



UNIVERSITÀ  
degli STUDI  
di CATANIA

DIPARTIMENTO DI FISICA E ASTRONOMIA

DOTTORATO DI RICERCA IN FISICA

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## Strong Interactions at Finite Temperature and Density

2 CFU

### Teaching staff

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### Program of the course:

Basic ideas and concepts of non-abelian gauge theories: asymptotic freedom and confinement. Quantum Chromodynamics (QCD) a general overview: perturbative and non-perturbative regimes. Parton model: distribution functions and basic properties. Relativistic pp, pA, AA collisions and elementary calculation of  $pp \rightarrow gg, qq, q\bar{q} \rightarrow \text{hadrons}$ .

QCD phase diagram of nuclear matter at finite density and temperature. Equation of State of the quark-gluon plasma and its transport coefficients. Basic thermodynamics of the phase transition from hadronic matter to the Quark-Gluon Plasma (QGP) in the Early Universe and in Neutron stars. Impact of the Strong Interaction in the expansion of the Early Universe and in the evolution of ultra-relativistic collisions.

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### Bibliography:

- "An Introduction to Quark and Gluons", F. E. Close, Academic Press London, 1979.
- "Handbook of Perturbative QCD", G. Sterman et al., Review of Modern Physics 67 (1995) 158.
- "Quark-Gluon Plasma", K. Yagi, T. Hatsuda and Y. Miake, Cambridge University Press, Cambridge, 2005.