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Superconductivity with Rashba spin-orbit coupling and magnetic field: a route to topological superconductivity

A two-dimensional s-wave superconductor in a magnetic field with a sufficiently strong Rashba spin-orbit coupling is a candidate system for a topological superconductor. Typically, the required magnetic field to convert the superconductor into a topologically non-trivial state is however by far larger than the upper critical field, which excludes its realization. This problem is overcome by rotating the magnetic field into the superconducting plane. The character of the superconducting state changes with the strength and the orientation of the magnetic field. A topological state indeed extends to an in-plane field orientation. Mapping the spin texture in momentum space reveals a meron-like structure. In analogy to skyrmion patterns, the momentum-space spin texture translates into an integer number which offers an alternative to reflect the topological character of the superconducting state. A possible realization of the topological s-wave superconductor at LaAlO3/SrTiO3 interfaces is examined.