Magnetic Field Induced Phases of the Strontium Ruthenates

RAJEEV GUPTA, MINJUNG KIM, HARINI BARATH, S. LANCE COOPER, Dept. of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois, GANG CAO, Dept. of Physics, University of Kentucky — Magnetic-field- and temperature-dependent Raman scattering has been used to investigate the magnetic-field-induced structural and magnetic phases of the triple-layer ruthenate system Sr$_4$Ru$_3$O$_{10}$ (Sr4310), which is a low temperature ferromagnet with $T_C =$ 105 K. Magnetic-field-induced changes in the phonon spectra reveal dramatic spin-reorientation transitions and strong magnetoelastic coupling in this material. Further, the highly anisotropic field-induced effects observed for magnetic fields along the c-axis (magnetic easy axis) and ab-plane provide insight into the complex magnetic and structural (H,T) phase diagram of this material. We compare our magnetic-field dependent Raman results in Sr4310 with those of the quantum-critical bilayer material Sr$_3$Ru$_2$O$_7$, as well as with magnetic and transport measurements of Sr4310.

$^1$Work supported by NSF DMR02-44502 and DOE DEFG02-91ER45439

Rajeev Gupta
Dept. of Physics and Frederick Seitz Materials Research Laboratory
University of Illinois

Date submitted: 23 Nov 2004