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Nonlinear optical imaging of antiferromagnetic domains in orbital-ordered $Pr_{0.5}Sr_{0.5}MnO_3$ thin films KENJIRO MIYANO, NAOKI OGAWA, Univ of Tokyo, CREST, YASUSHI OGIMOTO, Univ of Tokyo, CREST, Fuji Electric HD — Perovskite manganites develop various ordering patterns of charge, orbital, and spin, whose geometrical correlation brings out a new order, e.g., electronic polarization. As an example in pseudo-cubic systems, the CE-type charge/orbital order (CO/OO) was predicted to be multiferroic. With the use of nonlinear optics, we show that $Pr_{0.5}Sr_{0.5}MnO_3$ thin films exhibit symmetry breaking in the OO phase without CO. Ultrathin films prepared on LSAT(110) substrates reproduce bulk-like properties, showing successive phase transitions from paramagnetic metal, to ferromagnetic metal, and finally to A-type antiferromagnetic (AF) insulator upon cooling. Below T_{OO}=T_N, we detect SHG from these films and visualize the formation of AF domains with the size of several μm, which is much larger than that of phase-separated manganites. With careful examination of the magnetic point group, we can ascribe the broken symmetry to the AF spin order under the monoclinic lattice distortion concomitant with the OO, which also manifests the direction of the AF vector.

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