Non-local Josephson effect in carbon nanotubes

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Résumé

Andreev bound states (ABS) are fermionic states localized at the weak link of a Josephson junction. They carry a supercurrent that flows coherently through the device with an amplitude depending on the superconducting phase difference δ across the junction: it's the Josephson effect. When two Josephson junctions are sufficiently close to each other compared to the superconducting coherence length, the ABS wavefunctions hybridize forming an Andreev molecule and the Josephson effect becomes non-local: the supercurrent flowing through one junction not only depends on the phase difference across this junction, but also on the phase difference across the other junction. We present here the experimental observation of such an effect in carbon nanotube-based Josephson junctions. The device was fabricated using a novel assembly technique involving carbon nanotube pick-up with hexagonal boron nitride, yielding remarkably clean samples.

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