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Two new quantum spin compounds: S=1/2 alternating chain system, high pressure form of $(VO)_2P_2O_7$ and 2D spin trimer compound $La_4Cu_3MoO_{12}$

Masaki AZUMA, Takashi SAITO and Mikio TAKANO

Institute for Chemical Research, Kyoto University, Uji, Kyoto-fu 611-0011, Japan

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Magnetic properties of recently found two quantum spin compounds are discussed. $(VO)_2P_2O_7$, known as a quantum spin chain compound, was found to undergo a structural transition when treated at 2 GPa and 700° C. The high-pressure phase comprises a unique kind of $S = 1/2$ Heisenberg alternating antiferromagnetic chain, in contrast with the ambient pressure phase containing two crystallographically different chains. Magnetic susceptibility, high-field magnetization and inelastic neutron scattering data showed the presence of only one spin gap as expected from the structure. This result confirms the recent assertion based on magnetization and NMR measurements that the two kinds of alternating chains of the AP phase have single independent spin gaps. $La_4Cu_3MoO_{12}$ is a 2D compound with an average structure of $YAlO_3$ type. In the Cu_3MoO_4 layer of this compound, 1/4 of Cu^{2+} (spin-1/2) forming a triangular lattice is replaced with nonmagnetic Mo^{6+} as in the Kagome lattice. However the arrangement of the nonmagnetic ions are different from Kagome. Triangular clusters (trimers) of Cu^{2+} form an orthorhombic sublattice, so there is no frustration between the trimres. Susceptibility data showed that each Cu^{2+} had spin-1/2 above room temperature, but the magnetic moment decreased to spin-1/2 per trimer at lower temperatures because of the strong intra-trimer antiferromagnetic interaction. The moments localized on the trimers got antiferromagnetically ordered at 2.7 K. This ordering was broken by applying a magnetic field higher than 20 T. After the spin flip, the magnetization data showed a plateau at a saturation moment of 1 μ_B per trimer.

KEYWORDS: $S = 1/2$ Heisenberg alternate chain, susceptibility, specific heat, magnetization, spin trimer