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Modified Jeans Instability for Dust Grains in a Plasma GIAN

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In two recent papers, Delzanno et al. [1, 2] have pointed out that an electron emitting (for instance due to photoemission) dust grain immersed in a plasma can sustain profiles of the shielding potential having an attractive potential well (reminiscent of the Lennard-Jones potential for the attraction among atoms). The presence of a potential well in the shielding potential has important consequences as it can lead to attractive forces on other grains even if they have the sign of charge and can be particularly important for astrophysical systems. In this study, we will present the kinetic theory of the modified Jeans instability [3], where a system of dust particles interacts through the gravitational and electrostatic forces. The latter, however, is not modeled with the Coulomb potential but with the potential well discovered in Refs. [1, 2]. We show that the well acts broadening the spectrum of gravitationally unstable modes and enhance their growth rates, even with respect to the pure gravitational case [3]. On the other hand, a pure Debye-Huckel potential always acts as to stabilize the system. [1] G. L. Delzanno, A. Bruno, G. Sorasio, G. Lapenta, Phys. Plasmas 12, 062102 (2005). [2] G. L. Delzanno, G. Lapenta, M. Rosenberg, Phys. Rev. Lett. 92 (3), 035002 (2004). [3] G. L. Delzanno, G. Lapenta, Phys. Rev. Lett. 94, 175005 (2005).

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