Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

" Superconductivity and nematic fluctuations in a model of FeSe monolayers: A determinant quantum Monte Carlo study"

Phillip Dumitrescu, University of California - Berkeley

Abstract: In contrast to bulk FeSe, which exhibits nematic order and low temperature superconductivity, atomic layers of FeSe reverse the situation, having high temperature superconductivity appearing alongside a suppression of nematic order. To investigate this phenomenon, we study a minimal electronic model of FeSe, with interactions that enhance nematic fluctuations. This model is sign problem free, and is simulated using determinant quantum Monte Carlo (DQMC). We developed a DQMC algorithm with parallel tempering, which proves to be an efficient source of global updates and allows us to access the region of strong interactions. Over a wide range of intermediate couplings, we observe superconductivity with an extended s-wave order parameter, along with enhanced, but short ranged, q=(0,0) ferro-orbital (nematic) order. These results are consistent with approximate weak coupling treatments that predict that nematic fluctuations lead to superconducting pairing. Surprisingly, in the parameter range under study, we do not observe nematic long range order. Instead, at stronger coupling an unusual insulating phase with q=(π,π) antiferro-orbital order appears, which is missed by weak coupling approximations.

12:00pm
Tuesday, March 22, 2016
Duboc Room (4-331)

Host: Itamar Kimchi