Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Two-dimensional FFLO vortex lattices and vortex liquids[1] PREDRAG NIKOLIC, Rice University — We consider fermionic atoms with attractive interactions in two dimensions, and time-reversal symmetry removed by fast rotation. The phase diagram of this system has a remarkably rich structure due to the competition between superfluidity, Landau quantization and Zeeman effect (introduced by a number imbalance of the two atom species which form Cooper pairs). Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) states and vortex liquids are found and sharply distinguished at zero temperature, in addition to the usual superfluid with an Abrikosov vortex lattice and quantum Hall states. The FFLO states are stabilized by the presence of a vortex lattice, and come in two varieties: FFLO-metals and FFLO-insulators, depending on whether the "spin-polarized" vortex core states form a Fermi surface or a band insulator. The vortex liquid phases exist at zero temperature alongside quantum Hall insulators of unpaired atoms when the attractive interactions between atoms are not too strong. We discuss how to observe this rich phase diagram in trapped ultra-cold atom experiments, as well as connections to high magnetic field superconductivity and pseudo-gap physics in condensed matter.

[1]Funded by W. M. Keck Program in Quantum Materials.

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Date submitted: 27 Jan 2009 Electronic form version 1.4