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Bulk viscosity of baryonic matter with trapped neutrinos

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We study bulk viscosity arising from weak current Urca processes in dense baryonic matter at and beyond nuclear saturation density. We consider the temperature regime where neutrinos are trapped and therefore have non-zero chemical potential. We model the nuclear matter in a relativistic density functional approach, taking into account the trapped neutrino component. We find that the resonant maximum of the bulk viscosity would occur at or below the neutrino trapping temperature, so in the neutrino trapped regime the bulk viscosity decreases with temperature as T^{-2}, this decrease being interrupted by a drop to zero at a special temperature where the proton fraction becomes density-independent and the material scale-invariant. The bulk viscosity is larger for matter with lower lepton fraction, i.e., larger isospin asymmetry. We find that bulk viscosity in the neutrino-trapped regime is smaller by several orders than in the neutrino-transparent regime, which implies that bulk viscosity in neutrino-trapped matter is probably not strong enough to affect the evolution of neutron star mergers.

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