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Momentum distribution function and short-range correlations of the warm dense electron gas – ab initio quantum Monte Carlo results

Content

In a classical plasma the momentum distribution, $n(k)$, decays exponentially, for large k, and the same is observed for an ideal Fermi gas. However, when quantum and correlation effects are relevant simultaneously, an algebraic decay, $n_\infty(k) \sim k^{-8}$ has been predicted. This is of relevance for cross sections and threshold processes in dense plasmas that depend on the number of energetic particles. Here we present the first *ab initio* results for the momentum distribution of the nonideal uniform electron gas in the entire warm dense matter range. Our results are based on first principle fermionic path integral Monte Carlo simulations and clearly confirm the k^{-8} asymptotic. This aymptotic behavior is directly linked to short-range correlations which are analyzed via the on-top pair distribution function (on-top PDF). We present extensive accurate results for the density and temperature dependence of the on-top PDF and for the momentum distribution in the entire momentum range.

Consent Film recordings

Yes

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