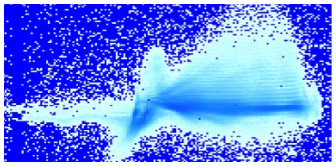

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Role of nanoscale heterogeneties on the metal to insulator transition in rare earth nickelates

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Rare earth nickelates RNiO3 display an insulator to metal transition (MIT) which is accompanied by a magnetic transition, charge ordering, and a crystal structure change from orthorhombic low temperature to monoclinic high temperature state. While this system has been widely studied, the nature of the fluctuation across the transition, and the associated time- and length-scales is not known. Spontaneous fluctuations are important components for stabilizing topological magnetic structures such as skyrmions in quantum materials. However, the dynamic susceptibility of the nickelates remains relatively unexplored, and the role played by nanoscale phenomena such as domain-wall formation and motion, local strain fields and phase separation in underlying pathways of MIT is not well- understood. In our work, we focus on understanding the role of nanoscale heterogeneities and their fluctuations in rare earth nickelates by employing x-ray photon correlation spectroscopy (XPCS), a technique requiring highly coherent x-rays. Our XPCS measurements on NdNiO3 thin films, show complex evolution of fluctuations dependent upon temperature and wavevector q. We also observe unexpected non-equilibrium dynamics and suggests a new approach to understanding these materials.

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