Essential Course Information	
Course title	High Energy Astrophysics
Degree Course title	PHYSICS
ECTS	6
Compulsory attendance	YES
Course teaching language	ENGLISH

Teacher	Francesco Giordano	francesco.giordano@uniba.it

ECTS Details	**Disciplinary area**	SSD	ECTS
	Characterizing	FIS/01	6

Time management and teaching activity type	Period	Year	Lesson type
	2nd semester	Ist	Lessons (40h) Laboratory (15h)

Time management	Total hours	In-class/in-lab study hours	Out-of-class study hours
	150	55	95

Course calendar	Starting date	Ending date
	March 2021	June 2021

Syllabus	
Prerequisites	**Elementary particle, radiation matter interecation**
Expected learning outcomes (according to Dublin Descriptors)	• *Knowledge and understanding:* knowledge of fundamentals elements of standard model of cosmology and the most common astrophysical sources • *Applying knowledge and understanding:* knowledge of basic principle of radiation matter interaction general relativity and understanding principal properties of astrophysical objects (stars, Whtie dwarsf, blask holes) • *Making judgements:* Ability to analyze a problem and to propose the most appropriate astrophysics interpretation of observation. • *Transferable communication skills:* Ability to work in a group and to develop strategies for problem solving by comparing with colleagues and teachers. • *Lifelong learning skills:*

	Ability to consult bibliographic material, databases and material on internet.
Course contents summary	
Detailed syllabus	Introductory outlines on High Energy Astrophysics 1.Universe structure: measurement techniques of astronomical distances, the Milky Way, large scale universe structure, galaxies classification, galaxies rotation curves, local group, galaxies clusters and super-clusters, universe expansion, Hubble law, red-shift, outlines on big bang. 2.Stellar evolution: star photometric quantities, Hertzprung-Russel diagram, historical development of star evolution theories, pp and CNO cycles, star clusters and star populations, star formation, star evolution, brown dwarfs, white dwarfs, giant stars, binary systems, Cepheids. 3.Supernovae: evolution, collapse, explosion, supernovae remnants, SN 187A, new stars generation. 4.Gamma astronomy: transparency of universe to e.m. radiation, gamma sources, Compton Gamma Ray Observatory, EGRET, Fermi satellite, non identified gamma sources, diffusion gamma radiation component, pulsars, Active Galactic Nuclei, dark matter. 5.Pulsars and black holes: properties and operation models of pulsars, binary pulsars, accreting disks, characteristics and detection techniques. 6.Active Galactic Nuclei (AGN): radio-galaxies, unified model of AGNs, Seyfert galaxies, BL-Lac, quasars, blazars, detection techniques. 7.Gamma ray burts: first observations, BATSE, Beppo-SAX, localization models, time characteristics, generation models, collapsars, Fermi-LAT observations.
Books	De Angelis-Pimenta - Introduction to Particle and Astroparticle Physics-Springer International Publishing (2018) Longair - High Energy Astrophysics Vol 1 (2Nd Ed) Thomas K. Gaisser - Cosmic Rays and Particle Physics-Cambridge University Press (1990)
Notes	Selected chapters
Teaching methods	Classroom lessons / tutorials, supported by video projector and with the help of networked PCs.
Assessment of final mark	Oral examination
Evaluation criteria	The student **knows** population of stars and evolution, general relativity and black holes galaxies and GRBs

	knows how to describe acceleration and emission processes in astrophysical objects **knows how** scale energetics of objects depending of their initial mass **know how** to present the results of an experiment effectively in written and oral form;.
Other	