Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Spectral Approach to Anderson Localization in a Disordered 2D Complex Plasma Crystal.[1] EVA KOSTADINOVA, CONSTANZE LIAW, LORIN MATTHEWS, KYLE BUSSE, TRUELL HYDE, CASPER, Baylor University — In condensed matter, a crystal without impurities acts like a perfect conductor for a travelling wave-particle. As the level of impurities reaches a critical value, the resistance in the crystal increases and the travelling wave-particle experiences a transition from an extended to a localized state, which is called Anderson localization. Due to its wide applicability, the subject of Anderson localization has grown into a rich field in both physics and mathematics. Here, we introduce the mathematics behind the spectral approach to localization in infinite disordered systems and provide physical interpretation in context of both quantum mechanics and classical physics. We argue that the spectral analysis is an important contribution to localization theory since it avoids issues related to the use of boundary conditions, scaling, and perturbation. To test accuracy and applicability we apply the spectral approach to the case of a 2D hexagonal complex plasma crystal used as a macroscopic analog for a graphene-like medium. Complex plasma crystals exhibit characteristic distance and time scales, which are easily observable by video microscopy. As such, these strongly coupled many-particle systems are ideal for the study of localization phenomena. The goal of this research is to both expand the spectral method into the classical regime and show the potential of complex plasma as a macroscopic tool for localization experiments.

[1]NSF / DOE funding is gratefully acknowledged - PHY1414523 PHY1262031

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Date submitted: 12 Jul 2016 Electronic form version 1.4