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Majorana Fermions in Quantum Wires with Helical Magnetic Textures[1] GEOFFREY FATIN, ALEX MATOS-ABIAGUE, BENEDIKT SCHARF, IGOR ZUTIC, University at Buffalo - SUNY — Magnetic textures can lead to the formation of Majorana states in a quantum wire located nearby an s-wave superconductor [1-3]. We investigate theoretically the formation of Majorana fermions in quasi-one-dimensional quantum wires in the presence of different kinds of helical-like magnetic textures. Our calculations reveal that finite-size effects as well as non-trivial helical magnetic configurations can lead to the formation of multiple Majorana states. Under some specific conditions it is possible to localize some of the Majorana modes at certain points within the wire. The positions of these points can be controlled by properly tuning the system parameters. The conditions governing the transitions from the trivial to the topological state are found and the different Majorana modes are characterized according to their local spin polarization. The possibility of experimentally realizing the proposed models in actual physical systems is also discussed.

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