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Nonlocality of local Andreev conductances as a probe for topological Majorana wires

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Distinguishing trivial and topological phases in Majorana wires is challenging due to, mainly, the ubiquitous presence of disorder-driven trivial states. In this work (1), we propose a method of observing Majorana oscillations that trivial states are unable to mimic. To this end, we calculate the transport and spectral properties of Majorana wires by using the scattering matrix in the Bogoliubov-de Gennes formalism. We find that for experimentally accessible parameter regimes, including electron temperatures in the range $30 \leq T \leq 150$ mK, we can observe Majorana oscillations in variations of a local conductance (for instance, G_{LL}) when we change the coupling to the lead on the opposite side of the wire (Γ_R), i.e. $\delta G_{LL}(V_z) = G_{LL}(V_z, \Gamma_R = \Gamma_L) - G_{LL}(V_z, \Gamma_R << \Gamma_L)$, where $\Gamma_{L,R}$ represent the couplings to the leads and V_z is the Zeeman energy due to an external magnetic field. Importantly, these oscillations are only observed in the topological phase, in contrast to oscillations in $G_{LL}(V_z)$, which can be mimicked by trivial states. We investigate the origin of such a correlation between the left and right sides in terms of the hybridization between the Majorana modes. Our proposal provides a method of distinguishing topological and trivial subgap states that may guide future experiments in the field.

Palavras-chave: Majorana zero modes; Conductance; Nonlocality.

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