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Infrared Studies of Charge Dynamics in $Ca_3Co_4O_9$ Thin Films and Single Crystals[1] JIUFENG TU, ZHIJUN XU, The City College of New York, WEIDONG SI, QIANG LI, Brookhaven National Laboratory — In recent years, the 2D-layered cobaltates have emerged as promising p-type thermoelectric materials. These systems show high thermoelectric figure of merit and are ideal candidates as the materials of choice at elevated temperatures. We have carried out infrared reflectivity studies of $Ca_3Co_4O_9$ thin films and single crystals as a function of frequency and temperature with the emphasis on the coupling between the lattice, the charge and the spin degrees of freedom. Several important features have been observed: (1) the overall reflectivity is low as a result of a small carrier density in this system (the plasma frequency around 100 meV); (2) several phonon features are observed and some exhibit evidence of strong electron-phonon coupling; (3) a gap-like structure is seen in the low frequency region below 100 K that could be responsible to the insulating behavior observed in transport measurements at low temperatures. Further infrared studies will be performed in magnetic field (both parallel and perpendicular to the CoO_2 layers). A good understanding of our infrared results should shed light on the origin of high thermo-power in these 2D-layered cobaltates.

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