Investigation of Spin Dynamics in the *E-type* Antiferromagnetic Ground State of Mn-doped $Sr_3Ru_2O_7$

The aim of this proposal is to perform an inelastic neutron scattering (INS) investigation of $Sr_3(Ru_{1-x}Mn_x)_2O_7$ (x = 0.16)) single crystal using 7 days of beam time at the BT-7 Double Focusing Triple-Axis Spectrometer T7 in order to characterize the spin dynamics of this system. We have already completed an extensive elastic neutron scattering study for this doping level by using the awarded beam time [the result has been published in Phys. Rev B, Rapid Comm. **85**, 180410(R) (2012)]. Our investigation revealed the ground state of this system to have a Mn-induced unusual spin arrangement: *single-bilayer E-type antiferromagnetic (AFM) order*---a quasi 2D spin structure. However, the AFM order parameter, i.e. the staggered magnetization, cannot be described by the standard 2D magnetic phase transition picture. Understanding of the anisotropic spin-spin couplings and unusual electronic properties in this unique system can only be achieved by a comprehensive study of spin dynamics. Some preliminary INS results at measured at BT7 before shows unusual spin dynamics in this quasi-2D AFM ground state.

Scientific Background

The material reported in this investigation belongs to the much-studied Ruddlesden-Popper (RP) series $Sr_{n+1}Ru_nO_{3n+1}$, where n is an integer [1]. The RP series displays an abundant array of physical phenomena (as n changes) such as metallicity, spin-orbital ordering, and exotic superconductivity, all of which have re-fueled the interest in these and related ruthenates among the scientific community. To illustrate this, we have for example, the ($n=1$) member of the series and parent compound Sr_2RuO_4, which displays characteristics of both a paramagnetic Fermi liquid and of an unconventional spin-triplet

any) ordered moment in the SRO 327 system. In contrast to the latter, two independent inelastic neutron scattering studies on the same parent compound