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Spin noise and magnetic screening of impurities in a BCS superconductor[1] MATTHIAS LE DALL, Department of Physics and Astronomy, University of Victoria, British Columbia, Canada, LUIS G. G. V. DIAS DA SILVA, Instituto de Física, Universidade de São Paulo, Brazil, ROGÉRIO DE SOUSA, Department of Physics and Astronomy, University of Victoria, British Columbia, Canada — The coupling of a localized impurity to a BCS superconductor (SC) leads to the formation of impurity Cooper-pairs via the proximity effect, generating two bound states within the SC energy gap, the so-called Yu-Rusinov-Shiba (YSR) states. They are similar to the Andreev Bound States that originate from Andreev reflection, e.g. when the impurity is hosted in a Josephson junction, and are known to produce sharp sub-gap resonances in charge noise [de Sousa et al., PRB 2009], providing a natural explanation for the observation of microresonators in superconducting devices [Simmonds et al., PRL 2004]. Here we present a theory for the spin noise generated by magnetic impurities in a SC, and discuss the impact of the Shiba states on models of flux noise in superconducting qubits. We use a combination of analytical methods and the numerical renormalization group technique to calculate the spin noise of an Anderson impurity in a SC, unveiling the competition between the proximity effect and Kondo correlations. Both mechanisms produce magnetic screening and a corresponding reduction in spin noise, giving rise to new insights on the kinds of impurities that are responsible for the observed $1/f^{\alpha}$ flux noise in superconducting circuits.

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