Spatially resolved coherent spectroscopy of lamellar nanosystems

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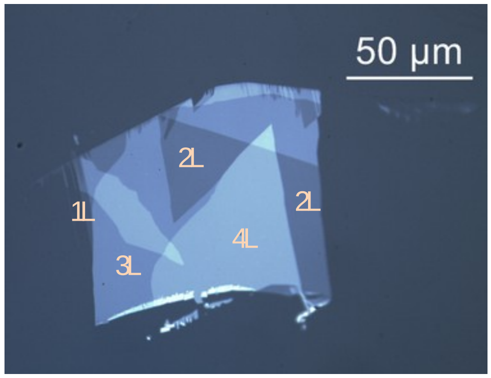

Research in the field of nanophysics is motivated by the possibility to control physical, optical and electronic properties of nanostructures in order to use them in future electronic devices. In particular, one could take advantage of the quantum behavior of single nano-objects to implement quantum information and quantum computing. Ultrafast spectroscopy is a powerful tool to measure the lifetime of charges and spins in semiconductor nanostructures. Moreover, it allows to optically create coherent superposition of quantum states and to measure their evolution. Because of sample spatial inhomogeneities, the subtle properties of nanostructure are only revealed at the micrometric scale. We plan to perform non-linear time and spatially resolved spectroscopy in order to study coherent optical properties of nano-objects which exhibit unique electronic and optical properties, and can be integrated in nano- and micro-optoelectronic devices, such as two dimensional graphene like semiconductors:

Layered metal chalcogenides such as MoS_2 represent a class of atomically thin two dimensional crystals materials offering a broad range of exciting fundamental and applied perspectives. In particular, due to strong spin-orbit interaction and to the lack of inversion symmetry, it is possible, in MoS_2, to optically create electrons in specific valleys of the reciprocal space by using circularly polarized light. We are strongly interested in the optical creation and manipulation of coherent superpositions of valley states for potential applications in quantum information and quantum computing.

The PhD student will be fully involved in the development of pump-and-probe four wave mixing experimental set-up: We aim at mapping the changes of the nonlinear response and the dynamics on a spatial scale that overpass the diffraction limit. That setup is based on the spatially structured illumination of the sample.

Required profile : Solid knowledge of quantum mechanics and/of optics. Strongly self-inclined towards experimental work.