

Andreev levels in superconducting nanostructures

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Abstract

In this talk I will outline a fundamental role of subgap quasiparticle states (Andreev levels) in a variety of superconducting hybrid nanostructures. In particular, I will demonstrate that dc Josephson effect in superconducting-normal-superconducting structures (SNS junctions) can adequately be understood and explained only employing the concept of Andreev levels.

I will also discuss some other intriguing phenomena, such as, e.g., the so-called parity effect in superconducting nanorings, where subgap Andreev states essentially determine both the magnitude and the magnetic flux dependence of persistent currents flowing in such nanorings. Finally, I will argue that Andreev levels in superconducting weak links form an effective quantum dissipative environment which can serve as an important source for intrinsic inelastic relaxation and dephasing of the Josephson "particle".