Investigation of the Magnetic Structure OKand Electronic Properties of Mn oxypnictides

Description: The electronic and magnetic properties of transition metal oxides have been widely investigated as a result of the array of outstanding functional properties discovered. High temperature superconductivity (HTSC) in copper oxides and colossal magnetoresistances (CMR) in manganite perovskites are two particularly important phenomena that have been extensively studied. The recent report of high temperature superconductivity in oxyarsenides such as $LnFeAsO_{1-x}F_x$ with superconducting transition temperatures (T_cs) up to 55 K has led to a rapid expansion in the research of oxypnictide materials. We have recently discovered a new mechanism of colossal magnetoresistance (CMR) in the Mn^{2+} analogue $NdMnAsO_{1-x}F_x$ (x = 0.05-0.08). A negative magnetoresistant material exhibits a large reduction in electronic resistivity upon application of a magnetic field. Magnetoresistance, MR, is defined as MR = $((\rho_H-\rho_0 \rho/)_0)$, where ρ_0 and ρ_H are equal to the resistivity in zero and applied field respectively. Magnetoresistant materials are of technological importance and are applied in magnetoresistive sensors and spintronic devices.

In this PhD project the effect of anion doping ($P^{3--} \leftrightarrow As^{3-}$) on the colossal magnetoresistance of $NdMnAsO_{0.95}F_{0.05}$ will be investigated. The synthesis of novel more complex Mn oxypnictides will also be performed with the aim of discovering new properties such as superconductivity and interesting magnetism. Materials will be synthesised via solid state chemistry and characterised by X-ray and neutron diffraction, SQUID magnetometry, (magneto)resistivity measurements, electron microscopy and thermal measurements.