CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

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Vendredi 8 octobre 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Magnetic Flux 1/f Noise: Origins, SQUIDs and Superconducting Qubits

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At millikelvin temperatures and low frequencies f, superconducting flux qubits and SQUIDs both exhibit intrinsic magnetic flux noise. In SQUIDs, the noise power spectrum scales as $1/f^{\beta}$ where β varies from approximately 0.6 to 1. The amplitude of the 1/f noise ranges from about 1–10$\mu\Phi_0 Hz^{-1/2}$ at $1Hz$, although the area of the SQUDs varies over four orders of magnitude. There appears to be no dependence of the noise magnitude on the nature of the superconducting material or the substrate. A local model based on the random flipping of surface electrons between up and down states is consistent with the observed dependence of the noise on area. This model requires an areal electron density of about $5 \cdot 10^{17}\ m^{-2}$ to account for the observed magnitude of the noise. Experiments at Wisconsin and Stanford on the paramagnetic susceptibility of SQUIDs and normal metal rings yield the same areal density. Recently, we have developed a model in which the noise is generated by localized states at the superconductor-insulator interface. Detailed calculations show that a modest level of interfacial disorder causes Anderson localization of the metal-induced gap states; an areal density of $5 \cdot 10^{17}\ m^{-2}$ is readily achieved. This result suggests that epitaxially grown films with reduced disorder may lead to lower levels of flux noise. Recent studies of the dependence of the slope β on the geometry of SQUIDs are presented.

This work is in collaboration with Steve Anton, Jeff Birenbaum, SangKook Choi, Andrew Fefferman, Sean O'Kelly, Dunghai Lee, Steven Louie, Keenan Pepper, Cristian Urbina and Fred Wellstood, and supported by IARPA and ARO.

A coffee break will be served at 11h00. The seminar will be given in English.

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