

Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Is the compressibility positive or negative in a strongly-coupled dusty plasma?¹ JOHN GOREE, W. D. SURANGA RUHUNUSIRI, The University of Iowa — In dusty plasmas, dust particles are often strongly coupled with a large Coulomb coupling parameter Γ , while the electrons and ions that share the same volume are weakly coupled. In most substances, compressibility β must be positive; otherwise there would be an explosive instability. In a multicomponent plasma, however, one could entertain the idea that β for a single strongly coupled component could be negative, provided that the restoring force from charge separation overwhelms the destabilizing effect. Indeed, the compressibility for a strongly-coupled dust component is assumed to be negative in three theories we identified in the literature for dust acoustic waves. These theories use a multi-fluid model, with an OCP (one component plasma) or Yukawa-OCP approach for the dust fluid. We performed dusty plasma experiments designed to determine the value of the inverse compressibility β^{-1} , and in particular its sign. We fit an experimentally measured dispersion relation to theory, with β^{-1} as a free parameter, taking into account the systematic errors in the experiment and model. We find that β^{-1} is either positive, or it has a negligibly small negative value, which is not in agreement with the assumptions of the OCP-based theories.

¹Supported by NSF and NASA

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Date submitted: 08 Jul 2014

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