Electronic properties of nickelate-based heterostructures

Marta Gibert

Physics-Institut, University of Zurich, Switzerland

Perovskite nickelates (*R*NiO_3, *R*=rare earth), with the exception of $LaNiO_3$, 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. $NdNiO_3/SmNiO_3$ superlattices display a single or a double MIT depending on the structure wavelength. When grown as ultrathin film, even $LaNiO_3$ 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 $LaNiO_3$ but also to generate rich and complex magnetic behaviour in (111)-oriented $LaNiO_3/LaMnO_3$ heterostructures. For 7-monolayer-thick $LaNiO_3/LaMnO_3$ superlattices, the emergence of negative and positive exchange bias is observed at low temperature before the stabilization of an antiferromagnetically-coupled state between the $LaMnO_3$ layers.