MAR17-2016-020122

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

High Tc in monolayers and intercalates of FeSe: role of incipient bands and orbital selectivity[1]

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High temperature superconductivity in monolayers and some intercalates of FeSe is puzzling because it appears to contradict the usual spin fluctuation pairing scenario for Fe-based superconductors, where the repulsive interactions between hole and electron Fermi pockets lead to strong pairing. In this picture, however, T_c should be negligible in these Fe-chalcogenide systems since they are known to be missing Γ-centered hole pockets. I discuss two possible modifications of the conventional spin-fluctuation approach that may be relevant to this paradox. First, I consider the hitherto neglected role of bands away from the Fermi level ("incipient")[1], and argue that the incipient band contributes significantly to spin-fluctuation pairing in the strong coupling limit where the system is close to a magnetic instability [2]. As the incipient band extremum (or doping) is tuned, the competition between the paramagnon pairing bandwidth and interaction can lead to high T_c with a dome-like dependence. In this context I further discuss the role of phonons and impurities [3]. Finally, I consider the effect of orbitally selective electronic correlations, which can strongly affect the anisotropy of the gap functions observed [4].

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[1]Funded in part by US Department of Energy grant DE-FG02-05ER46236