Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Dimensionality switching in electric conduction in FeS TOMOHIRO TAKAYAMA, KOHSHI TAKENAKA, HIDENORI TAKAGI, RIKEN(The Institute of Physical and Chemical Research), also at University of Tokyo and CREST-JST — Orbital degree of freedom plays an essential role in the properties of strongly correlated systems, and will be a key function in the next generation. The orbital state, namely, shape of electron cloud, can affect some macroscopic properties such as transport properties. We have indeed observed a dimensionality change in electric conduction in stoichiometric iron sulfide, FeS, as a consequence of change in orbital states. FeS crystallizes in a NiAs-based troilite structure and is an antiferromagnetic semiconductor below $T_{\rm N} = 600$ K. At $T_s \sim 400$ K, spin-axis transition, the rotation of antiferromagnetically ordered spins of iron atoms, occurs; the spins are directed along c-axis at low temperatures, and they rotate and lie in c-plane at T_s. This transition involves a change in orbital states of Fe^{2+} ions. The outermost electron of Fe^{2+} ions spreads in basal-plane below T_s, while it elongates in c-direction above T_s. This change strongly couples onto the electric conduction and induces its dimensionality change from two-dimensional below Ts to three-dimensional above T_s. We will discuss this change in orbital states and its appearance in electric conduction.

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Date submitted: 30 Nov 2005 Electronic form version 1.4