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Pi-states and Dissipative Currents in Superfluid 3He Josephson Junctions

The Josephson effect is a well known phenomenon taking place in weak links between two superconductors. Similar effect is possible also in the fermion superfluid 3He, where two containers of superfluid are connected through a small aperture. Similar to superconducting weak links, the current through the weak link is determined by the bound states at the link. In 3He-B bound state energies are spin split, depending on the order parameters in the bulk. As a result, unusual current-phase relations with pi states appear. Increasing Josephson coupling modifies the order parameter in the bulk. This leads to a stronger pi state and to an additional current at a constant pressure bias. The theoretical results are compared with experiments.