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Novel Quantum Spin-quantum Anomalous Hall Effect with Tunable Edge States in Sb Monolayer-based Materials TONG ZHOU, Fudan University, HUA JIANG, Soochow University, ZHONGQIN YANG, Fudan University, SOOCHOW UNIVERSITY COLLABORATION, FUDAN UNIVERSITY TEAM — A novel quantum spin-quantum anomalous Hall (QSQAH) effect, where the quantum anomalous Hall effect (QAH) occurs at one valley and the quantum spin Hall effect (QSH) occurs at the other valley, is predicted in Sb monolayer-based materials by using *ab initio* methods. The non-magnetic and magnetic atoms induce a drastic staggered exchange field, which together with proper spin-orbit coupling (SOC) interactions from Sb p_x and p_y orbitals, generates the QSQAH effect in the system. A tight-binding model based on p_x and p_y orbitals is constructed to understand the underlying physical mechanism of the QSQAH effect. Dissipationless chiral charge edge states related to one valley are found to emerge along the both sides of the sample, while low-dissipation spin edge states related to the other valley flow only along one side of the sample. These edge states can be tuned flexibly by polarization-sensitive photoluminescence controls and/or chemical edge modifications. Such flexible manipulations of the charge, spin, and valley degrees of freedom provide a promising route towards applications in electronics, spintronics, and valleytronics.

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