

Abstract Submitted  
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**Transition from fractional to Majorana fermions in Rashba nanowires** JELENA KLINOVAJA, PETER STANO, DANIEL LOSS, Department of Physics, University of Basel — We study hybrid superconducting-semiconducting nanowires in the presence of Rashba spin-orbit interaction as well as helical magnetic fields.[1] We show that the interplay between them leads to a competition of phases with two topological gaps closing and reopening, resulting in unexpected reentrance behavior. Besides the topological phase with localized Majorana fermions (MFs) we find new phases characterized by fractionally charged fermion (FF) bound states of Jackiw-Rebbi type. The system can be fully gapped by the magnetic fields alone, giving rise to FFs that transmute into MFs upon turning on superconductivity. We find explicit analytical solutions for MF and FF bound states and determine the phase diagram numerically by determining the corresponding Wronskian null space. We show by renormalization group arguments that electron-electron interactions enhance the Zeeman gaps opened by the fields.

[1] J. Klinovaja, P. Stano, and D. Loss, arXiv:1207.7322 (2012).

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