FACOLTÀ DI SCIENZE MATEMATICHE, FISICHE E NATURALI
DIPARTIMENTO DI MATEMATICA E FISICA "NICCOLÒ TARTAGLIA"
I-LAMP - INTERDISCIPLINARY LABORATORIES FOR ADVANCED MATERIALS PHYSICS

Non-equilibrium optical processes in 2D semiconductors and related heterostructures

Interviene

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Abstract

Transition metal dichalcogenides (TMD) are semiconductors exhibiting a transition from indirect to direct bang gap structure when are thinned to a single layer (1L). This property combined with a strong light matter interaction, enhanced by many-body effects, make semiconducting 1L-TMDs forefront materials in the field of electronics, optoelectronics, photonics and energy harvesting research. In addition to that, 1L-TMDs are an ideal platform to study exciton physics even at room temperature: the strong quantum confinement effect and the reduced Coulomb screening, have a deep impact on the 1L-TMD optical response which is dominated by excitons characterized by large binding energy. Moreover, the lower energy excitons are formed at K and K' valley at the edge of the Brillouin zone and they can be optically addressed by circular polarized light opening up tantalizing possibilities for valleytronics and spintronics applications.
In my talk, I will report on the non-equilibrium optical response of such materials by optical pump-probe spectroscopy[1]. In the first part of the talk, I will mainly focus on spin/valley polarization in 1L-TMDs and how it is affected by inter- and intra-valley relaxation processes[2,3].
The second part of the talk will be dedicated to the study of exciton and charge transfer dynamics in heterostructures realized by vertically stacking two layers of different two-dimensional materials[4,5].

[1] C. Trovatello et al. Nat. Commun. 11, 5277 (2020)
[2] S. Dal Conte et al. Phys. Rev. B 92, 235425 (2015)
[3] Z. Wang, et al. Nano Lett. 18, 6882 (2018)
[4] Z. Wang, et al. Nano Lett. 21, 5, 2165−2173 (2021)
[5] Policht et al. Nano Lett. 21, 11, 4738−4743 (2021)

Seminario

Martedì 16 novembre
Aula 16, ore 11:30
Via Garzetta 48, Brescia

UNIVERSITÀ CATTOLICA del Sacro Cuore