Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Metallic quantum critical points with finite BCS couplings SHAMIT KACHRU, SRINIVAS RAGHU, Stanford University, GONZALO TORROBA, Centro Ato mico Bariloche and CONICET, HUAJIA WANG, University of Illinois, Urbana-Champaign — We study the fate of superconductivity in the vicinity of a class of metallic quantum critical points obtained by coupling a Fermi surface to a critical boson. In such systems there is a competition between the enhanced pairing tendency due to the presence of long-range attractive interactions near criticality, and the suppression of superconductivity due to the destruction of the Landau quasiparticles. We show that there are regimes in which these two effects offset one another, resulting in a novel non-Fermi liquid fixed point with *finite*, scale invariant, BCS coupling. While these interactions lead to substantial superconducting fluctuations, they do not drive the system into a superconducting ground state. The metallic quantum critical fixed points are connected to the superconducting regime by a continuous phase transition. These results are established using a controlled expansion in the deviation from $d = 3$ spatial dimensions, as well as in a large number N of internal flavors. We discuss the possible relevance of our findings to the phenomenon of superconducting domes condensing out of a non-Fermi liquid normal state near quantum critical points.

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Date submitted: 06 Nov 2015 Electronic form version 1.4