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Topological superconductivity at the edge of transition metal dichalcogenides GANG XU, JING WANG, Stanford Univ, BINGHAI YAN, Max Planck Institute for Chemical Physics of Solids, XIAO-LIANG QI, Stanford Univ —
Time-reversal breaking topological superconductors are new states of matter which can support Majorana zero modes at the edge. In this paper, we propose a new realization of one-dimensional topological superconductivity and Majorana zero modes. The proposed system consists of a monolayer of transition metal dichalcogenides MX_2 (M=Mo, W; X=S, Se) on top of a superconducting substrate. Based on first-principles calculations, we show that a zigzag edge of the monolayer MX_2 terminated by metal atom M has edge states with strong spin-orbit coupling and spontaneous magnetization. By proximity coupling with a superconducting substrate, topological superconductivity can be induced at such an edge. We propose NbS_2 as a natural choice of substrate, and estimate the proximity induced superconducting gap based on first-principles calculation and low energy effective model. As an experimental consequence of our theory, we predict that Majorana zero modes can be detected at the 120° corner of a MX_2 flake in proximity with a superconducting substrate.

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