

The shift-current photovoltaics of group-IV monochalcogenides has been predicted to be comparable to those of state-of-the-art Si-based solar cells. However, its exploration has ...

Shift current is a steady-state photocurrent generated in non-centrosymmetric single crystals and has been considered to be one of the major origins of the bulk photovoltaic effect. The

Shift current bulk photovoltaic effect in polar materials--hybrid and oxide perovskites and beyond Liang Z Tan 1, Fan Zheng, Steve M Young 2, Fenggong Wang 1, Shi Liu 3 and Andrew M Rappe 1

Shift Current photovoltaic effect Sean Raglow December 12, 2020 Abstract The bulk photovoltaic effect (BPVE) is a nonlinear optical effect that generates photocurrents in materials with broken inversion symmetry without the presence of an external dc electric field. This effect has garnered interest due to its potential applications in highly efficient

While the basic principles of conventional solar cells are well understood, little attention has gone towards maximizing the efficiency of photovoltaic devices based on shift currents. By analysing effective models, here we outline simple design principles for the optimization of shift currents for ...

Design principles for shift current photovoltaics Ashley M. Cook,^{1,2} Benjamin M. Fregoso, ¹Fernando de Juan, and Joel E. Moore^{1,3} ¹Department of Physics, University of California, Berkeley, California, 94720, USA ²Department of Physics, University of Toronto, CAN ³Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720 ...

The ultrafast evolution of the shift current in a prototypical ferroelectric semiconductor antimony sulfur iodide (SbSI) is observed by detecting emitted terahertz electromagnetic waves. Significance Shift current is one of the bulk photovoltaic phenomena in the materials without inversion symmetry, originating from the geometric Berry phase of the ...

Shift current is the dominant dc-current response in the bulk photovoltaic effect (BPVE), which is the conversion of solar energy into electricity in the materials with broken ...

28 Using the shift current theory, we successfully predict short circuit photocurrent direction, 29 magnitude, and spectral features, demonstrating that shift current dominates the ...

We theoretically study the current-voltage relation, the I - V characteristic, of the photovoltaics due to the shift current, i.e., the photocurrent generated without the external dc electric field in noncentrosymmetric crystals through the Berry connection of the Bloch wave functions. We find that the I - V characteristic and shot noise are controlled by the difference ...

Shift current photovoltaics

The shift current photovoltaics of group IV monochalcogenides have been predicted to be comparable to those of state-of-the-art Si-based solar cells. However, its exploration has been prevented from the centrosymmetric layer stacking in the thermodynamically stable bulk crystal. Herein, we stabilized the noncentrosymmetric layer stacking of tin ...

photovoltaic effect by revealing the complete quantum geometric meaning of the second-order optical conductivity tensor. The bulk photovoltaic effect has two origins, which are the transition of electron ... called the shift current and the injection current. Based on an analysis of two-band models, we show that the injection current is ...

Shift current is a steady-state photocurrent generated in non-centrosymmetric single crystals and has been considered to be one of the major origins of the bulk photovoltaic effect. The mechanism of this effect is the transfer of photogenerated charges by the shift of the wave functions, and its amplitude is closely related to the polarization ...

In this review article, we discuss the bulk photovoltaic effect (BPVE), in particular, the shift current mechanism, which has a number of advantages over traditional p-n junction ...

Given these numbers, our work is a sign that shift current photovoltaics capable of surpassing conventional solar cells may be close at hand, and a push to investigate their full potential using methods discussed in this work--along with established techniques--is warranted. We believe that the simple principles derived in our work will serve ...

I V characteristics of shift current photovoltaics | In the experimental setup to measure shift current, an electrical circuit is formed by attaching two electrodes to the crystal and including resistors as shown in Fig. 1(a). The relationship between the voltage between the two electrodes and the current owing through the crystal is

The shift current j_{sh} is caused by the displacements of electrons in real space on quantum transitions ... M. et al. Shift current photovoltaic effect in a ferroelectric charge-transfer complex. Nat.

Shift current bulk photovoltaic effect influenced by quasiparticle and exciton Ruixiang Fei,¹ Liang Z. Tan,² and Andrew M. Rappe¹, ¹Department of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6323, USA ²Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, California 94720, United States We compute the shift ...

Shift current photovoltaic devices are potential candidates for future cheap, sustainable, and efficient electricity generation. In the present work, we calculate the solar ...

We compute the shift-current bulk photovoltaic effect (BPVE) in bulk BaTiO_3 and two-dimensional monochalcogenide SnSe considering quasiparticle corrections and exciton effects. We

Shift current photovoltaics

explore changes in shift-current peak position and magnitude reduction due to band renormalization. For BaTiO₃, we demonstrate that shift current reduces ...

This work uses a simple design principles approach to identify two classes of shift current photovoltaics, ferroelectric polymer films and single-layer orthorhombic monochalcogenides such as GeS, which display the largest band edge responsivities reported so far. While the basic principles of conventional solar cells are well understood, little attention has gone towards ...

The bulk photovoltaic effect (BPVE) rectifies light into the dc current in a single-phase material and attracts the interest to design high-efficiency solar cells beyond the pn junction paradigm.

The shift-current photovoltaics of group-IV monochalcogenides has been predicted to be comparable to those of state-of-the-art Si-based solar cells. However, its exploration has been prevented from the centrosymmetric layer stacking in the thermodynamically stable bulk crystal. Herein, the non-centrosymmetric layer stacking of tin sulfide (SnS ...

Shift current photovoltaic devices are potential candidates for future cheap, sustainable, and efficient electricity generation. In the present work, we calculate the solar-generated shift current and efficiencies in 326 different 2D materials obtained from the computational database C2DB.

No eLetters have been published for this article yet. Science The quantum phenomenon of shift photovoltaic current was predicted decades ago, but this effect was never observed directly because shift and ballistic currents coexist. The atomic-scale relaxation...

Here, we report a facile, direct-current, steady-state method for unambiguous determination of shift by means of the simultaneous measurements of linear and circular bulk photovoltaic ...

Nature Communications 8, Article number: 14176 (2017) Cite this article While the basic principles of conventional solar cells are well understood, little attention has gone towards maximizing the efficiency of photovoltaic devices based on shift currents.

In a number of recent experimental works (18 - 24), it has been reported that the shift mechanism may be responsible for any photovoltaic current in a crystal lacking inversion symmetry and may account for enhanced BPE (25, 26) and even anomalously large carrier collection length arising from local excitation (23, 24, 27).

We calculate the bulk photovoltaic response of the ferroelectrics BaTiO₃ and PbTiO₃ from first principles by applying the "shift current" theory to the electronic structure from density functional theory. The first principles results for BaTiO₃ reproduce experimental photocurrent direction and magnitude as a function of light frequency, as well as the ...

Shift current photovoltaics

identify two new classes of shift current photovoltaics, ferroelectric polymer 1ms and orthorhombic monochalcogenides, both of which exhibit peak photoresponsivities larger than predictions ...

Design principles for shift current photovoltaics Ashley M. Cook^{1,2,*}, Benjamin M. Fregoso^{1,*}, Fernando de Juan¹, Sinisa Coh^{1,w} & Joel E. Moore^{1,3} While the basic principles of conventional solar cells are well understood, little attention has gone towards maximizing the efficiency of photovoltaic devices based on shift currents.

of the bulk photovoltaic effect with shift current makes it clear that there is no direct, mechanistic dependence of response on material polarization, as is the case for many mechanisms to which photovoltaic effects in ferroelectrics have been attributed. However, shift current requires bro-

In this paper, I aim to describe the origins of the shift current photovoltaic effect, and demonstrate the process for calculating its photoresponsivity for a simple tight binding model of the 2D ...

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