Optical spectroscopy of the metallic Nd$_{1-x}$TiO$_3$ system

NATHAN ARMSTRONG, McMaster University, ATHENA SEFAT, Materials Science and Technology Division, Oak Ridge National Laboratory, JING YANG, Tianjin University, JOHN GREEDAN, THOMAS TIMUSK, McMaster University — The neodymium titanate system, Nd$_{1-x}$TiO$_3$, exhibits two metal-to-insulator transitions at $x = 0.08$ and $x = 0.24$. The $n$-type metallic regime between the two transitions exhibits the Fermi liquid $T^2$ DC resistivity over a large range of temperatures. We have measured the reflectivity of the $x = 0.15$ and $x = 0.2$ samples from 4 meV to 5.5 eV at temperature from 15 K to 300 K. Previous optical work by Yang et al. measured an insulating, a semiconducting, and a metallic sample. The metallic sample was found to have the Fermi liquid $\omega^2$ dependence in the scattering rate. We reevaluate the Yang et al. data for the $x = 0.095$ metallic sample, just inside the MIT, and compare it to our samples deeper in the metallic regime that have $T^2$ coefficients an order of magnitude smaller.