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How Yukawa balls expand¹ ALEXANDER PIEL, TIM BOCKWOLDT, IEAP Christian-Albrechts-University Kiel, Germany, JOHN GOREE, The University of Iowa, Iowa City, IA52242, USA — Yukawa balls [1] are spherical arrangements of highly charged microparticles in a complex (dusty) plasma, which are confined in a potential trap and interact by shielded Coulomb forces. When the confinement is switched off, the particle cloud expands rapidly. The analogous process of Coulomb explosions of a xenon nanocluster that has been completely stripped of electrons by a femtosecond laser pulse, see e.g. [2], is an established technique to produce energetic ions. Coulomb explosions represent a self-similar expansion process. In this contribution we demonstrate that the expansion of a Yukawa system is governed by a different principle. Because of the shielding, the expansion starts as blow-off of the surface layer and continues by the inward propagation of a rarefactive wave, which delays the blow-off of deeper layers. The differences between Coulomb explosions and Yukawa expansions are investigated by Molecular Dynamics simulations and analytical models.

[1] Arp et al, Phys. Rev. Lett. 93, 165004 (2004)

[2] Nishihara et al, Nucl. Instrum. Methods A 464, 98 (2001)

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