The environment around fast spinning asteroids: The case of (65803) Didymos, target of the AIDA mission

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This study is carried on in the frame of the working group on physical and dynamical characterization of the AIDA mission. We have collected available data on binary NEA systems with fast rotating primaries with good estimates of primary's spin rates and system mass. We mainly focus on the binary system (65803) Didymos. In order to study the dynamics of particles, we use a numerical code that integrates the equations of motion of individual particles that are ejected from the asteroid surface when centrifugal acceleration is strong enough to overcome local gravity. The equation of motion is written in a non-inertial asteroid-centered reference frame, taking into account the asteroid, the secondary, and solar gravity, solar radiation pressure and inertial terms. We then study the motion of particles in the 1 m to 1 cm range in the described non-inertial reference frame of the rotating primary. The eccentricity of the heliocentric orbit of the system and the obliquity of the system are taken into account. The dynamics of particles of a wide mass range is calculated during many orbital cycles as a function of their initial position on the asteroid surface for each system under study. A mass density of levitating particles is calculated as a function of distance to surface, latitude, and longitude. In the very case of Didymos, the study has been refined taking into account the shape model of the primary and has been discussed in the available range of size and mass. We present the results of our ongoing study in the case of Didymos. We find that fine particles ($<$ 100 m) are quickly swept away from the system by solar radiation pressure, while larger particles may undergo landing and lift off cycles that form a dusty environment above the surface at near-equatorial latitudes. The mass density of floating particles drops quickly beyond 10-20 degrees of latitude. Consequences in the AIM navigation around the Didymos' primary can be derived from this study