Low-dimensional magnetism in ordered perovskite and Ruddlesden-Popper variants

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Perovskites and their myriad of structural permutations have long been studied for their intriguing properties and interplay of degrees of freedom, both chemical and physical. While generally three dimensional in nature, perovskites can provide multiple means of access to low dimensional properties as well. In this talk, new results in three different directions pertaining to this concept will be presented. The first, most common approach, is the use of the Ruddlesden-Popper and similar phases, which separate perovskite-like layers with interlaced AO layers, rendering them primarily two dimensional. Several new cation-ordered iridate and rhodate Ruddlesden-Popper phases will be presented. The second approach is that of orbital order using Cu$^{2+}$ in the double perovskite structure to yield in-plane only square lattice like magnetic interactions (e.g. Ba$_2$CuWO$_6$). New compounds produced by substitution series and high pressure methods will be shown. The third is that of vacancy ordering. By ordering of vacancies in combination with cation ordering, hexagonal perovskite phases can be reduced to well separated triangular two dimensional magnets with variable spin sizes and frustration. Again, new compounds will be shown. In all three directions, primarily crystallographic and magnetometry data on these new inorganic transition metal oxides will be presented.