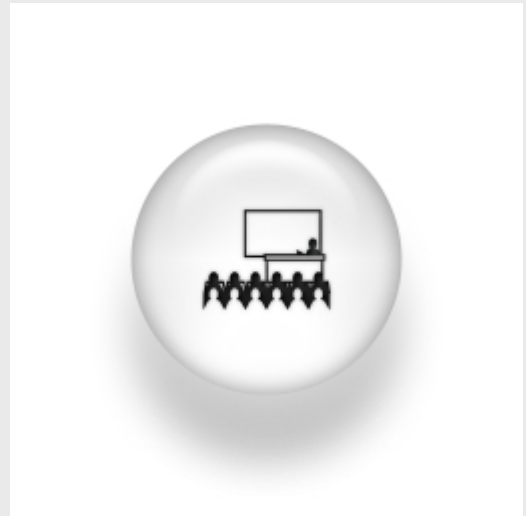


Weak localization-like processes in gapped systems in connection with the realization of a source of entangled pairs of electrons

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A lot of interest is devoted to realize experimentally devices in which pairs from a superconductor are splitted in two different normal or ferromagnetic electrodes, therefore realizing a source of entangled pairs of electrons.

After reviewing some experiments, I will discuss higher order processes in the tunnel amplitudes already for a normal metal - insulator - normal metal junction. Then going to normal metal - superconductor - normal metal junctions, I will show that the non local conductance contains two terms of opposite sign: i) a term corresponding to a double Andreev process, and ii) weak localization-like tunneling. I will also discuss a simple model for multiple reflections on disorder in the normal electrodes, or on the sample boundaries. Finally, I will discuss the same weak localization-like processes in experiments showing magnetoresistance oscillations in another gapped system (charge density waves pierced by nanoholes).