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Dimensionality effects and phase transition dynamics in spintronics materials as seen by X-ray electron spectroscopies

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Hole-doped rare-earth manganites, like La0.66Sr0.33MnO3 (LSMO), display peculiar phenomena such as colossal magnetoresistance and half-metallicity, originating from the competition between charge, spin, and orbital order parameters [1]. Optimally doped LSMO thin films can be used to realize fully spin polarized currents (the spin polarization at the Fermi level reaches about 100% for T<TCurie [2]), a feature which, combined with the ferromagnetic order that persists up to about 350 K [3] render such system a most technologically attractive material for spintronics. . Hard X-ray PhotoElectron Spectroscopy (HAXPES) extends the probing depth of PES to the bulk of the solid (tens of nm), and therefore does not suffer of the modification induced by the surface electronic relaxation, revealing specific bulk-only features responsible of electron and metallic properties [4,5]. Furthermore, pump-probe HAXPES experiments reveal spin-dynamics extending up to several hundreds of picoseconds after the IR pumping. By comparison with all-optical techniques we are able to attribute the observed quenching to a collapse of magnetic order related to double exchange and half-metallicity of the system [6].
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Summary

Topic

1. Nanomagnetism and Spintronics

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