

<b>Course number</b>	U-LAS70 10002 SE50				
<b>Course title (and course title in English)</b>	ILAS Seminar-E2 :The Invisible Universe ( 不可視の宇宙 ) ILAS Seminar-E2 :The Invisible Universe		<b>Instructor's name, job title, and department of affiliation</b>	Graduate School of Science Associate Professor,LEE, Shiu Hang	
<b>Group</b>	Seminars in Liberal Arts and Sciences		<b>Number of credits</b>	2	<b>Number of weekly time blocks</b> 1
<b>Class style</b>	seminar (Face-to-face course)	<b>Year/semesters</b>	2025 ・ First semester		<b>Quota (Freshman)</b> 5 (5)
<b>Target year</b>	Mainly 1st year students	<b>Eligible students</b>	For all majors		<b>Days and periods</b> Thu.5
<b>Classroom</b>	Room 328, Graduate School of Science Bldg No.4 (North Campus)			<b>Language of instruction</b>	English
<b>Keyword</b>	宇宙物理学 / 天文学 / シミュレーション / データ可視化 / データ解析				
<b>[Overview and purpose of the course]</b>					
<p>Our Universe is far beyond what our eyes can perceive. Hidden in the tranquil ocean of stars, nebulae and galaxies pictured by optical telescopes and cameras around the world everyday, extreme energetic phenomena that can only be observed through ‘ invisible lights' (e.g., radio waves, X-rays, gamma-rays) or even messengers other than electromagnetic waves (e.g., cosmic-rays, neutrinos) are happening frequently here and there in the Cosmos. This seminar will bring students into this exciting world of the Invisible Universe. Students can carry out introductory research projects or study from a book in a subject of his/her interest under the guidance of the instructor.</p> <p>Some projects pursued by past members:</p> <ol style="list-style-type: none"> <li>1) Evolution of stars</li> <li>2) Gamma-ray astronomy using a NASA satellite (Fermi Gamma-Ray Space Telescope)</li> <li>3) Cosmic ray physics</li> <li>4) Learn about astrophysics of blackholes, supernovae, and other fascinating celestial objects.</li> </ol> <p>The way a student will proceed with her/his project varies depending on the subject. For example, the following methods were used by students in the past successfully:</p> <ol style="list-style-type: none"> <li>1) Numerical simulations using open-source codes</li> <li>2) Writing Python scripts for simple calculations and data visualization</li> <li>3) Data analysis using mission-specific applications</li> <li>4) Simulation for observations by future X-ray instruments</li> </ol> <p>Pre-requisite knowledge is not needed for this seminar. The students will be tutored according to their pre-knowledge levels on an individual basis.</p>					
<b>[Course objectives]</b>					
<ol style="list-style-type: none"> <li>1) To obtain basic knowledge and feel the excitement of forefront astronomy and astrophysics through a subject of a student's interest.</li> <li>2) To briefly experience the everyday life of an astrophysicist nowadays through the process of guided independent research, report writing and an oral presentation.</li> </ol>					
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### [Course schedule and contents]

In this seminar, besides a few introductory lectures on topics surrounding multi-wavelength astronomy, the students will perform independent research on intriguing astrophysical objects of their choices and/or study on a topics of their interests by reading books and articles under the guidance of the instructor.

Research projects can be carried out in a group of 2 (or 3 at most) students if preferred.

This seminar will be delivered in a casual format and conducted mainly in English (with occasional Japanese only when necessary). Students are encouraged to ask questions and discuss on topics with their peers and instructor spontaneously at each meeting.

Students will present their studies and findings through a written report and a short oral presentations at the end of the semester.

Total : 14 classes, 1 Feedback session

### [Course requirements]

None

### [Evaluation methods and policy]

Final grades will be assessed according to:

- 1) In-class participation (40%)
- 2) A written report (30%)
- 3) An oral presentation (30%)

### [Textbooks]

Not used

### [References, etc.]

( References, etc. )

Introduced during class

### [Study outside of class (preparation and review)]

Independent research and/or book reading. Guidance will be given in each seminar meeting.

### [Other information (office hours, etc.)]

No fixed office hour will be scheduled. Students can make appointment with the instructor in-person if necessary, or simply contact by Emails.

### [Essential courses]