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Bilayer manganites: a playground for magnetoresistance, charge density waves and spin reorientation transitions[1]

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Manganites are perovskite structures that were rediscovered in 1994 with the report of a thousand-fold change in resistance upon the application of a magnetic field. This "colossal magnetoresistance" is due to a transition between a paramagnetic insulator phase and a ferromagnetic metallic phase. The complex phase diagram of these pseudocubic compounds results in a plethora of interesting phenomena that have been studied intensively for the last 14 years. A newer class of manganites has a bilayer structure that exhibits more complicated ferromagnetic ground states as a function of the hole doping x, because of the two dimensionality of the system. For example, in single crystals of $La_{2-2x}Sr_{1+2x}Mn_2O_7$ the spins can arrange themselves ferromagnetically or antiferromagnetically, and with easy axes parallel of perpendicular to the bilayer, as the doping x ranges from 0.30 to 0.50. For x=0.32 this transition occurs as a function of temperature as we have observed directly with magnetic force microscopy. We have also observed a charge density wave in this compound using scanning tunneling microscopy.

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