

Existence and stability of multibreathers in a dusty plasma crystal

V. Koukouloyannis^{1*}, I. Kourakis²

¹ Aristotles University of Thessaloniki, Theoretical Mechanics, 54124 Thessaloniki, Greece

² Universiteit Gent, Sterrenkundig Observatorium Krijgslaan 281, B-9000 Gent, Belgium
and

Institut für Theoretische Physik IV, Fakultät für Physik und Astronomie, Ruhr Universität Bochum, D-44780 Bochum, Germany

* Electronic Address: `vkouk@physics.auth.gr`

Recent studies of collective processes in a dust-contaminated plasma (DP) [1] have revealed the formation of strongly coupled DP crystals by highly charged dust grains, typically in the sheath region above a horizontal negatively biased electrode in experiments [1, 2]. Typical low-frequency oscillations are known to occur [2] in these mesoscopic dust grain quasi-lattices in the longitudinal (in-plane, acoustic mode), horizontal transverse (in-plane) and vertical transverse (off-plane, inverse dispersive optic-like mode) directions.

A (quasi) one-dimensional DP crystal is considered. The transverse motion in this system is described by a Klein-Gordon like Hamiltonian with a quartic potential. Provided the potential (nonlinearity) constants by experiments [3] and using the results of [4, 5, 6], we prove that this system can support multi-site localised oscillations (multibreathers) [7].

This system provides a macroscopic way in order to experimentally check our theoretical predictions. The present work will be generalised in two dimensional crystals which are spontaneously organised in a triangular lattice.

-
- [1] P. K. Shukla and A. A. Mamun, *Introduction to Dusty Plasma Physics* (Institute of Physics, Bristol, 2002).
 - [2] G. E. Morfill, H. M. Thomas and M. Zuzic, in *Advances in Dusty Plasma Physics*, Eds. P. K. Shukla, D. A. Mendis and T. Desai (World Scientific, Singapore, 1997) p. 99.
 - [3] C. Zafiu, A. Melzer and A. Piel, *Phys. Rev. E* **63**, 066403 (2001).
 - [4] V. Koukouloyannis and S. Ichtiaroglou, *Physical Review E*, **66**, 066602 (2002).
 - [5] V. Koukouloyannis and S. Ichtiaroglou, *A stability Criterion for Multibreathers in Klein-Gordon chains*, to appear in *IJBC* (2006).
 - [6] V. Koukouloyannis, *Physical Review E*, **69**, 046613 (2004).
 - [7] V. Koukouloyannis and I. Kourakis *Existence and stability of multibreathers in a dusty plasma crystal* (in preparation)