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Studying phonons and electrons in 2D materials by resonance Raman spectroscopy.

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Electron-phonon (el-ph) scattering processes in 2D heterostructures can emerge from the coupling of atomic layers and are essential for describing their physical properties. The additional possibility of controlling the twisting angle between layers opens new possibilities for tunable devices. Raman spectroscopy is a fundamental tool to investigate el-ph interactions, and the use of multiple laser energies allows the study of the resonance mechanisms. In this seminar I will first present Raman results in samples of twisted bilayer graphene (TBG) with different twisting angles and measured using many different laser lines. Results reveal that there are two different resonance processes: the intralayer process, where the el-ph scattering occurs in a single graphene layer and the other layer imposes a periodic potential that scatters the electron, and the interlayer el-ph process, where the scattering occurs between states in the Dirac cones of adjacent graphene layers. [Eliel et al., Nature Comm. 9, 1221 (2018)]. I will then present a multiple excitation Raman study in a single atomic layer of MoS2, which is a semiconducting 2D material, where we could evidence electron scattering processes by acoustic phonons between different valleys in the electronic structure [Carvalho et al. Nature Comm. 8, 14670 (2017)]