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Flux noise due to magnetic impurities in superconducting circuits: Optimal spin texture and role of phase transition[1] ROGÉRIO DE SOUSA, Department of Physics and Astronomy, University of Victoria, British Columbia, Canada — Superconducting quantum interference devices (SQUIDs) and other superconducting circuits are limited by intrinsic flux noise with spectral density $1/f^{\alpha}$ with $\alpha < 1$ whose origin is believed to be due to spin impurities. We present a theory of flux noise in the presence of phase transitions and arbitrary spin textures in the impurity spin system [1]. At higher temperatures we find that the spin-spin correlation length scale (describing, e.g., the average size of ferromagnetic spin clusters) greatly impacts the scaling of flux noise with wire geometry. At lower temperatures we find that flux noise is quite sensitive to the particular spin texture realized by the spin system ground state. Remarkably, we show that flux-noise is exactly equal to zero when the spins form a poloidal texture. Flux noise is nonzero for other spin textures, but gets reduced in the presence of correlated ferromagnetic fluctuations between the top and bottom wire surfaces, where the flux vectors are antiparallel. This demonstrates the idea of engineering spin textures and/or inter-surface correlation as a method to reduce flux noise in superconducting circuits.

[1] S. LaForest and R. de Sousa, Phys. Rev. B **92**, 054502 (2015).

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Rogerio de Sousa
University of Victoria, BC

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