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Numerical Calculation of a Dust Grain Equilibrium Potential in the Lunar Environment

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Dust grains coexist with plasma of various parameters in the space. The mutual interaction of plasma particles and the UV radiation with dust grains leads to their charging. An equilibrium grain potential depends on plasma environment as well as on the grain composition, size, shape, and charging history. A precise estimation of the equilibrium grain potential in a specific plasma environment can be thus complicated.

We present results of a modified numerical method for calculation of an equilibrium potential of the grain immersed in the plasma with a focus on the lunar environment. In our calculations, we apply a modified model of the secondary electron emission for dust grains which takes into account not only an influence of the grain size and material, however, also the grain shape and its surface roughness. Since this model describes an increase of the secondary emission yield caused by a finite dimension of the dust grain, our calculations provide a more realistic estimation of the dust grain surface potential in hot environments. We show that the equilibrium potential is a descending function of the grain size and this effect can even lead to opposite polarity of the charge of small and large grains.