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Ultrafast electron dynamics of the correlated Dirac semimetal BaNiS2

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The existence of Dirac cones in the electronic band structure of a material is recognized as a possible hallmark of the proximity to a topological state. We unveil the existence of robust two-dimensional Dirac cones at the Fermi level in BaNiS2, the metallic precursor of the Mott transition in BaCoxNi1-xS2. The Dirac cones are made of nickel d-orbitals and emerge as a result of the strong hybridization with the ligand p-orbitals of the sulfur atoms. The C_2v symmetry along some k-points line protects the crossing points. The d-orbital nature of the Dirac cones in the BaNiS2 makes this compound an ideal platform to explore the effects of strong electronic correlation in Dirac and topological materials.

We also present the out-of-equilibrium dynamics of the Dirac fermions in BaNiS2. By means of time- and angle-resolved photoelectron spectroscopy (tr-ARPES) and time-resolved reflectivity (tr-Ref) measurements, we observed an ultrafast and non-thermal renormalization of the Dirac cone. This phenomenon is purely provoked by the electronic excitation and is stabilized by the interplay between the electrons and phonons. Our results underline the importance of the orbital filling and electron-phonon coupling as well as the strong effect of the selective orbital excitation in the ultrafast electron dynamics of correlated Dirac semimetals.

Choix de session parallèle

3.3 Propriétés remarquables des matériaux topologiques : de la théorie à la réalisation expérimentale

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