Flux Noise due to Spin Impurities in SQUIDs

Stephanie LaForest[1], Trevor Lanting[2], Mohammad Amin[2] and Rogério de Sousa[1]

[1]Department of Physics and Astronomy, University of Victoria, Victoria BC, V8W 3P6, Canada
[2]D-Wave Systems, Inc., 100-4401 Still Creek Drive, Burnaby BC, V5C 6G9, Canada

April 26, 2013

Superconducting Quantum Interference Devices (SQUIDs) are currently being used as flux qubits in a variety of solid-state quantum computer architectures. The main limitation of SQUID qubits is that they have a coherence time of the order of 10 μs, due to the presence of intrinsic flux noise that is not yet fully understood. The origin of flux noise is currently believed to be related to spin impurities present in the materials and interfaces that form the device. Here we present a novel numerical method that enables calculations of the flux produced by spin impurities even when they are located quite close to the SQUID wire. We show that the SQUID will be particularly sensitive to spins located at its wire edges, generating flux shifts of up to 4 nano flux quanta, much higher than previous calculations based on FastHenry. This shows that spin impurities in a particular region along the wire's surface play a much more important role in producing flux noise than other spin impurities located elsewhere in the device.