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Orbital order in $BiMnO_3$ and its magnetic consequences

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Epitaxial thin films of perovskite $BiMnO_3$ were synthesized on $SrTiO_3$ substrates, and orbital ordering and magnetic properties of the thin films were investigated. The ordering of the Mn^{3+} e_g orbitals at wavevector $2\pi(1/4,1/4,1/4)$ was proposed and detected by Mn K-edge resonant x-ray scattering. This rather peculiar orbital order, discovered for the first time in manganites, inherently contains magnetic frustration. While bulk $BiMnO_3$ is known to exhibit simple ferromagentism, the frustration enhanced by positive pseudotetragonal strain in the films brings about superparamagnetic characteristics.