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Robustness of quantum critical pairing against disorder in iron-based superconductors[1] JIAN KANG, RAFAEL FERNANDES, School of Physics and Astronomy, University of Minnesota — Several experiments in iron pnictides and cuprates reveal a superconducting (SC) state remarkably robust against non-magnetic disorder at least when compared to the simple extension of the Abrikosov-Gorkov formalism to dirty unconventional superconductors. Motivated by the fact that most of these SC states appear in proximity to a magnetic instability, here we study the impact of non-magnetic disorder on the SC state promoted by quantum critical magnetic fluctuations. We go beyond the weak coupling approach by applying a variational formalism of the Eliashberg equations of the spin-fermion model, taking into account the effects of disorder on both fermionic and bosonic degrees of freedom. We find that the reduced fermionic coherent spectral weight near the magnetic quantum critical point strongly decreases the suppression rate of T_c by weak disorder, as compared to the Abrikosov-Gor'kov universal value. Furthermore, because the bosons promoting the Cooper pairs emerge as collective modes of the fermions, they are also impacted by disorder, giving rise to an additional reduction of the suppression rate of T_c by weak disorder. Our results qualitatively agree with experiments, shedding new light on why unconventional superconductors are robust against disorder.

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