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Borderline magnetism in $Sr_4Ru_3O_{10}$: Impact of dilute La and Ca doping on itinerant metamagntism and ferromagnetism[1] SHALINEE CHIKARA, V. DURAIRAJ, W.H. SONG, Y.P. SUN, X.N. LIN, A. DOUGLASS, G. CAO, University of Kentucky — The triple-layered $Sr_4Ru_3O_{10}$ features ferromagnetic behavior with Tc=105 K along the c-axis (interlayer) and a first-order metamagnetic transition below 50 K in the basal plane [1]. The coexistence of ferromagnetism and metamagnetism suggests $Sr_4Ru_3O_{10}$ be on the borderline that separates its closest neighbors: the itinerant ferromagnet $SrRuO_3$ and the enhanced paramagnet $Sr_3Ru_2O_7$. We report our results on $Sr_4Ru_3O_{10}$with Sr slightly substituted by La and Ca ions. The La doping drastically changes the magnetic and transport properties. In particular, it effectively suppresses Tc along the c-axis, but simultaneously induces ferromagnetic behavior in the basal plane with Tc=30 K, entirely different from that of the c-axis. Associated with these changes, the metamagnetism disappears in the basal plane but appears along the c-axis. In sharp contrast, the Ca doping significantly enhances the ferromagnetism along c-axis but drastically weakens the magnetic ordering in the basal plane where an unusual $T^{3/2}$-power law for the resisitivity is developed. The vastly different responses to the La and Ca doping, despite similar ionic radii of La^{3+} and Ca^{2+}, highlight the role of the extra electron from the La ion added to the t_{2g} orbitals. [1] G. Cao, et al., Phys. Rev. B **68** 174409 (2003)

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