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Comparison of Viscosities from the Chapman – Enskog & Relaxation Time Methods[1] ANTON WIRANATA, MADAPPA PRAKASH, Ohio University — Viscosity to entropy ratios of hadrons and the quark-gluon system control the elliptic flow observed in relativistic heavy-ion collisions. Here we establish the extent to which results from different approximation schemes for shear viscosities agree (or disagree) by choosing classic examples in which the elastic scattering cross sections are specified. The two different approximation schemes chosen are the Chapman-Enskog [1] and the Relaxation Time [2] methods. These test studies are performed for (i) a hard sphere gas ($\sigma = a^2/(4\pi)$, where a is the hard sphere radius), (ii) the Maxwell gas ($\sigma = m\Gamma(\theta)/2g$) with m being the mass of the particles, $\Gamma(\theta)$ is an arbitrary function of θ, and $\mathbf{g}$ is the relative velocity), (iii) chiral pions ($\sigma = 5s/(48\pi f_\pi^4)$, where s is the squared c.m. energy and f_π is the pion-decay constant, and (iv) massive pions (here $\sigma(\theta)$ is taken from experiments). Where possible, analytical results are obtained in either the non-relativistic or extremely relativistic cases.

[1] M. Prakash, et. al, Physics Report 227, 6 (1993) 321 – 366.
[2] P. Chakraborty and J. I. Kapusta, arxiv:1006.0257v1 (2010).

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