



UNIVERSITÀ  
degli STUDI  
di CATANIA



DIPARTIMENTO DI FISICA E ASTRONOMIA  
“ETTORE MAJORANA”

DOTTORATO DI RICERCA IN FISICA  
ANNO ACCADEMICO 2021/2022

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## Strong Interactions at Finite Temperature and Density

3 CFU

### Teaching staff

**VINCENZO GRECO**

**Email:** greco@Ins.infn.it

**Office:** Department of Physics and Astrophysics, Building 6, Room 346

**Telephone:** +39 095 3785403

**Reception hours:** send an e-mail to greco@Ins.infn.it

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## Program of the course:

Basic ideas and concepts of Strong Interactions: asymptotic freedom and confinement. Quantum ChromoDynamics (QCD) a general overview: perturbative and non-perturbative regimes. Chiral symmetry phase transition and NJL lagrangian. Parton model: distribution functions and basic properties. Relativistic pp, pA, AA collisions phenomenology.

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 and fluid dynamics of the phase transition from hadronic matter to the Quark-Gluon Plasma (QGP). Applications to the Early Universe and the Neutron stars. Impact of the QGP 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, 2005.