



Observational support for dust grain emission by electrostatic forces

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Dust collected close to the comet 67P by the COSIMA instrument, indicates that fluffy grains up to sizes of several 100 μm are lifted off the comet surface and transported to the instrument substrate several tens of kilometers away. The temperature of the surface and the detected gas densities are too low to properly explain lifting grains from the cometary surface. We investigate grain dynamics using electrostatic forces. Comet surface lighting conditions create small scale multi pole electric fields by photons. These fields create forces on both charged and neutral dust grains and may serve as “active regions”. The forces acting on the grain, scale as D^3 with grain size and therefore large grains are proportionally simpler to elevate, provided the mass is not increasing at the same rate. The fluffy structure of the grains seem to fulfill this requirement. The limiting factor of this mechanism is set by the tensile strength of the grains. If the electrostatic force created exceeds the tensile strength, the grain will disintegrate through Coulomb explosion. The mechanism would favor lifting large fluffy grains off the surface because they have a capability of most easily creating mobile charges which interact in a favorable manner with the multi pole fields. Because of the conglomerate nature of the grains, a splitting of a grain may trigger a Coulomb explosion setting free the bulk dust distribution of small grains detected. The measured elongated impacts also suggest that disintegration is taking place close to the spacecraft. This would also be supported by the proposed model as the space craft charging represents a small scale field anomaly where grain splitting could become enhanced. The observed grains seem to fulfill all requirements of this tentative model.