MB, Roma unit

Omar Benhar

INFN and Department of Physics
"Sapienza" Università di Roma
I-00185 Roma, Italy

Members

- Members in 2014-2016
  - Omar Benhar
  - Angela Mecca (PhD student)
  - Noemi Rocco (PhD student)
- Additional present and past members
  - Artur M. Ankowski (Postoctoral Fellow, till October 3rd, 2013)
  - A. Cipollone (former PhD student, now at Univrsity of Surrey)
  - A. Loreti (former MS student, now at Aarhus University)
  - R. Biondi (former MS student, now at the Univesity of L'Aquila)

Topics

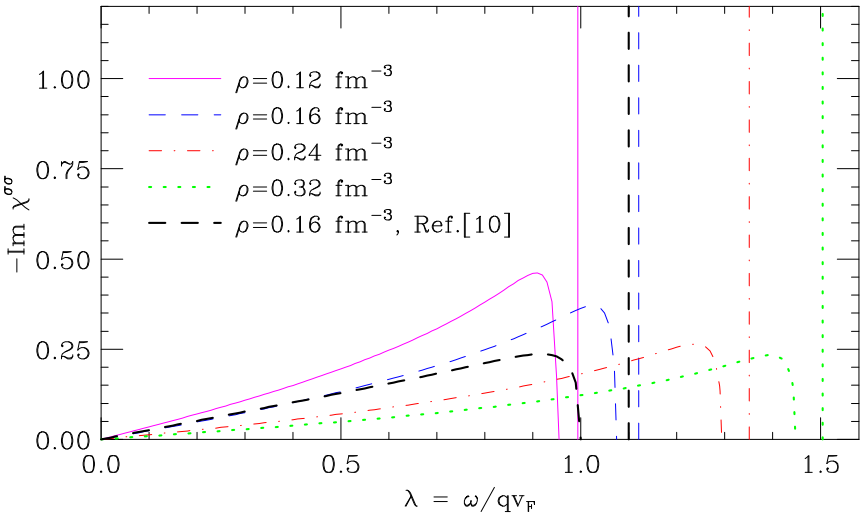
- Equilibrium and non equilibrium properties of neutron star matter
  - Development of an effective interaction within the correlated basis function (CBF) formalism (A. Lovato, OB)
  - Calculation of the nuclear matter response to interactions with low energy (few MeV) neutrinos (A. Cipollone, A. Lovato, A. Loreti, C. Losa, OB)
- Neutrino-nucleus interactions in the few GeV region
  - Limits of applicability of the impulse approximation (A. Ankowski, OB)
  - Role of two-nucleon currents (Noemi Rocco, OB)
- Variational derivation of the FHNC approach wihin the formalism of path integrals (A. Mecca, R. Cenni, OB)
- Correlation effects on the nuclear matrix elements of double β-decay (R. Biondi, E. Speranza, OB)

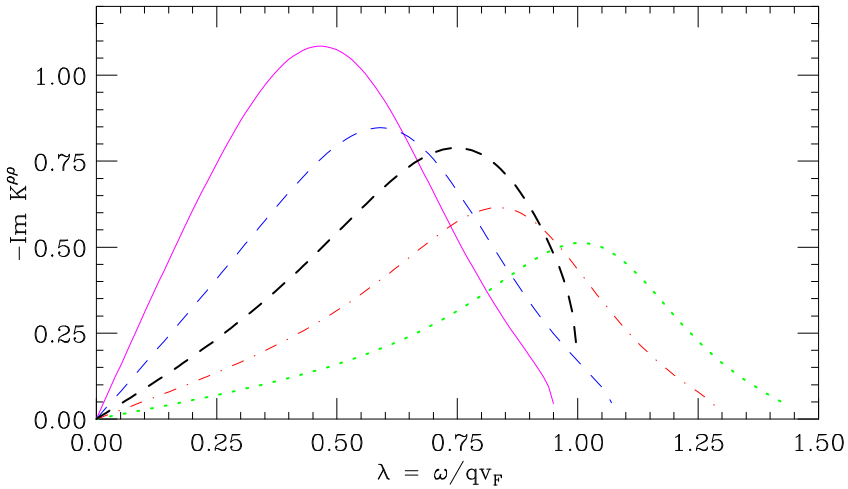
Landau theory + CBF effective interaction

★ The mean free path of non degenerate neutrinos in cold neutron matter is obtained from

$$\frac{1}{L_\nu} = \frac{G_F^2}{4}\rho \int \frac{d^3q}{(2\pi)^3}\left[(1+\cos\theta)S(\mathbf{q},\omega) + \mathbf{C_A^2}(\mathbf{3}-\cos\theta)\mathcal{S}(\mathbf{q},\omega)\right]$$

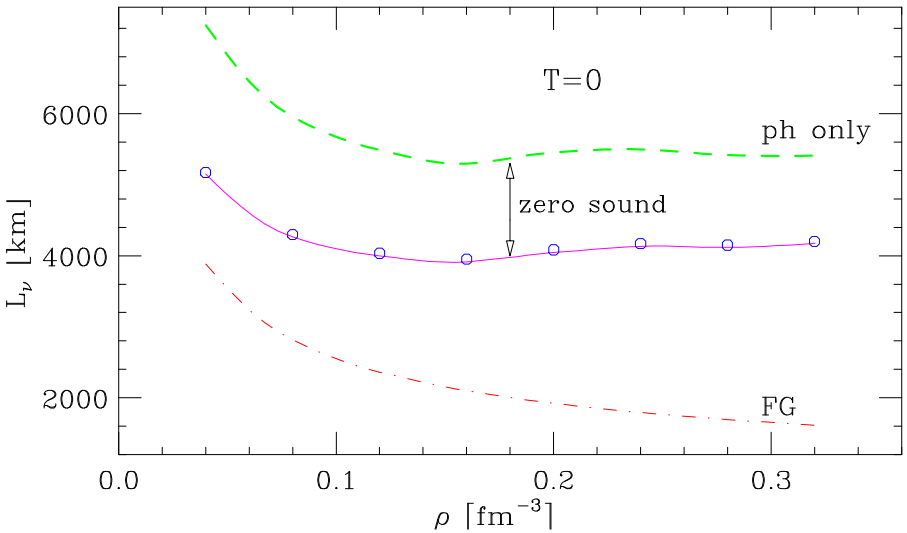
where S and $\mathcal{S}$ are the density (Fermi) and spin (Gamow Teller) response, respectively

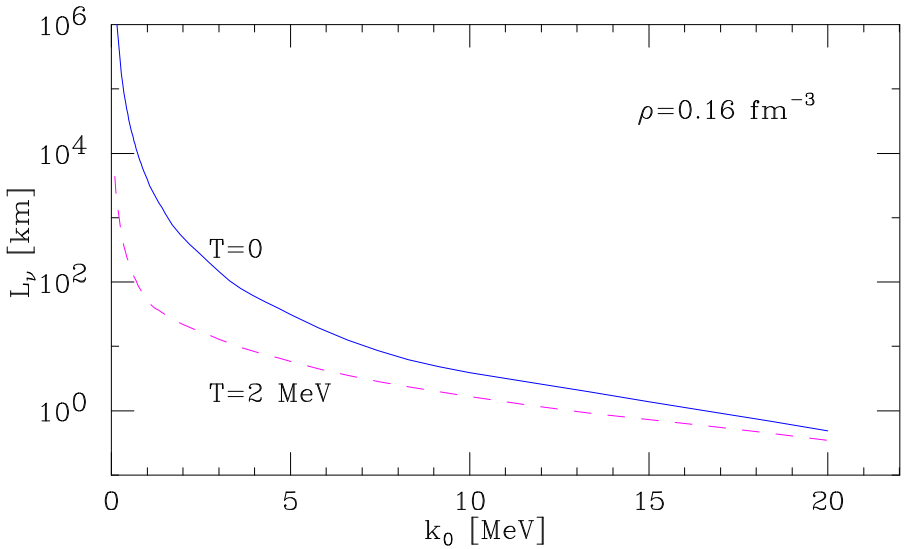




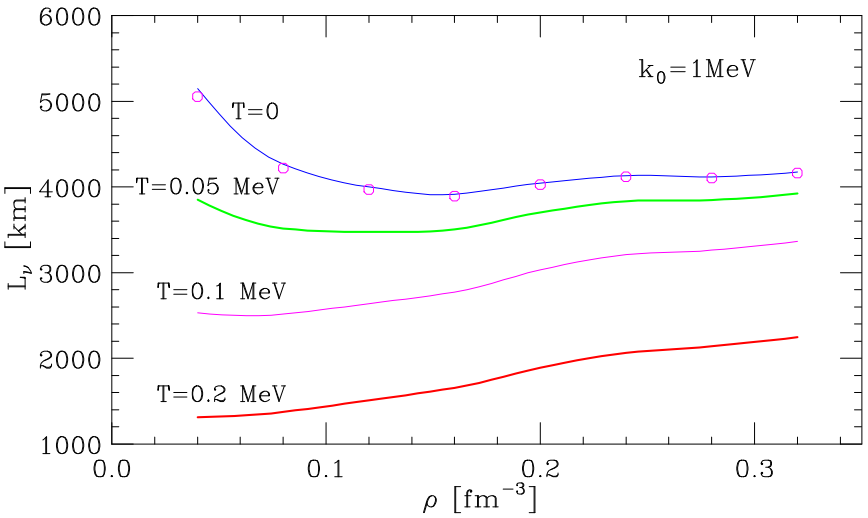
★ the collective mode is only excited in the spin channel

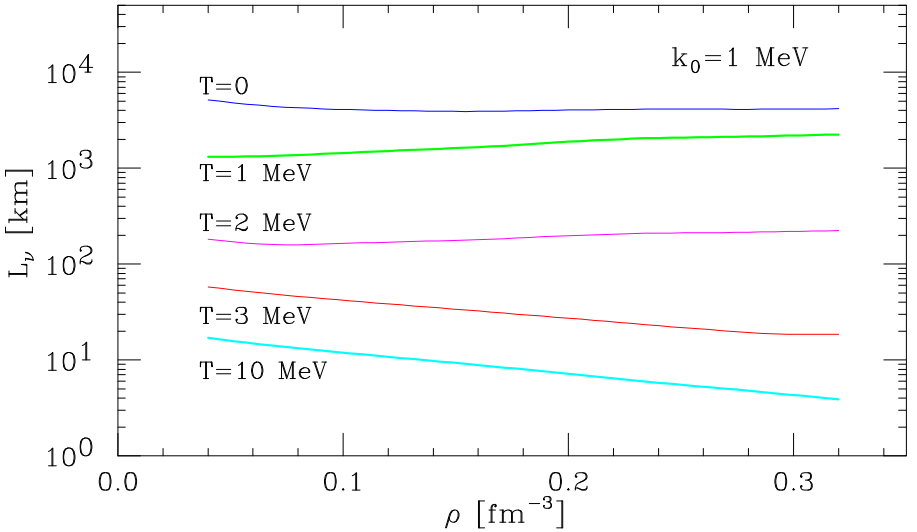
★ Mean free path of a non degenerate neutrino in neutron matter. Left: density-dependence at $k_0 = 1$ MeV and $T = 0$; Right: energy dependence at $\rho = 0.16$ fm^{-3} and $T = 0, 2$ MeV





- ★ Density and temperature dependence of the mean free path of a non degenerate neutrino at $k_0 = 1$ MeV and $\rho = 0.16$ fm^{-3}





- ★ Comparison between the responses obtained from Landau theory and those obtained from direct calculations of the transition matrix elements with the CBF effective interactions is under way
- ★ Preliminary results look quite promising