Spin photovoltaic effect in magnetic van der waals heterostructures

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The development of van der Waals (vdW) crystals and their heterostructures has created a fascinating platform for exploring optoelectronic properties in the two-dimensional (2D) limit. With the recent discovery of 2D magnets, the control of the spin degree of freedom can be integrated to realize 2D spin-optoelectronics with spontaneous time-reversal symmetry breaking. Here, we ...

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Here, we report spin photovoltaic effects in vdW heterostructures of 2D magnet chromium triiodide (CrI 3) sandwiched by graphene contacts. The photocurrent displays a distinct dependence on light helicity, which can be tuned by varying the magnetic states and photon energy.

Spin field-effect transistors (FETs) were first proposed by Datta and Das in 1990 1.These spin-based devices promise non-volatile data storage, and faster and more energy-efficient performance ...

Title: Spin Photovoltaic Effect in Magnetic van der Waals Heterostructures Authors: Tiancheng Song 1, Eric Anderson, Matisse Wei-Yuan Tu2, Kyle Seyler, Takashi ... In various magnetic heterostructures, spin photovoltaic effects can be realized by different mechanisms. For instance, a spin voltage arises from spin-dependent

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Giant photo-magnetocurrent is observed, which tends to infinity for a small applied bias. Our results pave the way to explore emergent photospintronics by engineering magnetic vdW heterostructures. Spintronics aims at manipulating the spin degree of freedom in electronic systems for novel functionalities (1).

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PHYSICAL REVIEW B105, 054506 (2022) Controlling magnetism through Ising superconductivity in magnetic van der Waals heterostructures Faluke Aikebaier, 1,2 3 * Tero T. Heikkilä,2 and J. L. Lado 1Department of Applied Physics, Aalto University, 00076, Espoo, Finland 2Department of Physics and Nanoscience Centre, University of Jyväskylä, P.O. Box 35, fi-40014 University of ...

In optoelectronics, the generation and control of spins can open up emerging opportunities for spin-optoelectronics, enabling the exploration of new spin photovoltaic effects and spin photocurrents. In various magnetic heterostructures, spin photovoltaic effects can be realized by different mechanisms.

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Magnetic proximity interaction provides a promising route to manipulate the spin and valley degrees of freedom in van der Waals heterostructures. Here, we report a control of valley pseudospin in the WS2/MoSe2 heterostructure by utilizing the magnetic proximity effect of few-layered CrBr3 and, for the first time, observe a substantial difference in valley polarization ...

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Large tunneling magnetoresistance is reported through exfoliated CrI3 crystals and its evolution is attributed to the multiple transitions to different magnetic states, demonstrating ...

Among the tools for band-structure engineering in van der Waals heterostructures are the relative alignment between the neighboring crystals, surface reconstruction, charge transfer, and proximity effects (when one material can borrow the property of another by contact via quantum tunneling or by Coulomb interactions).

Spin photovoltaic effect in magnetic van der waals heterostructures

In various magnetic heterostructures, spin photovoltaic effects can be realized by different mechanisms. For instance, a spin voltage arises from spin-dependent excitation at the interface of a nonmagnetic metal in close proximity to a magnetic insulator (2).

Figure 1.2. Van der Waals heterostructures. (a) Assembly of different 2D materials where the constituent layers are held together by van der Waals forces. The resulting van der Waals heterostructure is analogous to the building of LEGO blocks. (b) Moiré superlattice of magic-angle twisted bilayer graphene. Reproduced from reference22 with ...

the demonstration of van der Waals heterostructures that com-bine them with nonmagnetic 2D crystals [6,7], motivate the present work. Specifically, there are now several experimental papers exploring the spin proximity effects induced by van der Waals ferromagnetic insulators on nonmagnetic 2D crystals,

The conventional spin proximity effect is normally pictured in terms of a small spin splitting of the bands of a nonmagnetic material, due to exchange coupling to a ferromagnet. In this work, the authors show a different type of proximity mechanism, where only one spin channel in the nonmagnetic material becomes strongly hybridized with the ferromagnet, whereas the ...

Magnetic proximity enabled bulk photovoltaic effects in van der Waals heterostructures Xingchi Mu, Qianqian Xue, Yan Sun, ... deformation, or electric bias have been developed. In this paper, we suggest that the magnetic proximity effect via van der Waals (vdW) interfacial interaction, a contact-free strategy, also breaks the centrosymmetry and ...

Magnetic multilayer devices that exploit magnetoresistance are the backbone of magnetic sensing and data storage technologies. Here, we report multiple-spin-filter magnetic tunnel junctions (sf-MTJs) based on van der Waals (vdW) heterostructures in which atomically thin chromium triiodide (CrI 3) acts as a spin-filter tunnel barrier sandwiched between graphene contacts.

The bulk photovoltaic (BPV) effect, a second-order nonlinear process that generates static current under light irradiation, requires centrosymmetric broken systems as its application platform. To realize measurable BPV photocurrent in spatially centrosymmetric materials, various schemes such as chemical doping, structural deformation, or electric bias have been ...