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Innovative uses of X-ray FEL and the pulsed magnets: High magnetic field X-ray scattering studies on quantum materials H. JANG, SLAC, H. NOJIRI, Tohoku Univ., S. GERBER, W.-S. LEE, D. ZHU, J.-S. LEE, C.-C. KAO, SLAC — X-ray scattering under high magnetic fields provides unique opportunities for solving many scientific puzzles in quantum materials, such as strongly correlated electron systems. Incorporating high magnetic field capability presents serious challenges at an x-ray facility, including the limitation on the maximum magnetic field even with a DC magnet (up to ˜20 Tesla), expensive cost in development, radiation damage, and limited flexibility in the experimental configuration. These challenges are especially important when studying the symmetry broken state induced by the high magnetic field are necessary, for example, exploring intertwined orders between charge density wave (CDW) and high T_c superconductivity. Moreover, a gap in magnetic field strengths has led to many discrepancies and puzzling issues for understanding strongly correlated systems – is a CDW competing or more intimately intertwined with high-temperature superconductivity. To bridge this gap and resolve these experimental discrepancies, one needs an innovative experimental approach. Here, we will present a new approach to x-ray scattering under high magnetic field up to 28 Teals by taking advantage of brilliant x-ray free electron laser (FEL). The FEL generates sufficiently high photon flux for single shot x-ray scattering experiment. In this talk, we will also present the first demonstration about the field induced CDW order in YBCO Ortho-VIII with 28 Tesla, which show the totally unexpected three-dimensional behavior.

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