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Prediction of an intrinsic spin Hall effect without spin-orbit coupling in non-collinear antiferromagnets[1] YANG ZHANG, MPI CPfS/IFW Dresden, JAKUB ZELEZNY, MPI CPfS, JEROEN VAN DEN BRINK, IFW Dresden, CLAUDIA FELSER, BINGHAI YAN, MPI CPfS — The spin Hall effect (SHE), which converts a charge current into a transverse spin current, has long been believed to be a phenomenon induced by the spin-orbit coupling. In this work, we have revealed the existence of an intrinsic SHE without the spin-orbit coupling by theoretical calculations. Such a SHE is realised in the chiral spin structure of non-collinear antiferromagnets, even when the scalar spin chirality is zero. We have obtained large intrinsic spin Hall conductivity in related compounds Mn_3Ge and Mn_3Sn, that are chiral antiferromagnetic above room temperature and also predicted to be Weyl semimetals recently. Our work provides further understanding on the spin Hall effect and paves a new way to design SHE materials based on the chiral magnetic materials.

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