Topologically protected Majorana zero modes around the edge of a magnetic skyrmion

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Magnetic skyrmions are topological spin textures currently at the forefront of research in spintronics because of their fundamental properties as well as their possible applications for memory devices. From another perspective, the question of the interplay of magnetic textures and superconductivity has naturally arisen as attempts to engineer topological superconductivity intensify. In that context, previous work has shown that magnetic skyrmions can host a Majorana zero mode (MZM) in their core when proximitized by a conventional s-wave superconductor. In constrast, we find a highly degenerate flat band of Majorana zero modes on the edge of the skyrmion that is robust to local perturbations be they electronic or geometric. We show that these states can be interpreted as the topologically protected end states of Rashba wires. In addition, the number of MZMs in the flat band surprisingly grows linearly with the perimeter of the edge of the texture, irrespective of its precise shape. In turn, this implies that the MZM are localized on the nanometer scale which potentially allows for their individual adressing. We finally argue that the system considered here implements a Majorana island suitable for the experimental realization of the topological Kondo effect and of electron "teleportation" and suggest possible physical realizations.