Phd Course: Physics and Nanoscience, curriculum Pyhysics (code 8666)
One position available.

Tutor:
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Research Line
Quantum Materials Theory.

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Proposed Research themes :

1. Effects of electron-phonon interactions in multiferroics

Description:
Multiferroics are functional materials that host multiple orders, for example, ferroelectricity and magnetism. They hold a promise to revolutionize information storage by combining magnetic storage and electric writing and readout. The key to this goal is in achieving strong interactions between these orders, that is, between structural and electronic degrees of freedom. The project will combine phenomenological theory and first-principles calculations to investigate the effects of these interactions on magnetoelectricity, non-reciprocal optical effects and magnetoelectric switching. The results are expected to be important for understanding ultrafast physics in multiferroics, the area that is rapidly developing at the moment. We will also study the implications for materials for optoelectronics, in collaboration with active experimental effort at the Institute.

2. Functional devices based on domain walls

Description:
Ferroelectric and other structural domain boundaries are natural 2D objects that are easy to tailor. Although atomically thin, they host a wealth of useful functionalities, for example, current rectification and microwave signal transmission and splitting were experimentally demonstrated. Our group combines field theory methods and atomistic simulations to address important questions at the forefront of this exciting field. The topics include electronic structure and localized excitations at domain walls, emergent phenomena, domain wall-based magnetoelectric effects and switching in multiferroics. The activities involve collaborations with top experimental groups in the field.