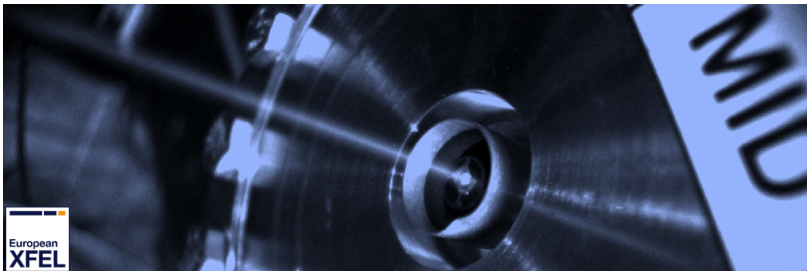

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Probing foundational to functional behaviors in quantum materials with very hard XFEL radiation

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Very hard XFEL radiation will enable a diversity of scattering studies of fundamental and functional behavior of quantum materials. With extreme pulsed magnetic fields (PMF) one may create novel electronic states, activate functional properties, and trigger non-equilibrium behavior, all of which can be probed by hard XFEL radiation. Competing charge and/or spin order in high-temperature superconductors (HTS), novel charge density waves that breaks time-reversal symmetry, piezo-magnetism, and anisotropy and vortices in superconductors are some exemplary cases. Judicious use of diffraction to reveal fundamental anisotropy constants and to understand functional and/or dynamical behavior of trapped vortices in HTS are discussed in some detail. A highly desirable functional application of bulk HTS requires trapping vortices introduced via PMF, an active area of research that may benefit by leveraging very hard XFEL radiation.

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