COURSE OF STUDY PHYSICS

ACADEMIC YEAR 2023/24

ACADEMIC SUBJECT GENERAL RELATIVITY

General information	
Year of the course	II year
Academic calendar (starting and ending date)	I semester
Credits (CFU/ETCS):	6
SSD	FIS/02
Language	English
Mode of attendance	Free

Professor/ Lecturer	
Name and Surname	Alessandro Mirizzi
E-mail	Alessandro.mirizzi@uniba.it
Telephone	
Department and address	*Dipartimento Interateneo di Fisica , Via Amendola 173, 70126 Bari*
Virtual room	
Office Hours (and modalities: e.g., by appointment, on line, etc.)	In presence and online, under request

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
143	55	15 hours exercises	88
CFU/ETCS			
	6		

Learning Objectives	Introduction to general relativity and to the formalism of Riemannian geometry. Applications to the study of relativistic gravitational systems.
Course prerequisites	Special relativity, classical field theory, elements of theoretical physics of the fundamental interactions.

Teaching strategie	Class lectures/exercises using blackboard.
Expected learning outcomes in terms of	
Knowledge and understanding on:	Knowledge of the Einstein theory of general relativity and of the formalism of the Riemannian geometry
Applying knowledge and understanding on:	Application of the tensor calculus in a Riemannian manifold in order to describe the main relativistic gravitational effects.
Soft skills	• *Making informed judgments and choices* Ability to discuss and to compare different relativistic models of fundamental interactions. • *Communicating knowledge and understanding* Ability to present a gravitational problem in a complete way and

	with an appropriate scientific language. • *Capacities to continue learning* Ability to approach the specialistic literature and to independently choose the method of solving a problem of relativistic gravitation.
Syllabus	
Content knowledge	Principle of equivalence and principle of general covariance. The local group of diffeomorphism. Tensor calculus in a Riemannan manifold. Covariant differentiation. Geometric gravity in the Newtonian limit. Geodesic motion. The Riemann curvature tensor and the Einstein equations. The weak field limit. Gravitational waves. Schwarzschild solution and black holes.
Texts and readings	S. Weinberg, *Gravitation and Cosmology* (John Wiley & Sons 1972) M. Gasperini, *Theory of Gravitational Interactions* (Second Edition, Springer International, 2017). Sean Carroll, *Spacetime and Geometry: An Introduction to General Relavitiy (Cambridge Univ. Press, 2019)*
Notes, additional materials	none
Repository	

Assessment	
Assessment methods	Written exam and oral colloquium.
Assessment criteria	• *Knowledge and understanding* knowledge and understanding of the basic aspects of general relativity and of the formalism of Riemannian geometry • *Applying knowledge and understanding* ability to perform simple calculations concerning relativistic gravitational interactions; • *Autonomy of judgment* ability to discuss the main differences/ analogies with the other fundamental interactions; • *Communicating knowledge and understanding* ability to present and to discuss with a professional language the geometric properties of gravity; • *Communication skills* ability to access the specialistic literature

	• *Capacities to continue learning* ability to extend and apply the formalism of curved space-time geometry to different sectors of physics
Final exam and grading criteria	Numerical rating from 0 to 30 attributed on the ground of the evaluation criteria listed above.
Further information	
	.