Electronic properties of nickelate-based heterostructures

Marta Gibert

*Physics-Institut, University of Zurich, Switzerland*

Perovskite nickelates (\(RNiO_3\), \(R=\text{rare earth}\)) display a textbook example of bandwidth-controlled metal-to-insulator transition (MIT), with the insulating ground state also characterized by an unusual antiferromagnetic order. In this presentation, I will show how nickelate heterostructures allow for a variety of strategies to control the electronic transitions of these compounds. Tuning of the MI and Néel transitions is efficiently achieved in nickelate thin films over a wide temperature range by epitaxial strain or selected growth directions. \(\text{NdNiO}_3/\text{SmNiO}_3\) superlattices display a single or a double MIT depending on the structure wavelength. When grown as ultrathin film, even \(\text{LaNiO}_3\) undergoes a MIT as the thickness is reduced and it also shows a surprising conductivity enhancement for films of intermediate thickness. I will also report on how interface engineering can be used not only to induce a new magnetic phase in the otherwise non-magnetic \(\text{LaNiO}_3\) but also to generate rich and complex magnetic behaviour in (111)-oriented \(\text{LaNiO}_3/\text{LaMnO}_3\) heterostructures. For 7-monolayer-thick \(\text{LaNiO}_3/\text{LaMnO}_3\) superlattices, the emergence of negative and positive exchange bias is observed at low temperature before the stabilization of an antiferromagnetically-coupled state between the \(\text{LaMnO}_3\) layers.