



Kolloquium

Prof. Dr. Jukka Pekola
(TKK Helsinki)

Josephson junction threshold detectors in quantum limit

I describe the dynamics of small underdamped Josephson junctions and SQUIDs (Superconducting QUantum Interference Devices) at low temperatures. I show how these junctions can be employed in threshold detection of electrical current and its noise. Switching event determining the threshold occurs when the superconducting phase of the junction escapes from a metastable well either by quantum tunneling or by thermal activation. I present the phase diagram of Josephson junctions that we obtained experimentally while optimizing the quality of the threshold detector [1]. Upon reducing the Josephson coupling energy of the junctions we entered into a new, formerly undiscovered regime, which we call underdamped phase diffusion (UPD). The cross-over into this phase can be described by a simple model by taking into account frequency dependent dissipation. In another set of experiments we have measured the influence of shot noise on hysteretic Josephson junctions [2]. Escape threshold current from the superconducting state is predominantly determined by excitation of the phase particle in the metastable well due to high-frequency shot noise. This process is equivalent to thermal activation over the barrier at effective temperatures up to about four times the critical temperature of the superconductor. The model I present is in excellent agreement with the experimental results.

[1] J. M. Kivioja, T. E. Nieminen, J. Claudon, O. Buisson, F. W. J. Hekking, and J. P. Pekola, Phys. Rev. Lett. 94, 247002 (2005), and New J. Phys. 7, 179 (2005).

[2] J. P. Pekola, T. E. Nieminen, M. Meschke, J. M. Kivioja, A. O. Niskanen, and J. J. Vartiainen, Phys. Rev. Lett., 95, 197004 (2005).

Wann?

Donnerstag, 15.12.2005, 17:15 Uhr

Wo?

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