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Photoemission study of triangular lattices in $NiGa_2S_4$, $FeGa_2S_4$, and $Fe_2Ga_2S_5$[1] KOU TAKUBO, Department of Physics, University of Tokyo, TAKASHI MIZOKAWA, Dept. of Complexity Science and Engineering, Univ. of Tokyo, YUSUKE NAMBU, KEISUKE ONUMA, HIROSHI TONOMURA, OSAMU SAKAI, SATORU NAKATSUJI[2], YOSHITERU MAENO, Dept. of Physics, Kyoto Univ. — The newly-discovered $NiGa_2S_4$ (Ni^{2+}, S=1) and $FeGa_2S_4$ (Fe^{2+}, S=2) form frozen spin-disordered states within the triangular lattice [1,2]. The spins of both compounds have no long range order even at lowest temperature. We have performed photoemission spectroscopy of $NiGa_2S_4$, $FeGa_2S_4$, and $Fe_2Ga_2S_5$. The photoemission results and subsequent model calculations indicate that the ground state of $NiGa_2S_4$ has the d^9L character (L is a S $3p$ hole) and that the strong S $3p$ hole character of the ground state provides the enhanced superexchange interaction between the third nearest neighbor sites. In contrast, the ground state of $FeGa_2S_4$ is dominated by the d^6 configuration and the superexchange interactions between the second and third neighbor sites are less important. [1] S. Nakatsuji, *et al.*, Science 309, 1697 (2005). [2] S. Nakatsuji, *et al.*, Phys. Rev. Lett. 99, 157203 (2007).

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