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X-ray Thomson scattering in warm dense matter at low frequencies MICHAEL MURILLO, Los Alamos National Laboratory — The low-frequency portion of the x-ray Thomson scattering spectrum is determined by electrons that follow the slow ion motion. This ion motion is characterized by the ion-ion dynamic structure factor, which contains a wealth of information about the ions, including structure and collective modes. The frequency-integrated (diffraction) contribution is considered first. An effective dressed-particle description of warm dense matter is derived from the quantum Ornstein-Zernike equations, and this is used to identify a Yukawa model for warm dense matter. The efficacy of this approach is validated by comparing a predicted structure factor with data for the extreme case of a liquid metal. A Thomas-Fermi model is then introduced to allow the separation of bound and free states at finite temperatures, and issues with the definition of the ionization state in warm dense matter are discussed. For applications, analytic structure factors are given on either side of the Kirkwood line. Finally, several models are constructed for describing the slow dynamics of warm dense matter. Two classes of models are introduced that both satisfy the basic sum rules. One class of models is the "plasmon-pole"-like class, which yields the dispersion of ion-acoustic waves. Damping is then included via generalized hydrodynamics models that incorporate viscous contributions. This suggests a method by which viscous transport properties can be measured.

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