NORMAL PHASES OF CORRELATED ELECTRONS IN IN V_2O_3 AND Fe_3O_4 SYSTEMS: FERMI LIQUID, METAL-INSULATOR TRANSITIONS AND THE SPIN LIQUID

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We review the electronic properties of V_2O_3 and Fe_3O_4 systems and, in particular, our theoretical interpretation of the observed discontinuous metal-insulator transitions. Emphasis is placed on the correlated nature of electron states, which are described within a parametrized, Hubbard-type of model. The insulator to metal transitions in both systems are regarded as examples of localization-delocalization transformations involving 3d electrons. Both the Fermi liquid close to but below the threshold of the transition to the localized state, as well as the liquid of strongly correlated electrons (the so-called spin liquid) well above this threshold for the Mott-Hubbard localization, are considered. The former is realized in $(V_{1-x}Ti_x)_2O_3$ for $x \gtrsim 0.05$, whereas the latter is manifested in slightly nonstoichiometric magnetite, $Fe_{3(1-\delta)}O_4$. The fundamental questions pertinent to the electronic properties of these systems are reiterated in the concluding portion of this article.