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Spin Liquid State of in the $S = 1/2$ Hyper-kagome Antiferromagnet $Na_4Ir_3O_8$[1]

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A new Ir oxide, $Na_4Ir_3O_8$, with a cation-ordered (Ir and Na) spinel structure, was discovered [1]. This compound is an S=1/2 Mott insulator with d^5 (low spin state) Ir4+. As a result of the ordering of Ir and Na within spinel B-sites, magnetic Ir^{4+} ions form a three-dimensional network of corner shared triangles, called hyper-kagome lattice, which provides us with a novel playground for the physics of frustration in S=1/2 hyper-kagome A new Ir oxide, $Na_4Ir_3O_8$, with a cation-ordered (Ir and Na) spinel structure, was discovered [1]. This compound is an $S = 1/2$ Mott insulator with d^5 (low spin state) Ir^{4+}. As a result of the ordering of Ir and Na within spinel B-sites, magnetic Ir^{4+} ions form a three-dimensional network of corner shared triangles, called hyper-kagome lattice, which provides us with a novel playground for the physics of frustration in S=1/2 hyper-kagome antiferromagnet. It may be interesting to infer that hyper-kagome lattice has a chirality. The result of magnetization measurements indicates the presence of strong antiferromagnetic coupling (Curie-Weiss temperature $\theta_{\rm CW} \sim -650$ K) between $S = 1/2$ spins. Nevertheless, we find no evidence for long range magnetic ordering in this $S = 1/2$ hyper-kagome antiferro-magnet at least down to 2 K, apparently due to the presence of geometrical frustration. The absence of long range ordering was firmly established by the persistence of ^{23}Na NMR lines down to 2 K without intensity change [2]. These results strongly suggest that the ground state of this system is a three dimensional $S = 1/2$ spin liquid. Unusual spin excitations of this $S = 1/2$ hyper kagome system will be discussed, based on the specific heat and the NMR data at low temperatures.

[1] Y. Okamoto, M. Nohara, H. Aruga-Katori, and H. Takagi, Phys. Rev. Lett., 99, 137207 (2007).
[2] S. Fujiyama, K. Kanoda, Y. Okamoto, and H. Takagi, in preparation.

[1]Work done in collaboration with Y.Okamoto, S.Fujiyama, M.Nohara, H.Aruga-Katori, and K.Knoda