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Sputtering through coronal mass ejections and the fate of nanodust near the Sun

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Dust particles in the interplanetary medium have their origins in the collision and fragmentation events of planetesimals within our solar system. Due to gravitational, radiative and magnetic forces they may reach the vicinity of the Sun ($r < 0.1$ AU). Dust particles are also ejected from comets when they closely pass the sun. This dust lives in a harsh environment, as the solar irradiance and the intensity of the solar wind (H/He plasma) increases rapidly when approaching the sun.The tiny particles may also be struck by coronal mass ejections (CME), which are outbursts of heavier plasma from the solar corona. The objective of this study is to investigate when sputtering of dust through CME's and the Solar Wind is a relevant loss mechanism. The smallest fraction of the dust component is generally called nanodust. What happens to the dust and nanodust in the vicinity of the Sun? Effective sputtering and sublimation leads to a loss of dust material, act as an additional source of nanodust, but may also lead to its complete destruction.
This hypotheses is tested by comparison of sublimation and sputtering lifetimes of dust of different composition near the sun. The sublimation lifetimes are computed using vapor pressures derived for different dust compositions that are generally present in planetary environments. The temperatures of the nanodust is derived using absorption efficiencies from Mie calculations using the refractive indices of these typical dust materials. The sputtering lifetimes and mass loss are estimated with the help of the TRIM/SRIM sputtering package (www.srim.org).This comparison of both lifetimes is done for the case of CME and standard Solar wind conditions, as well as for different particle sizes and compositions. That includes the identification of the distances from the Sun where particles are destroyed as well as relevant particle sizes and their compositions. The main finding is that only certain combinations of dust size and dust composition are rather destroyed by sputtering from CME's before they sublimate completely near the sun.