



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Stellar Astrophysics

2324-1-F5802Q002

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#### Aims

The aim of this course is at providing tools for understanding the physics of stars, their formation and evolution through cosmic ages. Stellar astrophysics is key for understanding galaxies, their colors and formation history. Recently this discipline finds new applications in the field of gravitational wave astrophysics.

#### Contents

Introduction to stellar astrophysics: formation, structure and evolution.

#### Detailed program

- Stellar equilibria, the virial theorem and stability, stellar timescales
- Light from stars: black body radiation, opacity and radiative transport
- Classical and quantum gases
- Nuclear reactions: Gamov's energy, 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, 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.
- 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 dwarfs and neutron stars"

Selected reviews and selected papers provided during the lectures.

Selection of recorded lectures.

## **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. A short slide-presentation by the student on a selected topic of stellar evolution/star formation.

## **Office hours**

Upon appointment via email

## **Sustainable Development Goals**

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