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Structural Control of Magnetic Anisotropy in a Multiferroic $EuTiO_3$ Thin Film J.W. FREELAND, Argonne National Laboratory, X. KE, Oak Ridge National Laboratory, P.J. RYAN, J.W. KIM, J.-H. LEE, Argonne National Laboratory, R. MISRA, P. SCHIFFER, Pennsylvania State University, T. BIROL, C.J. FENNIE, D.G. SCHLOM, Cornell University — Strain control of $EuTiO_3$ has been shown under tensile strain the system converts to a multiferroic ground-state with ferromagnetic and ferroelectric order[1]. Here we present a study of the magnetic order in thin films of $EuTiO_3$ grown on $DyScO_3$(110) substrates by reactive molecular-beam epitaxy (MBE). Neutron scattering and magnetic measurements show the magnetic moment orders with an easy axis along only one of the (110) pseudocubic axis of the unit cell. Such an easy axis is connected to the uniaxial crystal structure that evolves from cubic to tetragonal with octahedral tilting, which agrees well with the strain dependent structure predicted under biaxial tensile strain. The magnetic anisotropy for Eu is attributed to an asymmetric crystal field due to the uniaxial symmetry of the Eu-O coordination. Work at Argonne, including the Advanced Photon, is supported by the U.S. Department of Energy, Office of Science, and Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357. [1] J.-H. Lee et al. Nature **466**, 954 (2010).

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