Extragalactic Astronomy

Course Overview

- **Textbook:** *Extragalactic Astronomy and Cosmology* (2nd Edition) by Peter Schneider
- **Pacing:** 1-2 weeks per chapter
- **Timings**: Wed 2:30pm - 4 pm Rm 207 Ludwika Pasteura 7
- **Assessments:** Homework assignments (1 per chapter), 1 Midterm Exam, 1 Final Exam
- **Instructor**: Anirban Dutta (Anirban.Dutta@ncbj.govl.pl)
- **Office Hours**: By appointment. I am in Room 519 most of the time. If I am there feel free to walk in

Materials Covered

This course provides a broad overview of the astrophysics of galaxies and their environments, following Peter Schneider's textbook. It begins with the structure, kinematics, and stellar populations of the Milky Way as a foundational baseline. The curriculum then expands to the wider galaxy population, detailing the Hubble sequence, galaxy morphology, luminosity functions, and scaling laws such as the Tully-Fisher and Faber-Jackson relations. Moving to more extreme environments, the material examines Active Galactic Nuclei (AGN), the physics of accretion disks around supermassive black holes and the unified schemes that connect Seyfert galaxies, quasars, and radio galaxies. Moving up to larger structures, the course covers the dynamics and mass distributions of galaxy clusters, focusing on X-ray emission, the virial theorem, and the Sunyaev-Zel'dovich effect. Finally, the course concludes by tracing galaxy evolution across cosmic time, integrating observations of high-redshift sources, cosmic star formation histories, and the co-evolution of galaxies with their central black holes.
Chapter 1: Introduction and Overview
Chapter 2: The Milky Way as a Galaxy
Chapter 3: The World of Galaxies (Includes morphology, luminosity functions, and scaling relations like Tully-Fisher and Faber-Jackson)
Chapter 5: Active Galactic Nuclei (Includes Seyfert galaxies, quasars, and supermassive black hole accretion)
Chapter 6: Clusters and Groups of Galaxies (Includes X-ray emission, virial theorem mass determinations, and the Sunyaev-Zel'dovich effect)
Chapter 9: The Universe at High Redshift (Includes Lyman-break galaxies, sub-millimeter galaxies, and the cosmic star formation history)
Chapter 10: Galaxy Evolution (Includes hydrodynamical simulations, semi-analytic models, and the co-evolution of galaxies and black holes)

Grading Scheme

HWs' total weight is 70%. The midterm exam and the final exam are 15% each.

AI/LLM Use Policy

Using AI/LLMs as tools to understand the course materials is acceptable, even encouraged. However, simply copying answers for HWs from LLMs is not. It violates the course policy and will lead to removal of the student from the course. The final decision of whether a student has used AI/LLM lies with the instructor.

Academic Collaboration

Collaboration between students is strongly encouraged (but academic dishonesty is not). Every participating student enrolled in the course is expected to put in their own effort to solve the HWs/assignments/exams, as well as be able to answer questions regarding the logic and methodology followed by them to arrive at their solutions. Any form of academic dishonesty will lead to removal from the course