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Sputtering of dust grains in free space and on the surface

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Dust grains in an interplanetary environment can be found generally in two modifications—floating in a free space and lying on surfaces (e.g., of asteroids, comets, Moons). In both forms, they can be exposed to energetic ions, electrons, and UV irradiation and these processes lead to their charging and sputtering. The floating grain can rotate along all its axes, thus it can be sputtered isotropically, on the other hand, the grain lying on the surface cannot move and it is exposed from one side only. This process leads to non-regular grain sputtering and to changes of a grain shape. To study of the sputtering of both freely floating and lying grains, we used spherical SiO_2 grains with diameter in the range of 1 micron as a representative of the silicate-type space dust. For the floating grain we use the experimental set-up that in which a single dust grain levitates in an electrodynamic trap and it is influenced by 3 keV Ar^+ ions (due to the grain charge, the impact energy corresponds to approx. 2 keV). The mass of the grain is measured after each sputtering session and the sputtering yield is calculated from the temporal changes of its mass. On the other hand, the laying grain is sputtered by 30 keV Ga+ ions and SEM images of the grain are recorded in regular time intervals. The sputtering yield is estimated from changes of the grain shape and the final shape is compared with a simple model.