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Strong intrinsic spin Hall effect in the TaAs family of Weyl semimetals[1] YAN SUN, Max Planck Institute for Chemical Physics of Solids, 01187 Dresden, Germany, YANG ZHANG, MPI CPfS/IFW Dresden, CLAUDIA FELSER, BINGHAI YAN, Max Planck Institute for Chemical Physics of Solids, 01187 Dresden, Germany — Since their birth topological insulators have been expected to be ideal spintronic materials due to the spin currents carried by the surface states with spin-momentum locking . However, the bulk doping problem still remains to be an obstacle that hinders such application. In this work, we predict that a newly discovered family of topological materials, the Weyl semimetals, exhibits large intrinsic spin Hall effects that can be utilized to generate and detect spin currents. Our ab-initio calculations reveal large spin Hall conductivity that is comparable to that of 4d and 5d transition metals. The spin Hall effect originates intrinsically from the bulk band structure of Weyl semimetals that exhibits large Berry curvature and spin-orbit coupling, naturally avoiding the bulk carrier problem in the topological insulators. Our work not only paves a way to employ Weyl semimetals in spintronics, but also proposes a new guideline to search for spin Hall effect materials in various topological materials.

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Yang Zhang
MPI CPfS/IFW Dresden

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