2-D centrosymmetrical antiferromagnets model produces pure spin current

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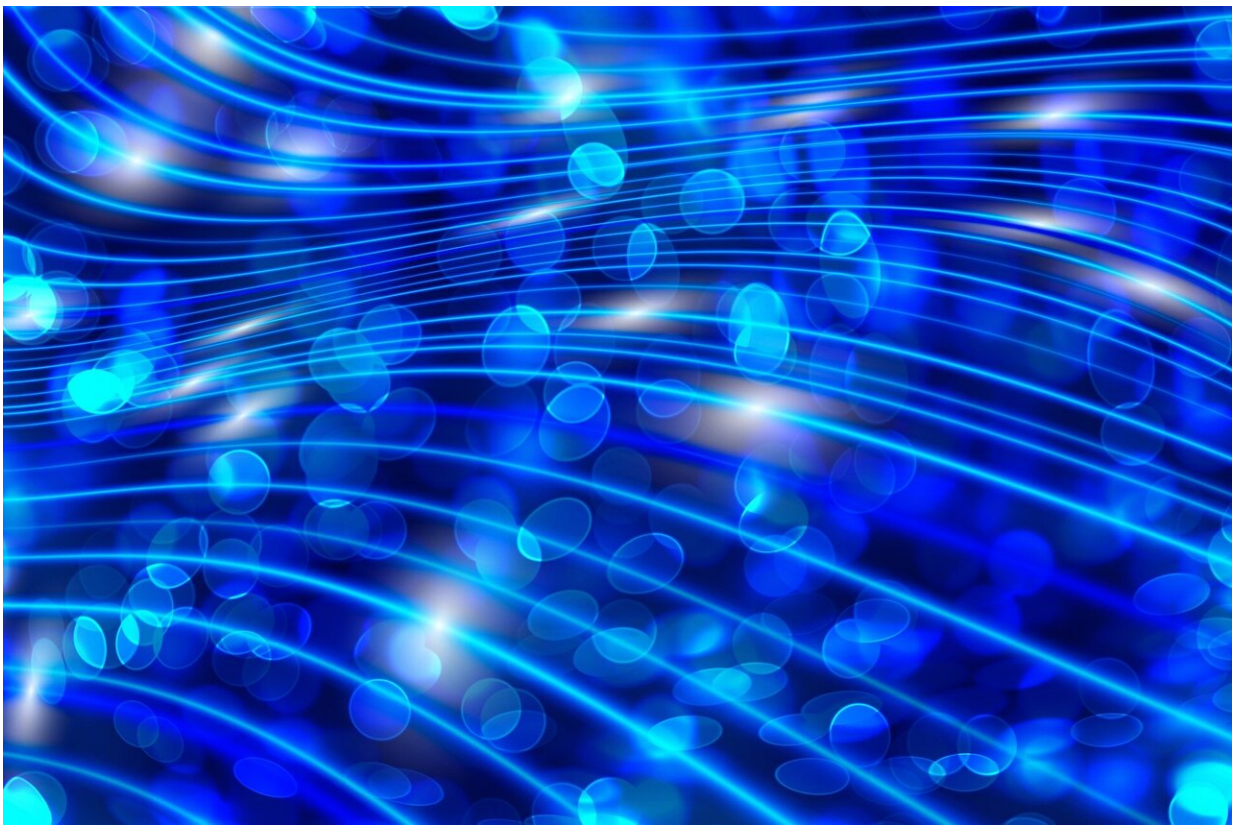

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Pure spin current without any accompanying net charge current can ensure low dissipation in information processing and storage.

Pure spin current can be produced by optical illumination in systems with broken spatial inversion symmetry with special photon energy or polarization angle. But it is difficult in practical application.

Recently, a research group led by Prof. Zheng Xiaohong from the Institute of Solid State Physics (ISSP), Hefei Institutes of Physical Science (HFIPS), proposed a new and robust route to achieve pure spin current by photogalvanic effect with two-dimensional (2-D) centrosymmetrical antiferromagnets. The study was published in *npj Quantum Information* on Feb. 4.

"Due to the preservation of structural inversion symmetry and spin polarization antisymmetry in these materials, the charge photocurrent induced by the spin photogalvanic effect (PGE) is definitely zero," said lead author Jiang Peng, a doctoral student. "While finite photocurrents for both spin channels with opposite flow directions and equal magnitude are still generated, giving rise to a pure spin current."

The researchers constructed a dual-gated photoelectric device with a zigzag graphene nanoribbon (ZGNR), which had intrinsic antiferromagnetic (AFM) coupling between the two edges and spin degenerate band structure.

They found that the generated pure spin current was neither dependent on the photon energy, nor on the polarization feature of the applied polarized light. Moreover, it demonstrated that spin-splitting band structures were not necessary.

"The device may work in the sense that both fully spin polarized current and pure spin current can be generated, by tuning the dual gates applied to the two leads," said Prof. Zheng.

This PGE-induced mechanism can be extended to other 2-D

centrosymmetric magnetic materials with spin polarization antisymmetry, providing a new way for the experimental generation of pure spin current in the photoelectric field.

More information: Peng Jiang et al. Two-dimensional centrosymmetrical antiferromagnets for spin photogalvanic devices, *npj Quantum Information* (2021). DOI: 10.1038/s41534-021-00365-7

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