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Effect of nonmagnetic impurities on $s_\pm$ superconductivity in the presence of incipient bands[1] XIAO CHEN, Department of Physics, University of Florida, Gainesville, VIVEK MISHRA, Joint Institute of Computational Sciences, University of Tennessee, Knoxville, SAURABH MAITI, PETER HIRSCHFELD, Department of Physics, University of Florida, Gainesville — Several Fe chalcogenide superconductors without hole pockets at the Fermi level display high temperature superconductivity, in apparent contradiction to naive spin fluctuation pairing arguments. Recently, scanning tunneling microscopy measurements have measured the influence of impurities on some of these materials, and claimed that non-magnetic impurities do not create in-gap states, leading to the conclusion that the gap must be s_{++}, i.e. conventional s wave with no gap sign change. Here we present various ways sign-changing gaps can be consistent with the absence of such bound states. In particular, we calculate the bound states for an $s_\pm$ system with a hole pocket below the Fermi level, and show that the nonmagnetic impurity bound state energy generically tracks the gap edge in the system, thereby rendering it unobservable. A failure to observe a bound state in the case of a nonmagnetic impurity can therefore not be used as an argument to exclude sign-changing pairing states.

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