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Dielectric function of non-equilibrium warm dense gold

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Warm dense matter lies in a regime where densities are near the solid density and temperatures are between 0.1 and 100 eV. The behavior of such systems is dominated by electron degeneracy, excited electronic states and ion-ion correlations, rendering them a truly daunting many-body problem. Interest in Warm Dense Matter has been growing among broad disciplines as driven by the fundamental urge to understand the convergence between plasma and condensed matter physics, and the practical need to understand dynamic behavior in the transformation of a cold solid into a high energy density plasma. A recent advance in this emerging field is the single state measurements of optical properties of non-equilibrium warm dense gold created by isochoric laser heating. This unveils for the first time the behavior of intraband and interband transitions in warm dense gold at high energy densities, providing a unique opportunity to examine effects of electron band structure and electron distribution. This talk is a review of the experimental technique and the new findings. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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