Tuning topological Dirac states using correlated *d*-electrons

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The topological properties of Dirac fermions lead to unique physical phenomena combined with extremely high charge mobilities, which suggests novel concepts of electronic devices. One prerequisite of these developments is the manipulation of the position and of the filling of Dirac bands, which is very challenging in the solid state and previous reports are very limited as they are either theoretical [1,2] or experimental in optical lattices [3].

Here we show that an effective tuning of these bands may be achieved in the quasi-2D Mott system $BaNiS_2$, where the nonsymmorphic symmetry and the inherent correlated properties of *d*-electrons lead to the formation of Dirac points whose location in *k*-space can move along the □-M symmetry line, instead of being pinned at symmetry points, as commonly found in graphene and other Dirac materials.

By means of ARPES supported by *ab initio* calculations, we show that both the *k*-position and dispersion of these Dirac bands can be tailored using a variety of control parameters: **i)** a partial substitution of Ni for Co [4], which controls the strength of the electronic correlations and the Mott transition; **ii)** the carrier density induced by K ad-atoms deposited onto the surface [5]; **iii**) femtosecond light pulses that induce out-of-equilibrium electronic states [6].

In this seminar, we shall present and discuss these results which indicate that $BaNiS_2$ is a model system to test the possibility of engineering Dirac states at surfaces, interfaces and heterostructures and also to explore the effects of electronic correlations on the topological properties of materials.

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