Influence of bulk disorder on the energy of Yu-Shiba-Rusinov states

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Magnetic impurities placed on the surface of a s-wave superconductors induce bound states. These Yu-Shiba-Rusinov states have recently gained a lot of attention as a building block for the realisation of Majorana edge states, with possible applications in topological quantum computation. However, there has been an ongoing debate whether or not these states are influenced strongly by disorder in the host superconductor. In this work we present results that suggest that the bound state energy is only weakly perturbed by the presence of bulk disorder with a mean free path much larger than the Fermi wave length. Our analysis will cover both two and three dimensional systems. Furthermore we investigate the regime of single strong scalar impurities in proximity to the Yu-Shiba-Rusinov state and and discuss the statistics of the small energy fluctuations induced by the disorder.