Ligand Holes: $SrFeO_3$ and $(Ca,Na)_2CuO_2Cl_2$

Mikio Takano

Institute for Chemical Research, Kyoto University, Japan

Fe^{4+}-oxides: $SrFeO_3$ (SFO, cubic perovskite) and $CaFeO_3$ (CFO, orthorhombic perovskite) contain iron in a rare oxidation state of 4+. Fe^{4+} is isoelectronic with Mn^{3+} but their oxides show remarkably different properties. This is basically because the *d* levels of Fe^{4+} are considerably deeper than those of Mn^{3+}: According to a photoelectron spectroscopic study by the Fujimori group, the Fe^{4+} ion should be regarded as a ferric ion accompanied by a ligand hole, $Fe^{3+}\underline{L}$.

The oxygen holes remain delocalized in SFO down to the lowest temperature, while those in CFO begin to be localized below 290 K in such a way as $2Fe^{3+}\underline{L}$ (orthorhombic, metallic) $\rightarrow Fe^{3+} + Fe^{3+}\underline{L}^2$ (monoclinic, semiconductive). These are antiferromagnets but are switchable to metallic ferromagnets chemically and physically. For example, Sr_2FeCoO_6 has a T_C of 340 K and a large spontaneouse moment of 4 μ_B/Fe and 1.8 μ_B/Co. SFO in its pure form becomes ferromagnetic at a pressure of 13 GPa, and $Sr_{2/3}La_{1/3}FeO_3$ (SFO doped with electrons) switches its ground state from a charge-disproportionated antiferromagnetic state to a charge-uniform ferromagnetic state at 25G Pa. The latest experimental results obtained using single crystals and films will be presented.

$(Ca,Na)_2CuO_2Cl_2$: $(Ca,Na)_2CuO_2Cl_2$ is a high-T_C superconductor with the CuO_2 sheets capped with chlorine. For the following reasons that (a) it is easily cleaved, (b) samples in the under-doped region are obtainable, (c) the structure remains simple tetragonal down to the lowest temperature this compound may be an ideal substance for photoemission and STM measurements.

The Na-content can be controlled as a function of pressure (a few GPa) during the crystal growth. Recently, however, samples free from Na and having a higher T_C (38 K) has been prepared. The latest experimental results obtained using these single crystals will be presented.

Spin-Injection into a paramagnetic manganite: If I have time, I shall report on a spin-injection effect in a manganite wire with a ferromagnetic/paramagnetic/ferromagnetic internal structure. Injection of a

spin-polarized current through the wire renders the paramagnetic part ferromagnetic and metallic. The physics here is, we believe, the suppression of spin fluctuation in the paramagnet by the injected spins.