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Possibility of Hot Superconductivity in Charged Graphene

In 2002 we combined Pauling's resonating valence bond theory with band theory and proposed [1] a phenomenological model for doped graphene like systems and found high Tc superconductivity. Recently Black-Schaffer and Doniach [2] analyzed our model further and found a PT violating d + id symmetry for the order parameter. In another important work [3] Meng and collaborators found Pauling's RVB phase, interpolating a semi metal and Mott insulating antiferromagnetic phases in repulsive Hubbard model at half filling in honeycomb lattice. In this talk we discuss our recent work [4], where we replace our old model by a more realistic repulsive Hubbard model and perform an extensive, state of the art, variational Monte Carlo analysis. We find that graphene, around an optimal doping, could support Kosterlitz-Thouless superconductivity, reaching room temperature scales. Graphene is weakly or at best moderately correlated. However, we bring out an adiabatic connection of our superconductivity in doped graphene to strong coupling RVB superconductivity. A novel phase diagram, that generalizes the phase diagram of reference [3], to non half filled case, will be presented.

[1] G. Baskaran, Phys. Rev. B **65**, 212505 (2002)
[2] A.M. Black-Schaffer and S. Doniach, Phys. Rev. B **75**, 134512 (2007)
[3] Z. Y. Meng, T. Lang, S. Wessel, F. Assaad, and A. Muramatsu, Nature **464**, 847 (2010)
[4] S. Pathak, V. B. Shenoy and G. Baskaran, Phys. Rev. B **81**, 085431 (2010)

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