UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Stellar Astrophysics

2122-1-F5802Q002

Aims

The aim is at providing the tools for understanding the physics of stars, from their formation in the interstellar medium to their death as collapsed objects. These studies find their application within the nascent field of gravitational wave astrophysics and in the cosmological context of galaxy formation and evolution.

Contents

Introduction to stellar astrophysics: formation, structure and evolution.

Detailed program

Stellar equilibria. Timescales along stellar evolution. Thermodynamics of classical and quantum fluids. Radiative processes: black body, opacity and transport. Nuclear reactions: quantum tunneling, Gamov'senergy, synthesis of the heavy elements. Stars on the main sequence: scaling relations, maximum and minimum mass. Degenerate stars: Chandrasekhar limiting mass. Stellar evolution beyond the main sequence: red giant phase and planetary nebulae, AGB and supernovae. Gravitational collapse: neutrino emission and deleptonisation. Compact objects as relics of stars: white dwarfs, neutron stars and black holes. Stellar evolution in binary systems. Dynamics of black holes and neutron stars in star clusters. Pulsars and X-ray sources. Star formation: Jean’s mass, proto-stars, initial mass function. Population III stars. Black hole seeds. Supermassive stars.

Prerequisites

Calculus, Classical Mechanics, Electromagnetism, Condensed Matter, Quantum Mechanics

Teaching form

Frontal Lectures.

Textbook and teaching resource

Books:

Prialnik, “Stellar structure and evolution”
Phillips, “The Physics of Stars”
Kippenhahn and Weigert, “Stellar structure and evolution”
Stahler and Palla, “The formation of stars”
Shapiro and Teukolsky, “Black holes, white dwrafs and neutron stars”

Slides distributed during the course.

Lectures recorded using multimedia tools.

Semester

First semester

Assessment method

Oral exam: extended test on the level of knowledge of the contents of the course by the student and attention on the degree of clarity in the exposition. The first question will focus on one of the most fundamental concepts of stellar physics highlighted during the course.

Office hours

Upon appointment via email