SOKENDAI CampusPlan Web Service

Syllabus Reference

Course title	Radio Astronomy V		
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	Radio Astronomy		
Lecturers	OHISHI, Masatoshi		

Instructor

Full name
* OISHI MASATOSHI

Outline	Interstellar molecules are the main object of observational research in radio astronomy. This course will provide an understanding of the history of their discovery, understanding of molecular line spectra, and methods for deriving molecular excitation temperatures and abundances from observational data. In addition, students will learn about the expansion of related research fields into interstellar chemistry and astrobiology, which are the boundary areas with chemistry and biology.
Goal	Develop an understanding of molecular spectroscopy, which is essential for observing interstellar molecules. Understand how to derive molecular excitations and abundances (column densities) from observed molecular line data. Obtain basic knowledge of chemical reactions occurring in interstellar space. Gain an overview of experimental and theoretical studies related to interstellar chemistry. To gain knowledge of interstellar organic molecules, which are the fundamental materials for life, and to understand that the universe is strongly connected to life. Gain an understanding of frequency protection to ensure that weak radio signals from space are not drowned out by artificial radio waves.

Grading system

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

Grading policy	Evaluate a Report on a given subject
Lecture Plan	Class period (tentative): April 15, 2022 to July 29, 2022 Lecture 1: Interstellar Molecules and Their History Lecture 2: Fundamentals of Molecular Spectroscopy Lecture 3: Molecular spectra (1) Linear molecules Lecture 4: Molecular spectra (2) Symmetric and asymmetric top molecules Lecture 5: Molecular spectra (3) Internal structure of spectral lines (fine structure, hyperfine structure, internal rotation, inversion motion) Lecture 6: Calculation of Molecular Line Intensity Lecture 7: Analysis of observed data (1) Radiative transport and excitation mechanism Lecture 8: Analysis of observational data (2) Derivation of physical quantities (excitation temperature, column density) Lecture 9: Fundamentals of interstellar chemistry (overview of gas- and solid-phase reactions) Lecture 10: Chemical reaction network simulations Lecture 11: Laboratory studies on Interstellar Reactions Lecture 12: Quantum chemical calculations of interstellar molecular reactions Lecture 13: Interstellar organic matter Lecture 14: Relation between the Universe and Life Lecture 15: Frequency protection activities to maintain the radio quiet environment
Location	The lecture room in the Mitaka campus, NAOJ and Online (choose as appropriate)

Language	English and Japanese
Textbooks and references	None
Others	All graduate students taking courses in the lecture room must take thorough measures to prevent COVID-19 infection. Ensure a regular lifestyle, a good diet, and adequate sleep. Ensure the social distancing between graduate students in the lecture room to be at least 1.5 to 2 m. Non-woven masks are required. Do not speak loudly when asking questions (use a microphone since there are remote participants). Those with even the slightest hint of a cold must participate online. Do not be misled by the uncertain information spread by the media such as television.

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