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Chirality-induced spin-Hall magnetoresistance in 2D chiral hybrid perovskites

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2D ferromagnetism is an emerging field in spintronics applications. The use of generic 2D ferromagnetic materials, however, suffers of the so-called superparamagnetic limit, which imposes restrictions on the size and dimension of the ferromagnetic component used in spintronics devices. The recent discovery of the Chiral-Induced Spin Selectivity (CISS) effect offers a possibility to generate spin angular momentum by replacing the ferromagnetic component with chiral systems, e.g., chiral (left- or right-handed) molecules and their assemblies lacking inversion symmetry. As a result of the CISS effect, the chiral materials can produce an effective magnetic field at room temperature, which direction is determined by the left or right chirality, circumventing the superparamagnetic limit. Here, we report the observation of a large chiral-induced magnetic field up to 4 Tesla in solution-processed, 2D-layered, organic-inorganic hybrid perovskites incorporating chiral molecule ligands. Such chiral-induced magnetic field is probed by measuring the resistance through an attached platinum layer, analogous with the spin- Hall magnetoresistance (SMR). We found a substantial angular dependent chirality-induced SMR that agrees well with theoretical models. By sweeping the magnetic field, the SMR reveals a clear hysteresis depending upon the chirality of 2D perovskites, which could be used to quantify the effective magnetic field strength produced via the CISS effect. Incorporating the chiral molecules into a 2D layered hybrid perovskite framework offers a versatile platform for designing 2D ferromagnetic materials at room temperature.

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