Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

The superfluid-insulator transition in disordered Fermi gases near unitarity SARANG GOPALAKRISHNAN, University of Illinois at Urbana-Champaign — Superfluids, whether composed of weakly interacting fermions (i.e., in the BCS limit) or bosons (i.e., in the BEC limit), undergo quantum phase transitions into an insulating phase in the presence of strong disorder. In the BCS limit, such a transition occurs when the disorder is strong enough to overcome the fermions' kinetic energy; in the BEC limit, it occurs when the disorder is strong enough to overcome the bosons' interaction energy. We address the fate of the disorder-driven superfluid-insulator transition in the intermediate "unitary" regime, discuss the conditions under which the superfluid-insulator phase boundary is non-monotonic in this regime, and investigate the properties of the insulating phase. Our analysis is quantitatively valid at high densities or for narrow Feshbach resonances, but its qualitative implications are expected to hold beyond these regimes; it can also be adapted to show that the superfluid-insulator transition occurs at infinitesimally weak disorder for a unitary Fermi gas in four dimensions.

Sarang Gopalakrishnan
University of Illinois at Urbana-Champaign

Date submitted: 19 Nov 2010 Electronic form version 1.4