find a large sample of candidates for stellar occultations.

Based on previous experience with CHFT programmes and Gaia survey, we will focus on these latter aspects, characterisation of the survey and the detection, dynamical and physical properties determination, population characterisation, testing of formation models, predictions of events…

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