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Dramatic suppression of the Josephson effect in floating superconductors MARIA JOSE MARTINEZ-PEREZ, FABIO TADDEI, FRANCESCO GIAZOTTO, NEST, Istituto Nanoscienze-CNR and Scuola Normale Superiore, Piazza S. Silvestro 12, I-56127 Pisa, Italy — A number of devices exploiting the Josephson effect consist of floating superconducting islands. A well-known example are SISIS junctions (where S and I stand for superconductor and insulating barrier, respectively) present in many applications such as SQUIDs. The Josephson effect relies on the macroscopic phase describing the wave function of the electrons in the superconducting electrodes. This phase is fixed by the electrochemical potential of the superconductor that is settled experimentally. An intriguing situation arises then when dealing with floating superconducting islands that have no well-defined reference potential. Here we present an experimental characterization of Al/AlOx/Al/AlOx/Al junctions. We focus, on the one hand, on genuine SISIS junctions in which the central aluminium island remains floating and, on the other, on virtually grounded samples in which the central aluminium island is referred to a fixed potential through a metallic contact. We observe that, under identical circumstances, floating junctions exhibit a dramatic suppression of their Josephson current compared to their grounded counterparts. Possible reasons such as the overheating of the central island or quasiparticle fluctuations are addressed.

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