Microwave induced effects in diffusive SNS junctions

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The observation of very large microwave-enhanced critical currents in superconductor-normal metal-superconductor (SNS) junctions at temperatures well below the critical temperature of the electrodes has remained without a satisfactory theoretical explanation for more than three decades. In this talk I present our theory[1] of the supercurrent in diffusive SNS junctions under microwave irradiation, based on the quasiclassical Green's function formalism. We show that the enhancement of the critical current is due to the energy redistribution of the quasiparticles in the normal wire induced by the electromagnetic field. Our theory provides predictions across a wide range of temperatures, frequencies, and radiation powers, both for the critical current and the current-phase relationship. At linear response, the microwave absorption can be described via the ac susceptibility (admittance) of the SNS junction. We describe this susceptibility[2]for a broad range of frequencies starting from the adiabatic regime described by kinetic inductance up to frequencies in excess of the inverse diffusion time, where non-adiabatic dynamics and proximity-influenced quasiparticle dynamics play a significant role. Our results are relevant in describing recent experiments, both on the microwave enhanced supercurrent and on the susceptibility.

[1]P. Virtanen, T.T. Heikkilä, F.S. Bergeret, and J.C. Cuevas, Phys. Rev. Lett. **104**, 247003 (2010).
[2]P. Virtanen, F.S. Bergeret, J.C. Cuevas, and T.T. Heikkilä, Phys. Rev. B (in press); arXiv:1012.4294.