CHARGING MODEL AND DUST ATOMS & MOLECULES

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The condition for the validity of the orbital motion limited (OML) theory is reviewed with reference to the calculation of the floating potential attained by a spherical body immersed in a plasma. It is shown that the OML theory is never satisfied for some cases. Then a new approach of obtaining floating potential which in a way answers the questions raised is presented.

Further assuming conservation of entropy, an important relation is obtained between the maximum potential and therefore the charge of the dust grain and the temperature of the electrons. The Thomas-Fermi equation is derived for the potential of a dust grain in a nondegenerate plasma suggesting the existence of dust atom with a well defined atomic radius. Furthermore, based on the Born-Oppenheimer approximation, the notion of a dust-grain molecule is introduced in which the protons act like a kind of "glue" which binds two negatively charged dust grains together, and the motion of the grains have little influence on that binding force. Finally, considering the weak interaction between the proton clouds of two dust grains, an expression of exchange energy is obtained.

1. J. E. Allen "Probe theory- the orbital motion approach. Physica Scripta **45**, 497 1992.
2. N. L. Tsintsadze, G. Murtaza and Z. Ehsan, Phys. Pl asmas **13**, 22103 2006.