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Optical Stark effect in a layered semiconductor

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The fundamental and technological interest to get access to coherence, for instance, to have a dissipation-less electronic process, was the driving force in investigating, understanding, and controlling the coherent quasiparticle interaction in condensed matter. In semiconductors, when the laser photon energy is quasi-resonant with an optical transition, the photon-dressed Floquet states are formed instantaneously. The newly-formed states interact repulsively with the original ones. This results in a transient energy shift of the electronic levels, which is a fingerprint for the coherent light-matter interaction in electronic systems. This effect is called Stark Optical Effect (OSE). In semiconductors, the OSE can also modulate the excitonic resonance with a decoherence time up to tens of fs. Usually, the decoherence time is limited by the electron-electron interaction and electron-phonon scattering, making the observation of OSE in semiconductors difficult. Here, I will show low temperature and resonant transient reflectance measurements on the layered semiconductor bismuth tri-iodide to get access to the OSE in this layered material. Pumping resonant with the excitonic resonance and at low temperature, the changes observed in the spectral map could be ascribed to the coherent light-matter interaction, due to the suppression of the scattering channels with free carrier and incoherent phonon.

PhD Seminar

8th February 2023
Sala Riunioni S5, 16.00
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