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Effects of Doping on the Field-dependent Phases of $Ca_3Ru_2O_7$
J. F. KARPUS, S. L. COOPER, Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois Urbana-Champaign, G. CAO, Department of Physics and Astronomy, University of Kentucky — The double-layer ruthenate $Ca_3Ru_2O_7$ has been shown to possess a rich magnetic-field dependence for fields applied in the a-b plane. In its ground state, $Ca_3Ru_2O_7$ is an antiferromagnetic insulator, turning metallic above $T_{MI} = 48$ K and paramagnetic above $T_N = 56$ K. Light doping with Sr (r = 1.18 Å vs. r = 1.00 Å for Ca) causes a reduction in the anisotropy field due to the change in lattice parameter along the c-axis, thereby giving us a bandwidth control, while doping with trivalent La (r = 1.03 Å) not only alters the bandwidth but also adds an extra electron for filling control. Using Raman scattering we map out the orbital, magnetic, and conducting phases by studying the field- and temperature-dependence of the magnetic and vibrational spectra. In this talk we describe the role Sr- and La- doping has on the field dependent phases of $(Ca,Sr,La)_3Ru_2O_7$. Work supported by NSF DMR02-44502, NSF DMR02-40813, and DOE DEFG02-91ER45439.

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