

Abstract Submitted  
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**On the possibility of the fractional ac Josephson effect and doubled Shapiro steps in non-topological Josephson junctions**<sup>1</sup> JAY SAU, Harvard University, EREZ BERG, Weizmann Institute of science, BERTRAND HALPERIN, Harvard University — Topological superconductors supporting Majorana Fermions with non-abelian statistics are presently a subject of intense theoretical and experimental effort. It has been proposed that the observation of a half-frequency or a fractional Josephson effect is a more reliable test for topological superconductivity than the search for end zero modes. In fact, the fractional Josephson effect has been observed for the semiconductor nanowire system in the form of doubled Shapiro states. Here we consider the possibility of seeing such a fractional ac Josephson and doubled Shapiro steps from a superconducting nanowire in the non-topological phase. Using a semiclassical treatment we find that both the fractional ac Josephson effect and the doubled Shapiro step can, in principle, occur in the non-topological phase because of non-dynamical Landau Zener processes associated with the Andreev bound state spectrum of the junction. Therefore, while the observation of doubled Shapiro steps can be taken as indicative of a topological phase, it may not be a smoking gun signature for topological superconductivity and Majorana fermions.

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