Magnetization plateaus in Tb2SrFe2O7

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Magnetically frustrated materials are highly interesting due to the occurrence of unconventional magnetic states, such as spin glasses, spin liquid, spin ice, and the discovery of magnetic monopoles [1-3]. We recently studied a magnetization plateau behavior in a layered perovskite $Tb_2SrFe_2O_7$ and discovered an ordered 2-in-2-out Tb-spin structure, similar to the field-induced ordered spin-ice state [4]. $Tb_2SrFe_2O_7$ has a bilayer perovskite structure ($A_3B_2O_7$) with Tb and Sr both at A-sites alternately ordered along the *c*-axis. Different from the multiferroic $Ca_2SrFe_2O_7$ that hosts the polar crystal structure and also the magnetic ordered state with canted Fe moments, $Tb_2SrFe_2O_7$ has the non-polar structure symmetry of *P*42/*mnm* and the collinear antiferromagnetic structure for the Fe-sublattice below 600 K. The magnetization plateaus were observed below the second magnetic transition at 15 K in $Tb_2SrFe_2O_7$. With the field applied along *c*-axis, three plateaus were observed. Single crystal neutron diffraction revealed that the magnetic transition at 15 K is from magnetic order of Tb-sublattice accompanied with the spin reorientation of Fe-sublattice. It was also proved that the order of 2-in-2-out spin structure is due to magnetic coupling with the Fe-sublattice. In this presentation, I will show the evolution of the spin structure with temperature and magnetic field and disclose the nature of the magnetization plateaus in $Tb_2SrFe_2O_7$.

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