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Cryogenic s-SNOM studies of metal-insulator transitions in correlated oxides

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Transition-metal oxides show rich phase diagrams due to a complex interplay between the charge, spin and lattice degrees of freedom. In particular, transitions from metallic to insulating phase can occur as a function of temperature or as result of fine structural tuning via atomic substitution, epitaxial strain or heterostructuring. These transitions often evolve through spatially inhomogeneous phase-separated states, where each phase has a distinct optical character. Therefore, an experimental tool combining optical spectroscopy with nanoscale resolution is highly needed in this case. We use cryogenic scattering-type scanning near-field optical microscopy (s-SNOM) to address these phenomena in epitaxially grown multilayer structures made of pseudocubic perovskite materials. Specifically, I will present two studies of such systems: (i) infrared nanoscopy of 2D electron gas formed at the interface between $LaAlO_3/SrTiO_3$ [1,2] and (ii) temperature-driven metal-insulator transition in thin $NdNiO_3$ films on $LaAlO_3$ substrate [3]. References: 1. W.W. Luo, M. Boselli, J.M. Poumirol, I. Ardizzone, J. Teyssier, D. van Der Marel, S. Gariglio, J.M. Triscone, and A.B. Kuzmenko, Nature Communications, **10,** 8 (2019). 2. M. Boselli, G. Scheerer, M. Filippone, W. Luo, A. Waelchli, A.B. Kuzmenko, S. Gariglio, T. Giamarchi, and J.-M. Triscone, submitted to Phys. Rev. B (2020); arXiv:2009.07867. 3. W.W. Luo et al., in preparation (2020).