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A second Equation of State for Astrophysical Simulations GANG SHEN, Los Alamos National Lab, CHARLES HOROWITZ, Indiana University Bloomington, EVAN O'CONNOR, Caltech — In this work, we present a second equation of state (EoS) of nuclear matter for a wide range of temperatures, densities, and proton fractions for use in supernova and neutron star merger simulations. We employ a full relativistic mean field (RMF) calculation for matter at intermediate density and high density, and the Virial expansion of a nonideal gas for matter at low density. The difference from the first EoS is that here we use the RMF parameter set FSUGold whereas the first based on NL3. The FSUGold EoS is considerably softer than NL3 in the high density, but stiffer at subnuclear density. The Virial gas part is common and consists of neutrons, protons, alpha particles, and 8980 species of nuclei with masses from FRDM mass tables. We tabulate the resulting EoS at over 100,000 grid points in the temperature range $T = 0 \sim 80$ MeV, the density range $n_B = 10^{-8} \sim 1.6$ fm^{-3}, and the proton fraction range $Y_P = 0 \sim 0.56$. We present the difference between the second EoS and first EoS along with the exisitng EoSs, in the phase diagram, composition, and neutron star structures. This table will soon be available for supernova and neutron star merger simulations.

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