Dielectric response function for warm dense matter states

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The dynamic structure factor (DSF) is an important parameter to determine warm dense matter properties and can be accessed using x-ray Thomson scattering from energetic x-ray sources at LCLS, SACLA or EU-XFEL[1, 2]. To improve upon the existing DSF models with greater accuracy and better description to model high pressure solids and liquids, a good agreement between theory and experiment is needed taking into account the electron-hole interaction resulting from an optical absorption, especially if the system is a semiconductor or an insulator. In a theoretical framework, we need access to the dielectric response function calculated using methods such as RPA, GW or even BSE based on density functional theory. Small-gap semiconductors and metals, instead, screen this electron-hole interaction, and the resulting contribution can therefore be negligible. The Bethe-Salpeter equation indeed couples the electron and the hole, and has been very successful for the calculation of absorption spectra of a large variety of systems: insulators, semiconductors, atoms, clusters. We would like to present the results using aforementioned methods for different systems modelling warm dense matter states.

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[2] Chapman, D. A. and Gericke, D. O., Phys. Rev. Lett. **107**, 165004 (2011).