

Contribution of Exchange-correlation Effects on Weakly Relativistic Plasma Expansion

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Abstract : Plasma expansion is an important physical process that takes place in laser interactions with solid targets. Within a self-similar model for the hydrodynamic multi-fluid equations, we investigated the expansion of dense plasma. The weakly relativistic electrons are produced by ultra-intense laser pulses, while ions are supposed to be in a non-relativistic regime. It is shown that dense plasma expansion is found to be governed mainly by quantum contributions in the fluid equations that originate from the degenerate pressure in addition to the nonlinear contributions from exchange and correlation potentials. The quantum degeneracy parameter profile provides clues to set the limit between under-dense and dense relativistic plasma expansions at a given density and temperature.

Keywords : plasma expansion, quantum degeneracy, weakly relativistic, under-dense plasma

Conference Title : ICCMPSS 2023 : International Conference on Condensed Matter Physics, Semiconductors and Superconductors

Conference Location : Istanbul, Türkiye

Conference Dates : September 25-26, 2023