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Ginzburg-Landau modeling of Nano-SQUIDs JOHN KIRTLEY, Stanford University, DIBYENDU HAZRA, KLAUS HASSELBACH, OLIVIER BUISSON, CNRS Grenoble — NanoSQUIDs are micron-sized Superconducting Quantum Interference Devices with narrow (50 nm) sized constrictions as weak links. They are used for, e.g., studying switching dynamics in magnetic nanoparticles and high spatial resolution magnetic microscopy. When the constriction dimensions become comparable to or larger than the superconducting coherence length, the current-phase relations become non-sinusoidal, reducing the flux modulation depth and increasing the thermally activated flux noise. We have numerically solved the Ginzburg-Landau (GL) equations for the nanoSQUID geometry to obtain current-phase relations, the dependence of critical current on magnetic flux, and the thermally activated escape rates. We predict NanoSQUIDs with short coherence lengths to have critical current distribution widths, and therefore flux noises, proportional to $T^{1/2}$, as opposed to tunnel junction SQUIDs, which are proportional to $T^{2/3}$. Our GL simulations predict that the ultimate noise performance of Al nanoSQUIDs, with their longer coherence lengths, should be better than Nb nanoSQUIDs, with suspended bridge Al/Nb nanoSQUIDs intermediate between the two.

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