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Geometric Magnetic Frustration in the Double Perovskites Ba2YMoO6, Ba2YRuO6, and Ba2CaOsO6 studied with neutron scattering and muon spin relaxation[1] J.P. CARLO, Villanova University, J.P. CLANCY, University of Toronto, C.M. THOMPSON, B.D. GAULIN, J.E. GREEDAN, McMaster University — Geometrically frustrated materials, in which the arrangement of ions inhibits the development of magnetic order, has been of substantial interest owing to their rich phase diagrams featuring exotic ground states and emergent properties. Typically associated with triangular or tetrahedral coordination of antiferromagnetically (AF) coupled moments, frustration manifests in a variety of lattices, including spinel, garnet, pyrochlore and Kagome systems. The double perovskites (DPs) $A_2BB'O_6$ also exhibit frustration, with magnetic B' ions comprising a lattice of edge-sharing tetrahedra. DPs can be synthesized with most elements in the periodic table, enabling systematic studies as a function of moment size, lattice distortion, ionic radius and even relativistic spin-orbit coupling. Here we report on neutron scattering and muon spin relaxation measurements of three frustrated DP systems - Ba_2YMoO_6 ($4d^1$ Mo^{5+}), Ba_2CaOsO_6 ($5d^2$ Os^{6+}), and Ba_2YRuO_6 ($4d^3$ Ru^{5+}). Our findings include long-range order with evidence for anisotropy due to spin-orbit coupling in the Ru system, to an exotic gapped state consistent with a spin singlet in the molybdate. These results are compared to other systems and to theoretical expectations.

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