UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Laboratory of Data Analysis

2223-1-F5802Q001

Aims

Provide core knowledge and skills for planning and conducting a scientific investigation in astrophysics using archival observations and theoretical models.

Contents

Brief introduction on the basic principles of galaxy formation and evolution, learn how to formulate a scientific question, design and conduct a scientific experiment in astrophysics using archival observations, analysis and data mining of observations and theoretical models, how to present results in a science report.

Detailed program

Galaxy formation and evolution: collapse of dark matter, cooling, gas accretion and star formation, feedback

Formulate a science question: pose an interesting and valid question within the context of current theories; refine the science question on the basis of available data

Design and conduct a scientific experiment: testing hypothesis and design tests and experiments that are most relevant to address a science question

Analysis and data mining: how to analyze and handle large datasets, how to quantify a phenomenon and model a process, how to process data to derive higher level quantities

How to write a report: structure and composition of a successful science report

Practicals: mini research projects using archival observational and theoretical data

Prerequisites

Undergraduate degree in physics.

Students particularly interested in a more in depth understanding of how astrophysical data are acquired are encouraged to follow the "Laboratory of data acquisition" offered in the first semester.

Students interested in deepening their understanding of galaxy formation and evolution should also consider the course "Cosmic Structure Formation".

Teaching form

Introductory workshops on elements of galaxy formation and evolution, formulating a valid scientific question, structuring a scientific investigation, report writing. Hands-on sessions to conduct the analysis and mining of archival data. The workshops are designed through inquiry-based-learning activities lead by the students themselves and facilitated by the instructors. During these activities, the students will be able to choose their own investigation path, develop their own material and, finally, share their findings with their peers in a equitable and inclusive environment.

All activities will be conducted in English.

Textbook and teaching resource

Material will include: i) power point and black-board presentations, ii) material developed in the laboratory during the activities by the students, iii) research papers and reviews, iv) extracts from books (provided during the laboratory when necessary).

Semester

Second semester.

Assessment method

Short written report on the laboratory investigation and oral exam on the written report and introductory laboratory workshops. The final assessment evaluates both scientific content on the formation and evolution of galaxies and scientific practices learned during the laboratory. In particular, the following practices will be evaluated: i) generating and refining scientific questions, ii) finding relevant physical variables in scientific problems, iii) making testable predictions, iv) making relevant assumptions, v) reducing complex problems in smaller units, vi) effectively

sharing and communicating the results.

Office hours

By appointment (via email).

Sustainable Development Goals

QUALITY EDUCATION | GENDER EQUALITY | INDUSTRY, INNOVATION AND INFRASTRUCTURE