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Hybrid magnon-phonons in the paraelectric antiferromagnet $EuTiO_3$[1] HUIBO CAO, Oak Ridge National Laboratory, OLIVIER DELAIRE, Duke University, JIAWANG HONG, Beijing Institute of Technology, STEVEN HAHN, SONGXUE CHI, GEORGE EHLERS, DOUGLAS ABERNATHY, ANDREW CHRISTIANSON, JAIME FERNANDEZ-BACA, BRYAN CHAKOUMAKOS, JIAQIANG YAN, BRIAN SALES, Oak Ridge National Laboratory — Magnetic perovskite titanate $EuTiO_3$ has attracted a lot of attentions for its large spin-lattice coupling. It has a number of similarities with the well-studied quantum paraelectric $SrTiO_3$ but a much higher cubic-tetragonal lattice transition at 290 K and an extra magnetic order at 5.5 K. The large difference between $EuTiO_3$ and $SrTiO_3$ has been attributed to the magnetic ion Eu^{2+}, that couples with the structural properties. However the spin-lattice coupling mechanism has not been fully understood yet although many theoretical models have been proposed. We grew a large, high-quality isotopically-enriched $EuTiO_3$ crystal for neutron scattering. The crystal and magnetic structures were calibrated with neutron diffraction at HB-3A at HFIR at ORNL at temperatures from 1.5 K to 450 K. The spin waves and phonons were measured in the temperature range of 1.5-400 K with HB-3 at HFIR, CNCS and ARCS at SNS at ORNL. I will report our new discovery of interaction between the soft ferroelectric phonon mode and likely (para)magnon mode, that is responsible for a giant magnetoelectric coupling in $EuTiO_3$. The magnetic excitation and atomic displacements will be discussed.

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