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Stuttgarter Physikalisches Kolloquium

Max-Planck-Institut für Festkörperforschung
Max-Planck-Institut für Intelligente Systeme
Fachbereich Physik, Universität Stuttgart

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Hybrid login data will be announced by email and on the colloquium webpage.

Dienstag, 19. April 2022	16.15 Uhr	Hörsaal 2D5

Stuttgarter Max-Planck-Institute, Heisenbergstraße 1, 70569 Stuttgart-Büsnau

New Directions in Layered, Anisotropic Materials

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Abstract

Abstract: Layered and 2D materials are currently one of the most well-studied classes of solid-state compounds, due to the plethora of unique physical phenomena found in these materials coupled with advances in the characterization of structure and properties down to the single layer scale. Here, we will describe our recent work in the synthesis, properties, and applications of layered materials that exhibit n-type conduction and p-type conduction simultaneously across different crystallographic directions. Recently, we discovered that $NaSn_2As_2$, an exfoliatable 2D van der Waals material, simultaneously exhibits p-type conduction along the in-plane direction and n-type behavior along the cross-plane direction, a phenomenon we define as “goniopolarity”. We will establish the origin of this exotic behavior and the chemical design principles for creating new goniopolar materials, which has allowed us to expand experimentally the number of known materials with this phenomenon. Finally, considering that most modern electronic devices require the integration of p-type and n-type regions for functionality, goniopolar materials have the potential to overcome specific inefficiencies and limitations with existing technologies. In particular, we show with Re_4Si_7 that goniopolar materials can be used to create a new class of thermoelectric devices called transverse thermoelectrics, which completely avoid the Achilles heel of traditional longitudinal thermoelectric devices – the hot side contacts.