

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Small Bodies Missions and Technologies (Part 1) (4A)

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THE DOLPHIN MISSION AND UNIQUE OPPORTUNITIES IN 2030 TO PROBE  
DUST-HELIOSPHERE INTERACTIONS

**Abstract**

Dust particles from the Local Interstellar Cloud that pass through the Solar System are messengers that tell us about processes in the interstellar medium and about the sources and sinks of the interstellar dust. Furthermore, because the dynamics of these dust particles depends on heliosphere plasma and magnetic fields, the interstellar dust also indirectly conveys information about the dynamic outer parts of the heliosphere. The year 2030 marks the “focusing phase” of the solar Hale cycle for interstellar dust in the Solar System. It presents a unique opportunity to learn about the dynamical heliosphere structure by measuring particles as small as possible with missions near Earth orbit and also further out in the solar system. One such mission, proposed as an F-class mission to ESA, is DOLPHIN (Dust Observatory to study the LIC, interPlanetary dust, and Heliospheric Interactions in our Neighborhood). DOLPHIN would use an Earth-Venus-Earth-Earth flyby sequence in order to gradually increase its orbit inclination to 23 near 1AU. Such an orbit allows detailed interplanetary dust measurements originating from different types of comets and asteroids at different inclinations. The orbit is also ideally suited to probe the latitude-dependence of the flux, composition, and dynamics of nanodust and beta-meteoroids. We also suggest a potential augmentation of DOLPHIN: the DOLPHIN+ mission, that would measure plasma and magnetic fields in situ, in order to characterize the plasma environment in which nanodust particles get ionized and picked up by the solar wind. Finally, we discuss how DOLPHIN and missions like JUICE and Europa Clipper can be used together to enhance the science return.