Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Ginzburg Landau Theory for Cuprate Superconductivity TIRUPPATTUR RAMAKRISHNAN, Dept. of Physics, Indian Institute of Science, Bangalore 560012. Also Banaras Hindu University, Varanasi 221005, India, SUMILAN BANERJEE, CHANDAN DASGUPTA, Dept. of Physics, Indian Institute of Science, Bangalore 560012, India — We propose and develop the consequences of a theory in which the free energy F of a cuprate is expressed as a functional of the complex nearest neighbour spin singlet bond pair order parameter $\Delta_{ij} \exp(i\phi_{ij})$. F is a sum of two terms $\sum_m (a\Delta_m^2 + b\Delta_m^4)$, and $F_1 = c\sum_{mn} \Delta_{mn} \cos(\phi_m - \phi_n)$; here m is the site corresponding to ij on the dual lattice (also square) and m, n are nearest neighbours. The doping x and temperature T dependences of a, b and c are rationalized (eg, $c \propto x$ for small x). The pseudogap (due to incoherent bond pairs) and the parabolic x dependence of T_c (AF ordering of the 2d-XY spin $\Delta_m \exp(i\phi_m)$ leading to d wave superconductivity) are described. The observed $C_v(T)$ behaviour is shown to be due to order parameter fluctuations. Detailed calculations of the vortex structure show a crossover from a Josephson like to a BCS like form with increasing doping, mirroring a similar change in superconductivity.

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Date submitted: 13 Nov 2008 Electronic form version 1.4