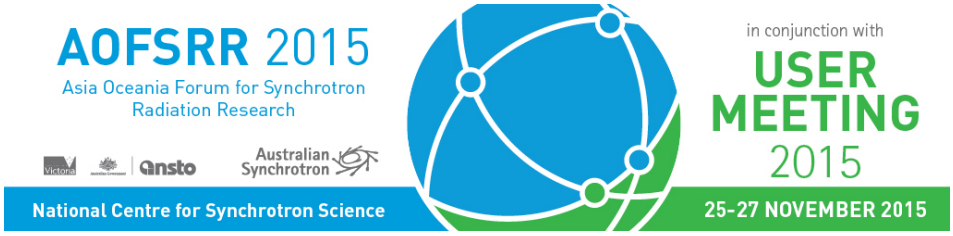

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Unraveling how electronic and spin structures control macroscopic properties of manganite ultra-thin films

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Perovskite manganites exhibit fascinating transport and magnetic properties. With the development of thin film technologies, more exotic properties have been observed in doped-manganites over a wide range of temperatures. Unraveling the interplay of spin, charge and orbital degrees of freedom that drives exotic, macroscopic properties is therefore crucial for the understanding of strongly correlated electron systems. Using a combination of transport, spectroscopic ellipsometry, X-ray absorption spectroscopy and X-ray magnetic circular dichroism, we observe two concomitant electronic and magnetic phases (insulating paramagnetic phase for T~195 K and insulating cantedferromagnetic for T~140 K) with an intermediate metal-like state in ultra-thin La0.7Sr0.3MnO3 (LSMO) film on DyScO3 substrate. Surprisingly, the O2p-Mn3d hybridization strength reduces with decreasing temperature, driving the system more insulating and ferromagnetic. The Jahn–Teller effect weakens markedly within the intermediate temperature range, making the system more metal-like. We also apply this comprehensive method to a LSMO film on SrTiO3 substrate. We find strong electron-electron and electron-hole interactions manifested in Wannier-like exciton and high-energy resonant excitons in SrTiO3 strongly influences physical properties. I will introduce fascinating phenomena of high-energy optical conductivity in correlated electron system, using the case of LaAlO3SrTiO3 heterostructure in which different mechanisms for the polarization divergence compensation in insulating and conducting interfaces are found.

Keywords

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