General information	
Academic subject	**HEAVY ION PHYSICS**
Degree course	Physics (Magistrale)
Academic Year	2021/2022
European Credit Transfer and Accumulation System (ECTS)	3
Language	ENGLISH
Academic calendar (starting and ending date)	March 2023 – May 2023
Attendance	NO

Professor/ Lecturer	
Name and Surname	Giacomo Volpe
E-mail	Giacomo.volpe@uniba.it
Telephone	080 5443242
Department and address	Dipartimento Interateneo di Fisica “M. Merlin”, Campus Universitario via Amendola 173 - 70125 Bari, ground floor, room 49
Virtual headquarters	
Tutoring (time and day)	Always available on request

Syllabus	
Learning Objectives	Basic notions of ultra-relativistic heavy ion collisions
Course prerequisites	Notions of nuclear and sub-nuclear physics, quantum mechanics, thermodynamic, particle detectors
Contents	Quantum Chromodynamics and the Phase Transition in Strongly Interacting Matter. The Quark Gluon Plasma (QGP). Relativistic Kinematics. Cross Section and Collision Geometry. Global properties of heavy-ion collisions. Space-time evolution of the QGP. Soft probes: Thermal photons and lepton pairs, particle multiplicity, collective flow and correlations, statistical model. Hard probes: Jet quenching. Quarkonia and Heavy Quark. Sources of relativistic and ultra-relativistic nuclei. Experimental apparatus: the ALICE experiment. Connections to other fields of physics: nuclear physics, particle physics, statistical physics, relativistic fluid dynamics, astrophysics.
Books and bibliography	
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
75	31		44
ECTS			
3	3		
Teaching strategy	Class lectures		
Expected learning outcomes			
Knowledge and understanding on:	Basic knowledge of ultra-relativistic nucleus-nucleus collisions physics and the state of art of the experimental measurements.		

Applying knowledge and understanding on:	Ability to autonomously recognize the main features of the phenomenology of heavy ion collisions and of QGP

Soft skills	• *Making informed judgments and choices*
	  ○ In discussing and comparing the main heavy ion physics results and their interpretation in term of the quark-gluon plasma properties
	• *Communicating knowledge and understanding*
	  ○ ability to present and to discuss ultra-relativistic nucleus-nucleus collisions results in a complete way and with an appropriate scientific language.
	• *Capacities to continue learning*
	  ○ Ability to approach the specialist literature and to work in an international and multidisciplinary context.

Assessment and feedback	
Methods of assessment	Oral colloquium

Evaluation criteria	• *Knowledge and understanding*
	  ○ of the basic aspects of the ultra-relativistic nucleus-nucleus collisions.
	• *Applying Knowledge and understanding*
	  ○ Ability to autonomously recognize the main features of the evolution of the system created in a heavy-ion collisions
	• *Autonomy of judgment*
	  ○ Ability to evaluate the conceptual accuracy of the physics equations and models.
	• *Communicating knowledge and understanding*
	  ○ Ability to discuss one's knowledge with appropriate scientific language
	• *Communication skills*
	  ○ Ability to discuss the properties of the quark-gluon plasma using a professional language
	• *Capacities to continue learning*
	  ○ Ability to deepen specific topics of heavy ion physics autonomously starting from the knowledge and methods acquired during the course.

Criteria for assessment and attribution of the final mark	The ability to explain the various concepts and the level of understanding of the same will be positively evaluated
Additional information	