Allegato A PROGETTO Scienza senza Frontiere – Brasile

Name of the doctoral program

Physics

Full degree X **Cotutelle X**

Title of the research activity

Nonextensive and nonlinear statistical effects in the relativistic nuclear equation of state with applications in high energy heavy ion collisions and compact stars

Short description of the research activity

In the physics of high energy heavy ion collisions and in several nuclear astrophysical problems, correlations among interacting particles of medium sensibly modify the distribution function of reacting nuclei. Depending on the conditions realized in the initial stage of the collisions, correlations of interacting particles have an intermediate interaction range between a long one and a short and memory effects could be very relevant in the complex many-body dynamics of the system. Therefore, it appears important to develop a method based on the so-called nonextensive statistical mechanics, characterized by non-linear power-law quantum distributions, to derive momentum and energy distribution functions. Moreover, the concept of equilibrium is relative, many equilibrium states are not stable, but metastable over long times.
In this context, we study of a theoretical formalism in the framework of a generalized statistical mechanics, able to take implicitly into account complex many-body interactions relevant in high energy nuclear collisions experiments and in the evolution of the protoneutron stars. We investigate the relativistic equation of state of hadronic matter and quark-gluon plasma considering the effects of the strangeness global conservation in regime of finite temperature and baryon chemical potential, conditions reachable in heavy ion collisions, at low energy RHIC (BNL-Brookhaven) runs and in the future FAIR-CBM (GSI-Darmstadt) and NICA-MPD (JINR-Dubna) facilities. Main goal of this investigation is to study the isospin dependence on the phase transition and the strangeness production in the hadron-quark mixed phase. Within the same thermodynamic framework, we will examine the phase transition at fixed specific entropy per baryon and we will compute other relevant thermodynamic functions useful for hydrodynamic simulations and microscopic multi-particle transport approaches.

Scientific responsible (name, surname, role)

Andrea Lavagno, Associate Professor in Nuclear Physics

Email: andrea.lavagno@polito.it

Number of vacancies for XXVIII cycle (begin January 2013)

1 (one)

Specific requirements (experiences, skills)

Website of the research group (if any)