Cooper pair splitter realized in a two quantum dot Y-junction

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An important step towards the realization of solid state based quantum computer is the demonstration of entangled spatially separated electrons. During the last years extensive theoretical investigation has been done and different device configurations were suggested. The Cooper-pairs of superconductors are a natural source of spin entangled electrons, the separation of these electron pairs is the underlying concept of several theoretical proposals [1-3].

In this work we present the first experimental realization of a tunable Cooper Pair Splitter. The device contains a superconducting electrode coupled to two quantum dots, which is fabricated based on InAs Nanowire (see Fig. 1). In a superconducting beam splitter configuration two basic processes can happen with a Cooper-pair: the two electrons either split up into the two arms of the beam splitter or they leave the device in the same arm. The charging energy strongly suppresses to put two electrons on the same quantum dot, therefore implementing quantum dots into the arms of the beam splitter serves as a filter for the desired splitting process.

Performing non-local transport measurements on such devices, we have demonstrated the Cooper-pair splitting process. Furthermore, the separate tunability of the two dots allows studying the splitter efficiency for different settings of the quantum dots' levels. The observed results show unexpected behavior, which is beyond the existing theoretical predictions [1].

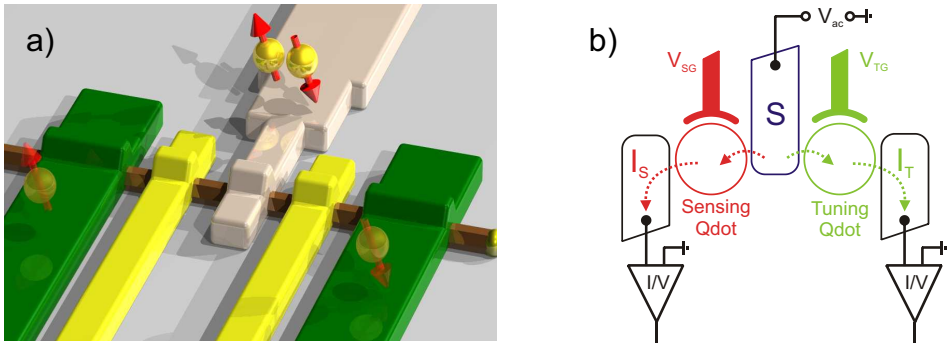

Figure 1: *a) Device architecture of the Cooper Pair Splitter based on InAs nanowire b) The schematic of the corresponding electric circuit, a superconducting lead (S) connected to two quantum dots, which are separately tunable with local top gates.*

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