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Gapped collective modes in quantum solids DANIEL AROVAS, University of California - San Diego, SNIR GAZIT, ASSA AUERBACH, HELOISE NONNE, DANIEL PODOLSKY, Technion - Israel Institute of Technology — The harmonic theory of crystals predicts that the excitation spectrum of a Bravais lattice, i.e. a mono-atomic crystal structure, consists solely of gapless acoustic phonos. Surprisingly, an inelastic Neutron scattering experiment of solid He4 BCC phase has uncovered a zero momentum gapped excitation [1]. Motivated by the large zero point motion in the BCC phase, we describe the crystal through a phenomenological effective Ginzburg-Landau field theory of a charge density wave order parameter. We find that the excitation spectrum contains gapped modes which correspond to fluctuations of the charge density wave order parameter amplitude. We characterize the modes according to their symmetry and compute their visibility in Neutron scattering experiments. To further validate our results, we calculate the scalar susceptibility by means of an ab-inito quantum Monte Carlo simulation. We find a gapped resonance in good agreement with the experimental measurements. Our results motivate future studies of the excitation spectrum of quantum solids. [1] T. Markovich, E. Polturak, J. Bossy, and E. Farhi, Phys. Rev. Lett. 88, 195301 (2002)

Assa Auerbach
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