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Band structure engineering with tailored light fields

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The structure and electronic properties of a solid are determined by the deepest minimum on its potential energy surface. To date there are different well established means to shape the potential energy surfaces and thereby control the electronic properties such as varying the chemical composition of a material, changing the temperature, or applying strong magnetic fields. The development of strong-field laser pulses with tunable photon energy has opened up an alternative pathway for electronic structure control. Depending on their photon energy these light pulses can couple to different degrees of freedom of the solid and, e.g., resonantly excite electronic transitions or lattice vibrations. If the scattering time of the Bloch electrons in the solid is long compared to the inverse driving frequency, laser pulses can also be used to coherently modulate the momentum of the Bloch electrons.

I will show that all of these excitation schemes can be exploited for electronic structure control of different low-dimensional solids. For this purpose we combine tunable wavelength excitation with a time- and angle-resolved photoemission (tr-ARPES) probe at extreme ultraviolet (XUV) wavelengths to gain access to the band structure of different photo-excited solids across the whole first Brillouin zone and beyond. I will show how photo-doping across the charge density wave (CDW) band gap in one-dimensional indium wires results in an ultrafast insulator-to-metal phase transition [1,2], how resonant excitation of the in-plane bond stretching phonon in bilayer graphene enhances the electron-phonon coupling in the material [3,4], and how coherent modulation of the Bloch electrons'momenta can result in light-induced topological phase transitions.

[1] M. Chávez-Cervantes, R. Krause, S. Aeschlimann, and I. Gierz, Phys. Rev. B 97, 201401(R) (2018)

[2] M. Chávez-Cervantes, G. E. Topp, S. Aeschlimann, R. Krause, S. A. Sato, M. A. Sentef, and I. Gierz, arXiv:1810.09731

[3] I. Gierz et al., Phys. Rev. Lett. 114, 125503 (2015)

[4] E. Pomarico et al., Phys. Rev. B 95, 024304 (2017)

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