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Advanced spectroscopy and imaging studies of multiferroicity in $YMnO_3$ and $BiFeO_3$[1] RELJA VASIC, MARC ULRICH, JACK ROWE, JERRY LUCOVSKY, JOSEPH FONTCUBERTA, XAVIER MARTI, JUREK SADOWSKI, HAIDONG ZHOU, JAMES BROOKS, CHRIS WIEBE, NCSU TEAM, CSIC COLLABORATION, NHMFL COLLABORATION — There has been recent research interest in a number of magnetic ferroelectrics, including $YMnO_3$, a hexagonal perovskite that is antiferromagnetic [Neél temperature (T_N) between 70 and 130 K] and ferroelectric [Curie temperature (T_C) between 570 and 990 K] in the ground state and perovskite $BiFeO_3$ which is ferroelectric ($T_C \sim 1103$ K) and antiferromagnetic ($T_N \sim 643$ K), exhibiting weak magnetism at room temperature due to a residual moment from a canted spin structure. These systems can be understood by competition between local interactions on several ion sites. We report synchrotron based spectroscopy and low-energy electron microscopy (LEEM) imaging studies of sample surface and bulk for magnetoelectric coupling and spin ordering in multiferroic heterostructures and single crystals. Preliminary results indicate the importance of oxygen vacancies in ferroic properties in thin films of $YMnO_3$. Photoemission and x-ray absorption spectroscopy of electronic structure indicate relations between strain and crystallographic structure of epitaxial thin films grown on different substrates. The goal of this study is better understanding the interface effects and spin ordering in multiferroic heterostructures vs single crystals.

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Relja Vasic

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