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The Supernova Equation of State: Finite-Range, Momentum-Dependent Potential Approach CONSTANTINOS CONSTANTINOU, SUNY Stony Brook, BRIAN MUCCIOLI, MADAPPA PRAKASH, Ohio University — Experimental evidence on nucleon-nucleus scattering suggests that the real part of the optical potential has a strong momentum dependence which causes it to be attractive for low energies while it becomes repulsive and saturates at high energies. Results of microscopic nuclear matter calculations are consistent with this picture. However, Skyrme-like single-particle potentials grow quadratically with momentum in contrast with experimental data. This behavior results from approximating non-local exchange forces by local effective ones. Field-theoretical models at the mean-field level are also inconsistent with experimental data. To explore the effect momentum-dependent interactions have on the thermal properties of dense, isospin-symmetric nucleonic matter, we study the schematic model constructed by Welke et al. in which the correct momentum dependence that fits optical potential data is built through finite-range exchange forces of the Yukawa type. The exact numerical results are compared to analytical ones in the quantum regime where we rely on Landau's Fermi-Liquid Theory, and in the classical regime where the state variables are obtained through a steepest descent calculation. Detailed comparisons with similarly calibrated Skyrme models are also performed.

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