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Quasi-One-Dimensional Magnetism in Transition-Metal Antimony and Tantalum Oxides[1] JOHN J. NEUMEIER, AARON B. CHRISTIAN, Montana State University — We have investigated the magnetic properties of transition metal oxides with the chemical formulae $A\mathrm{Sb_2O_6}$ and $A\mathrm{Ta_2O_6}$, where A is a transition metal. The samples are single crystals that are grown using vapor transport or an optical-image furnace. They form layered structures with A-O-O-A chains. The chains lie in the a-b planes of the tetragonal structure. Neighboring chains along the c axis alternate their orientation by 90°. This unusual arrangement leads to poor magnetic coupling between the chains, and quasi-one-dimensional antiferromagnetism. The magnetic ordering is easily destroyed if the magnetic field applied perpendicular to the chains. Since this can only be achieved at most for half of the chains if the field is in the a-b plane, two magnetic ordering temperatures can be observed. One outcome of this is an extremely unusual magnetocaloric effect. If rotated in constant magnetic field, the samples warm and cool. This presentation will discuss the crystal growth, measurements, the thermodynamics of the magnetocaloric effect, and unusual aspects of the physics of low-dimensional systems.

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