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Title : Cooper pair splitting in parallel quantum dot Josephson junctions

Abstract : It has been proposed that small quantum dots (QDs) with strong electron-electron interaction are an ideal filter to separate the quasi-particles of the Cooper pair creating an efficient source for spin-entangled electron pairs or Einstein-Podolsky-Rosen (EPR) pairs. Recent experiments have used an Andreev entangler design in which two QDs coupled to normal leads are contacted with a single superconducting reservoir. The strong electron-electron interaction prevents the tunnelling of Cooper pairs through a single QD and reinforces the process of crossed Andreev reflection allowing the efficient separation of Cooper pairs into the two metal leads. This has advantages over the normal-superconductor-normal system in which conventional cotunnelling events can be difficult to separate from the crossed Andreev reflections. I will present transport measurements on a device in which two QDs are placed in parallel with very close proximity within a nanogap between two superconducting leads allowing the separation of the Cooper pair between the two QDs. As the supercurrent arises only from processes which maintain the coherence of the Cooper pair the non-local entangled state may be confirmed by careful study of the gate dependence of the switching current of the junction. The non-local transport process in which the Cooper pair is separated between the QDs is detected as an enhancement of the switching current of the double QD junction under conditions in which both QDs are tuned to be on resonance. Under similar conditions we observe a suppression of transport in the normal state indicating selectivity in the transport resulting from the proximity of the QDs.