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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 e-mail and on the colloquium webpage.

Dienstag, 10. Januar 2023 | **16.15 Uhr** | **Hörsaal 2D5**

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

Design and construction of a new nickelate superconductor

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Abstract

Since the discovery of high-temperature superconductivity in copper oxide materials, there have been sustained efforts to both understand the origins of this phase and discover new cuprate-like superconducting materials. One prime materials platform has been the rare-earth nickelates; indeed, superconductivity was recently discovered in the doped compound $Nd_{0.8}Sr_{0.2}NiO_2$. Undoped $NdNiO_2$ belongs to a series of layered square-planar nickelates with chemical formula $Nd_{n+1}Ni_nO_{2n+2}$ and is known as the 'infinite-layer' ($n = \infty$) nickelate. Here, we report the synthesis of the quintuple-layer ($n = 5$) member of this series, $Nd_6Ni_5O_{12}$, in which optimal cuprate-like electron filling ($d^{8.8}$) is achieved without chemical doping. We observe a superconducting transition beginning at ~13 K. Electronic structure calculations, in tandem with magnetoresistive and spectroscopic measurements, suggest that $Nd_6Ni_5O_{12}$ interpolates between cuprate-like and infinite-layer nickelate-like behavior. By engineering a distinct superconducting nickelate, we identify the square-planar nickelates as a new family of superconductors that can be tuned via both doping and dimensionality.