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Measuring the Ion Temperature in X-ray Thomson Scattering Experiments of Warm Dense Matter (WDM)[1] JOHN BENAGE, MICHAEL MURILLO, Los Alamos National Lab — X-ray Thomson scattering offers an unprecedented method for measuring the properties of dense plasmas, including the electron temperature, the ionization state, and the free electron density. More difficult to extract from the measurements is the ion temperature. To date, the ion temperature has been extracted from experimental data using the diffractive portion of the scattering signal, which is a measure of the ion static structure S(k); thus, an accurate measurement requires an accurate model for S(k). Here, we compare models for S(k) in WDM and find that their differences are significant. Because of the paucity of WDM data, we use very accurate liquid metal data as a proxy. No current model reproduces all of the liquid metal data, although some are better for certain metals than others. We also introduce a new model that employs an effective screening length, obtained from the finite-temperature Lindhard response, in a modified hypernetted chain approach. This approach is superior to the previous approaches and we expect it will be even better for WDM.

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