SOKENDAI CampusPlan Web Service

Syllabus Reference

Course title	Introduction to Radio Observation system		
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	KAWABE, SHAN, OSHIMA, NAGAI, UZAWA		

Instructor

Full name
* KAWABE RYOHEI
UZAWA YOSHINORI
SHAN, Wenlei
OSHIMA TAI

Outline	This course introduces the latest overviews of radio observations from ground and space which allowed to unveil the new views of solar system and structure and evolution of the universe. We learn the physical background and basics of key instruments in radio observations, i.e., antennas, various detectors and spectrometers, two key observational methods, i.e., single-dish observations and interferometric (aperture synthesis) observations, and also various factors related to observational performances.
Goal	This course aims at understanding physical background and principles of key instruments - state-of-art telescopes, detectors, and spectrometers - in radio observations and how detected signals are converted to e.g., radio images through the radio observation systems, and also aims at acquiring basic knowledge desired for understanding how basic performances of radio telescope systems are decided, how observational results such as images and spectra are obtained in various types of radio observations.

Grading system

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

Grading policy	Grading will be based on examinations (including reports, oral examinations during lectures) and your attendance rate. You should be rated higher than 60 points out of 100 for earning credit in this course.
Lecture Plan	1) Historical Overview of Radio Observations(Kawabe): History of radio observations in astronomy, developments of radio telescopes, discoveries are introduced. 2) Overview of Radio Emissions I(Kawabe): Various emissions in meter- to submillimeter- wavelength are explained together with physical quantities inferred from the observations of radio continuum emissions and spectral line emissions. 3) Interstellar Matter(Kawebe): Review the basic characteristics of interstellar matter with showing observational results. 4) Radio Spectroscopy (Kawabe): The principle of radio spectroscopy, its importance in radio astronomy, and some examples of radio spectrometers are briefly explained. 5) Single-dish observations (Kawabe): Single dish radio observations and their methods will be discussed compared with interferometric (aperture synthesis) observations. 6) Introduction of heterodyne detection (Shan): Heterodyne detection in astronomical observations will be overviewed together with the principle of frequency mixing and frequency conversion efficiency and examples of heterodyne detectors. 7) Noise of heterodyne detectors (Shan): Physical background and origin of noise in heterodyne detectors and receiver equation will be briefly explained.

	8) Superconducting tunnel junctions as frequency mixers (Shan): Physical principle of superconducting tunnel junctions as frequency mixers, fabrication technology for superconducting devices, and frontier and challenges of the studies of heterodyne receivers will be lectured. 9) Direct Detectors I (Oshima): Overview of instruments using direct detectors for radio astronomy and some other wavelength will be presented. 10) Direct Detectors II (Oshima): Principles of cryogenic direct detectors such as bolometers and kinetic inductance detectors and their application to wide field cameras and broadband spectrometers will be reviewed. 11) Direct Detectors III (Oshima): The peripheral technologies of direct detectors such as cryogenics, optics, calibration devices and data analysis methods will be introduced. 12) Introduction to Interferometry (Nagai): Introduction to the interferometry principles and systems will be given. 13) Interferometric Observation, Calibration, and Imaging (Nagai): Practical method of interferometric observation, calibration, and imaging as well as the techniques therewith will be explained. 14) Superconducting Quantum Detectors and Quantum Computers I (Uzawa): An overview of how superconducting receivers and quantum computers work will be presented. 15) Superconducting Quantum Detectors and Quantum Computers II (Uzawa): The latest developments on superconducting devices necessary for large-scale superconducting receivers and quantum computers are introduced.
Location	NAOJ Mitaka Campus
Language	English
Textbooks and references	Not specifies

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