Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Chiral d-Wave Superconductivity in coupled ladders[1] JEAN PAUL LATYR FAYE, Université de Sherbrooke, Québec, Canada, SYED R. HASSAN, P.V SRILUCKSHMY, The Institute of Mathematical Sciences, Chennai, India, GANAPATHY BASKARAN, The Institute of Mathematical Sciences, Chennai, India and Perimeter Institute of Theoretical Physics, Waterlo, Ontario, Canada, DAVID SÉNÉCHAL, Université de Sherbrooke, Québec, Canada — We study the Hubbard model on the trellis lattice, a two-dimensional frustrated lattice of coupled two-leg ladders, with hopping amplitude t within ladders and t' between ladders. For large U/t this is a model for the cuprate $Sr_{14-x}Ca_xCu_{24}O_{41}$. We use the variational cluster approximation (VCA), with clusters of sizes 8 to 12. We investigate the phase diagram as a function of doping, U/t and t'/t and find a superconducting dome ending at roughly 20% doping. Repulsion-induced spin singlet correlations within ladders block inter-ladder single electron tunneling, but allow pair tunneling and help establish 2D superconductivity. However, the nature of the order parameter depends on doping. At small doping ($\delta < 3\%$ for $t' = 0.15t$ and $U = 10t$), the order parameter is real and its interladder component grows steeply with δ. Beyond that value, the order parameter becomes complex for a finite range of doping and gives the bulk chiral, PT violating, two-dimensional superconductivity. In all cases, the ladder component of the order parameter has d-wave character.

[1]Computational resources were provided by Compute Canada and Calcul Quebec

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Date submitted: 12 Nov 2014 Electronic form version 1.4