UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Fisica e Chimica - Emilio Segrè		
ACADEMIC YEAR	2020/2021		
MASTER'S DEGREE (MSC)	PHYSICS		
INTEGRATED COURSE	STELLAR EVOLUTION		
CODE	21352		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	FIS/05		
HEAD PROFESSOR(S)	ARGIROFFI COSTANZA	Ricercatore	Univ. di PALERMO
OTHER PROFESSOR(S)	ARGIROFFI COSTANZA MICELI MARCO	Ricercatore Professore Associato	Univ. di PALERMO Univ. di PALERMO
CREDITS	6		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**ARGIROFFI COSTANZA** Monday 15:00 17:00 Osservatorio Astronomico (Palazzo dei Normanni). Su richiesta dello studente il ricevimento puo anche essere svolto in remoto. Ricevimento dedicato agli studenti del corso di Evoluzione Stellare, Laurea in Fisica. Thursday 15:00 17:00 Osservatorio Astronomico (Palazzo dei Normanni). Su richiesta dello studente il ricevimento puo anche essere svolto in remoto. Ricevimento dedicato agli studenti del corso di Fisica, Laurea in Scienza della Natura e dell'Ambiente. Friday 15:00 17:00 Osservatorio Astronomico (Palazzo dei Normanni). Su richiesta dello studente il ricevimento puo anche essere svolto in remoto. Ricevimento dedicato agli studenti del corso di Strumentazione per Ottica e Astronomia, Laurea in Ottica e Optometria. **MICELI MARCO** Wednesday 14:30 16:30 Dipartimento di Fisica e Chimica, via Archirafi 36 (con prenotazione via email) Thursday 14:30 16:30 Dipartimento di Fisica e Chimica, via Archirafi 36 (con prenotazione via email)		

DOCENTE: Prof.ssa COSTANZA ARGIROFFI

PREREQUISITES	The prerequisites to effectively attend the teaching and achieve the predefined goals are: knowledge and capacity to apply laws and concepts related to classical physics, quantum mechanics, astronomy, astrophysics, and mathematical analysis.
LEARNING OUTCOMES	- Knowledge and understanding: the student will learn the fundamentals of stellar evolution, the physical processes that govern it, focusing on both theoretical and observational aspects. - Applying knowledge and understanding: the student will acquire the ability to solve problems related to the physics of stellar evolution, being also able to use this acquired knowledge within different topics and wider framework. - Making judgements: the student will be able to make physical evaluations, independently, and with critical thinking, on stellar evolution, on how that is related to other physical aspects and/or systems, and on how, the techniques used in this field can also be used in different contexts. - Communication: the student will be able to communicate clearly and accurately the learned concepts. - Learning skills: the student, having studied during the course in English texts and updated scientific publications, will be able to undertake further studies and researches with good autonomy.
ASSESSMENT METHODS	The final exam is an oral test. The student is required to be able to describe the different phases of stellar evolution, and identify the physical processes that characterize them, displaying knowledge on both observational and theoretical aspects. During the test, the student knowledge, understanding, ability to apply such knowledge, and to present it clearly and accurately are evaluated. Evaluation is based on the following scheme: - sufficient knowledge of the course topics, with elementary capabilities of analysis, application, and exposure: grade 18-21; - good knowledge of the course topics, with good capabilities of analysis, application, and exposure: grade 22-25; - very good knowledge of the course topics, with a very good understanding of both theoretical and experimental aspects, very good ability to apply and argue them, with logical and scientific accuracy, and very good exposure skills: grade 26-28; - full and deep knowledge of the course topics, with a complete and mature vision of both theoretical and experimental aspects, full ability to apply and argue them, with profound logical and scientific accuracy, excellent exposure skills: grade 29-30L.
TEACHING METHODS	The didactic activities consist of in-class lessons. The teacher presents the subjects, using both blackboard and electronic presentations. In presenting the different topics, both the theoretical and the observational aspects are emphasized. The topics are presented by the teacher by soliciting and guiding the discussion with the students, to make the lesson interactive, and hence more productive, and to increase the student critical thinking. Other than the recommended textbooks, additional texts and scientific publications are provided to the students, always in English, as material for deeper studies.

MODULE
POST MAIN SEQUENCE STARS AND SUPERNOVAE

Prof. MARCO MICELI

SUGGESTED BIBLIOGRAPHY	
- High energy astrophysics, Malcolm S. Longair - Handbook of Supernovae, Alsabti, Athem W., Murdin, Paul	
AMBIT	20901-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	51
COURSE ACTIVITY (Hrs)	24
EDUCATIONAL OBJECTIVES OF THE MODULE	
The main goal is understanding post main sequence stellar evolution of massive stars, including supernova explosions, and studying the physical processes involved in the different evolutionary stages. The student will address this topic with a critical approach aimed at a careful and analytic evaluations of both theoretical and observative issues	

SYLLABUS

Hrs	Frontal teaching
4	Equations of stellar evolution
4	Post main sequence stars
2	Nucleosynthesis in massive stars
4	Core-collapse Supernovae
2	Type Ia supernovae
4	Supernova remnants
4	Fermi acceleration and cosmic rays in supernova remnants

MODULE
STAR FORMATION AND MAIN SEQUENCE

Prof.ssa COSTANZA ARGIROFFI

SUGGESTED BIBLIOGRAPHY	
Introduction to Stellar Astrophysics: Volume 3, Erika Böhm-Vitense	
AMBIT	20901-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	51
COURSE ACTIVITY (Hrs)	24
EDUCATIONAL OBJECTIVES OF THE MODULE	
The goal of the course is the knowledge of stellar evolution, and of the physical processes that characterize and govern it, from the initial phases of cloud contraction, to the post-main sequence phases. The way in which the subjects will be presented by the teacher will allow the student to acquire a critical knowledge of these topics, being aware of both experimental and theoretical aspects.	

SYLLABUS

Hrs	Frontal teaching
4	Molecular clouds and star formation.
2	Pre-main sequence phases.
3	Circumstellar disks and planetary system formation.
9	Main sequence stars: equations of stellar structure; energy production and transport mechanisms; homologous stars.
2	High-energy processes in stellar atmospheres.
4	Post-main sequence phases for low-mass stars.