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Flux noise in SQUIDs: calculations of geometrical dependence[1]

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Low frequency ($1/f$) magnetic flux noise in SQUIDs is understood to arise from the random reversal of electron spins localized at the surface of the superconducting film. Analytical results[1] that assume independent electron spins predict that the spectral density at 1 Hz scales with the washer geometry approximately as R/W in the limit $R/W \gg 1$. Here, R is the outer radius and W is the linewidth. We present numerical calculations that reproduce the analytical result in the appropriate limit and extend these results to arbitrary values of R/W. In addition, a logarithmic dependence on W, evident when R/W is fixed and W is varied, is reproduced and discussed. The contribution of spins at the edge of the film is also computed. We compare the predicted geometrical scaling to our recent measurements of several SQUIDs with varying geometries. Our calculation that is valid for all values of R/W enables us to investigate a possible breakdown of the independent spin model in our experimental data. [1]R. C. Bialczak *et al.*, Phys. Rev. Lett. **99**, 187006 (2007).

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