

X-ray High Field (XHF) Collaborative Development Team (CDT)

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Executive Summary:

Materials subjected to extreme conditions such as high magnetic fields are of great interest in contemporary condensed matter physics and materials science. The magnetic field is a key fundamental parameter, which can be used to tune in novel states of matter that are critical for developing a correct understanding of the properties of materials. Nearly all studies of materials in extreme fields (>15 Tesla) conducted thus far, however, have been limited to transport, thermodynamic, and spectroscopic measurements. Information on the atomically resolved structural and magnetic responses, which are at the very heart of understanding of structure-properties relationship has been sorely lacking. The main theme of the CDT is to develop a beamline dedicated to scattering studies in high magnetic fields (>30 Tesla). This beamline will incorporate existing DC (13 Tesla) and pulsed-field (20-45 Tesla) magnets, respectively, for immediate use and as a bridge toward achieving the ultimate goal of building a 30-40 Tesla series-connected hybrid DC magnet. This facility will be unique in the world, providing unprecedented means for structural and magnetic studies at a synchrotron radiation source. Such capabilities could be applied to the most compelling problems, such as competing states in high- T_c cuprates, orbital physics in novel oxides, and meta-magnets.