Heating Effect of the Surface of the Dust Particle in Cryogenic Complex Plasmas

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This work is devoted to the investigation of a heating effect of a surface of a dust particle in cryogenic complex plasmas at low gas pressure. A relation that represents the temperature ratio of the dust particle surface to that of the surrounding gas, in low-pressure weakly ionized complex plasmas, was used to study a dust particle heating at cryogenic conditions [1]. Orbit motion limited theory was used to compute the electron as well as ion flux to the dust particle surface in a weakly collisional case [2].

It is shown that comparing with background gas, the dust particle surface temperature at low pressure is significantly higher (up to ten times). The gas temperature near the grain surface is a slowly decreasing function of distance with asymptotic ~ 1/r behavior. Therefore, the dust particle surface heating is important for near space around dust particle. At distances comparable with average inter-dust distance, the neutral shadowing interaction appearing due to large temperature difference between the grain surface and surrounding gas can lead to a significant changes in the structural properties of a cluster of dust particles [3].

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