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THz- and infrared ellipsometry studies of plasmonic modes in complex oxide heterostructures

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I will present THz- and infrared ellipsometry studies of complex oxide heterostructures with mobile charge carriers that are spatially confined. The first example concerns the two-dimensional electron gas in $LaAlO_3/SrTiO_3$ and related materials for which the sheet carrier density, the depth profile and the mobility of the charge carriers are obtained from the analysis of a so-called Berreman-mode. The second example is about $Pr_{0.5}La_{0.2}Ca_{0.3}MnO_3/YBa_2Cu_3O_7/Pr_{0.5}La_{0.2}Ca_{0.3}MnO_3$ (PYP) trilayers for which we recently discovered a very unusual kind of insulator-to-superconductor transition as a function of an applied magnetic field. Our THz-ellipsometry and magneto-transport data reveal that the insulator-like response at zero magnetic field arises in fact from a granular superconducting state with very efficient domain boundaries that completely block the superconducting phase coherence.