Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Bosonic Dirac Materials in 2 dimensions[1] SAIKAT BANERJEE, Los Alamos Natl Lab, Nordita, A.M. BLACK-SCHAFFER, J. FRANSSON, Uppsala University, H. AGREN, KTH, Royal Institute of Technology, A.V. BALATSKY, Los Alamos Natl Lab — We examine the low energy effective theory of phase oscillations in a two dimensional granular superconducting sheet where the grains are arranged in honeycomb lattice structure. Two different types of collective phase oscillations are obtained, which are analogous to the massive Leggett and massless Bogoliubov-Anderson-Gorkov modes for two-band superconductor. It is explicitly shown that the spectra of these collective Bosonic modes cross each other at K and K' points in the Brillouin zone and form a Dirac node. This Dirac node behavior in Bosonic excitations represent the case of Bosonic Dirac Materials (BDM). Dirac node is preserved in presence of an inter-grain interaction despite induced changes of the qualitative features of the two collective modes. Finally, breaking the sub lattice symmetry by choosing different on-site potentials for the two sub lattices leads to a gap opening near the Dirac node, in analogy with Fermionic Dirac material.

[1]Supported by US DOE E304, ERC DM 321031, KAW, VR2012-3447

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Date submitted: 05 Nov 2015 Electronic form version 1.4