SOKENDAI CampusPlan Web Service

Syllabus Reference

Course title	Basic Seminar ＩＣ		
Term	前期 1st Half		
Credit(s)	2		
The main day		The main period	
School/Program	School of Physical Sciences		
Department/Program	Department of Astronomical Science		
Category	Common		
Lecturers	Maria Dainotti		

Instructor

Full name
＊Dainotti, Maria Giovanna

Outline	High-energy astrophysics involves the study of dynamics and kinematics of explosive phenomena in the Universe such as black holes, neutron stars, white dwarfs, supernova, Active Galatic Nuclei, and Gamma-Ray Bursts. This course is meant to provide a physics-based overview of the radiative processes in high astrophysics. Some of the topics are: Introduction :astronomical wavelengths, energies/luminosities/time scales, radiative flux, specific intensities. radiation transfer: emission, absorption; thermal radiation. the maxwell equation, the electromagnetic potentials the radiation from moving particles, the Lorentz transformation, the Field Transformation emission from relativistic particles. Examples from GRBs.
Goal	The goal of this course is for the students to enhance their knowledge of specific topics in high energy astrophysics and facilitate the student learning of problem-solving and independent thinking and exercise the way of organizing and delivering the material of the course. The problem solving will be performed through learning to solve the exercises from the book. Independent thinking can be exercised by trying different solutions to the same exercise in the text book. The organization and delivery of the material will happen through means which are the most suitable for the students, power point presentation, on the white board, on iPad sharing screen etc.

Grading system

	Grading system
Grading system	01:Four-grade evaluation (A,B,C,D)

Grading policy	60% of the grading policy is based on the presence in the classroom and in active participation in the lectures. The other 40% is based on the performance of the students when they have to deliver their assignments. Each student will have several assignments during the duration of the course depending on the number of students.
Lecture Plan	1. April 15/2022 The selection biases in astrophysics and how the luminosity of a source can be affected. Practical exercise on the computation of luminosity of GRBs and the application of statistical methods to overcome selection biases. 2. April 22/2022 Chapter 1: The electromagnetic spectrum, the radiative flux, the specific intensity 3. May 6/2022 exercises from Chapter 1. 1.1, 1.2, and 1.3 and thermal radiation 4. May 13/2022 The Einstein coefficients: Exercises from 1.4, 1.5 and 1.6 5. May 20/2022 Scattering effects: Random walks and Radiative Diffusion. Exercises: 1,7. 1.8;

	1.9 and 1.10 6. May 27/2022 Chapter 2: Review of Maxwell equations, Plane electromagnetic waves, the radiation spectrum: Exercise 2.1 7. June 3/2022 The polarization and the stock parameters, the electromagnetic potential, 8. June 10/2022 APPLICABILITY OF TRANSFER THEORY AND THE GEOMETRICAL OPTICS LIMIT; Exercise 2.2 and Exercise 2.3 9. June 17/2022 Chapter 3: THE LIENARD-WIECHART POTENTIALS; the velocity and radiation field; RADIATION FROM NONRELATIVISTIC SYSTEMS OF PARTICLES; Larmor formula; the dipole approximation. Exercises 3.1-3.2 10. June 24/2022 The Thompson scattering; radiation reaction; Exercises 3.3-3.4-3.5 11. July 1/2022 Undriven Harmonically Bound Particles; Driven Harmonically Bound Particles; 3.6-3.7 12. July 8/2022 Chapter 4: REVIEW OF LORENTZ TRANSFORMATIONS: Length Contraction (Lorentz-Fitzgerald Contradon), time dilatation; Transformation of Velocities; 13. July 15/2022 Doppler effects; Proper time, Transformation of Velocities. Exercises 4.1; 4.2, 4.3. 14. July 22/2022 four vectors; TENSOR ANALYSIS; COVARIANCE OF ELECTROMAGNETIC PHENOMENA. Exercise 4.4; 4.6; 4.7; 4.8. 15. July 29/2022 A physical understanding of field transformations; FIELDS OF A UNIFORMLY MOVING CHARGE; RELATIVISTIC MECHANICS AND THE LORENTZ FOUR-FORCE; EMISSION FROM RELATIVISTIC PARTICLES; Invariant phase volumes and specific intensity: from 4.10-4.15.
Location	Mitaka Campus, the lecture room
Language	English
Textbooks and references	Radiative Processes in Astrophysics, Geroge Rybicki, Alan Lightman. Theory and exercises
Explanatory note on above URL	The reference book both for the theory and exercises is "Radiative Processes in Astrophysics" by Rybicki and Lightman. The first lecture will entail a presentation of each student among others and the assignment to the students for the months of April and May and the introductory lecture on the course and on the definition of luminosity, its computation. A power point presentation will be shared at the end of the lecture. Each student starting from the second lecture will present a topic. For example student 1 exercise 1.1, student 2 exercise 2 etc. May 27 we will assess the assignment for June and if there are changes to be made. On June 24 we will assess the assignment for July.
Others	The delay of students attending the class can be at most 30 minutes after the beginning of the lecture. After that, the presence of the student will not be registered. The presence of the students will be taken at the beginning of the class and within 30 minutes. A bonus (+) in the grade on punctuality along the course will be given.
Keyword	High energy astrophysics, definition of radiative processes, kinematics, basic theory of radiation fields, radiation from moving particles and relativistic covariance and kinematics

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