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Cosmic DUNE: An observatory for the study of interstellar and interplanetary dust

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In-situ technologies exist to operate a Cosmic Dust Observatory Near Earth (***Cosmic DUNE***) that will characterise interstellar and interplanetary dust and provide information not achievable with classical astronomical methods. Galactic interstellar dust constitutes the solid phase of matter from which stars and planetary systems form. Interplanetary dust, from comets and asteroids, represents remnant material from bodies at different stages of early solar system evolution. Thus, studies of interstellar and interplanetary dust with ***Cosmic DUNE*** in Earth orbit will provide a comparison between the composition of the interstellar medium and primitive planetary objects. ***Cosmic DUNE*** will prepare the way for effective collection in near-Earth space of interstellar and interplanetary dust for subsequent return to Earth and analysis in laboratories.

The discoveries of interstellar dust in the outer and inner solar system during the last decade suggest an innovative approach to the characterization of cosmic dust. ***Cosmic DUNE*** establishes the next logical step beyond NASA's Stardust mission, with four major advancements in cosmic dust research: (1) Analysis of the elemental and isotopic composition of individual cosmic dust grains, (2) determination of the size distribution of interstellar dust, (3) characterization of the interstellar dust flow through the planetary system, and (4) analysis of interplanetary dust of cometary and asteroidal origin.

The main instrument is a novel dust telescope, that is optimised for (1) large area (0.1

to 1 m^2) impact detection and trajectory analysis of submicron-sized and larger dust grains, (2) the determination of physical properties of sub micron sized grains, such as flux, mass, speed, electrical charge, and (3) high resolution chemical analysis ($M/\Delta M \geq 100$) of cosmic dust. Previous instruments have shown that the heavy element composition and the isotopic composition of C, H, N can be measured. A plasma monitor supports the dust charge measurements.