Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

A new phase of disordered phonons modelled by random matrices[1] SEBASTIAN SCHMITTNER, MARTIN ZIRNBAUER, Univ Koeln —
Starting from the clean harmonic crystal and *not* invoking two-level systems, we propose a model for phonons in a disordered solid. In this model the strength of mass and spring constant disorder can be increased separately. Both types of disorder are modelled by random matrices that couple the degrees of freedom locally. Treated in coherent potential approximation (CPA), the speed of sound decreases with increasing disorder until it reaches zero at finite disorder strength. There, a critical transition to a strong disorder phase occurs. In this novel phase, we find the density of states at zero energy in three dimensions to be finite, leading to a linear temperature dependence of the heat capacity, as observed experimentally for vitreous systems. For any disorder strength, our model is stable, i.e. masses and spring constants are positive, and there are no runaway dynamics. This is ensured by using appropriate probability distributions, inspired by Wishart ensembles, for the random matrices. The CPA self-consistency equations are derived in a very accessible way using planar diagrams. The talk focuses on the model and the results.

[1]The first author acknowledges financial support by the Deutsche Telekom Stiftung

Sebastian Schmittner
Univ Koeln

Date submitted: 14 Nov 2014 Electronic form version 1.4