Estimation of hadronic matter viscosity from atomic nuclei spectroscopy and neutron stars observation data

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Liquid drop model of nuclei capillary oscillations with account of viscosity have been developed in our previous paper [1]. Comparison of even spherical nuclei's quadrupole and octupole vibration frequencies give that nuclei matter viscosity η falls in the interval $4.2 - 7.6\ MeV fm^{-2} c^{-1}$ These results we applied to neutron stars gravitational quadrupole oscillations that take place right after their formation in collapse processes. Attenuation decrement for neutron star with mass M can be expressed in the form

$$\gamma = \frac{1}{3} \frac{\hbar^3}{E_p^2} \frac{\eta a}{r_g}, \tag{1}$$

were $r_g = \frac{2GM}{c^2}$, $E_p = 1.22\ 10^{19}\ GeV$, $\eta = 4.5\ MeV\ fm^{-2}\ c^{-1}$. For neutron core mass equal solar mass one can find that $\gamma = 6.8\ 10^{-17}$ s^{-1} and corresponding attenuation is equal to $\tau = 4.8\ 10^8$ years. Comparison of these results with RHIC data gives the following expression quark-gluon plasma viscosity

$$\eta = 1.5 \times 10^{-2} T MeV fm^{-2} c^{-1}, \tag{2}$$

where T is the temperature of quark-gluon plasma in MeV.

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