Astronomy 585/485 – Radio Astronomy
Spring 2016

INSTRUCTORS:	Professors Chris Walker	Dan Marrone
OFFICE:	SO Room 211	SO Room N314
TELEPHONE:	621-8783	621-5175
EMAIL:	cwalker@as.arizona.edu	dmarrone@email.arizona.edu

LECTURES: MWF 1:00 p.m. – 1:50 p.m, SO Room 204

COURSE DESCRIPTION: The purpose of this course is to introduce you to the theory, instrumentation, and techniques used in observational radio astronomy. We will achieve this goal by combining lectures and discussions with hands-on laboratory experience and real radio astronomical data.

GRADING:

Homework	30%
Labs	30%
Midterm	20%
Final	20%

TEXTBOOKS: Much of the course material will be covered by a new textbook, "TeraHertz Astronomy" written by Professor Walker. He plans to make pdfs of the pertinent sections of the draft version of the book available to students in the class. For the interferometry portion of the class, we strongly encourage you to purchase Thompson, Moran & Swenson, "Interferometry and Synthesis in Radio Astronomy" (2nd 2001/2004), which will be a useful reference throughout your career.

MIDTERM EXAM: An in-class, closed-book midterm is tentatively scheduled during the normal lecture time on February 26th.

FINAL EXAM: Individual oral examinations will be scheduled for students on May 5th and 6th.

LABS: Lab work is an essential part of this course. Three labs are scheduled for this semester, to be carried out in small groups outside normal class hours.

LECTURE TOPICS:

History of Radio Astronomy	Incoherent Detection	Radio Science
Antennas and Diffraction	Real Telescopes/Observing	ALMA
Gaussian Beam Optics	Inteferometry Theory	Future Observatories
Coherent Receivers	Interferometric Observations	

DRAFT SCHEDULE:

Jan 13, 15	Introduction to Radio Astronomy: History & Science	DM
Jan 20, 22	Antennas and Diffraction *Source-Beam Coupling, Diffraction, Convolution, Efficiencies* **(Martin Luther King, Jr. Day: Jan 18)**	CW
Jan 25, 27, 29	Gaussian Beam Optics *Theory, Illumination, Design* **Lab #1:** Gaussian beams	CW
Feb 1, 3, 5	Coherent Receivers I *Types, Theory of Operation, Limiting Sensitivity*	CW
Feb 8, 10, 12	Coherent Receivers II: Signal Processing and Calibration *Spectrometer Types, System Temp*	CW
Feb 15, 17, 19	Incoherent Detection *Types, Theory of Operation, Limiting Sensitivity* **Lab #2:** 1-2 GHz Amplifier	CW
Feb 22, 24, 26	Practical Radio Astronomy *Atmosphere, Real telescope capabilities, Heterodyne/incoherent comparison, Mapping speed of arrays* **Midterm (Feb 26)**	CW
Feb 29, Mar 2	Fourier Transforms *1D and 2D FT, digital sampling* **(Steward Internal Symposium: Mar 4)**	DM
Mar 7, 9, 11	Emission Processes I: Radio Propagation Effects *Interstellar scintillation, dispersion, Faraday rotation* **(UA Spring Break: Mar 14-18)**	DM
Mar 21, 23, 25	Emission Processes II: Radiative Transfer and Continuum	CW
Mar 28, 30, Apr 1	Interferometry I: Theory *Van Cittert-Zernike theorem. Two-element response.*	DM
Apr 4, 6, 8	Interferometry II: Practice *Building an interferometer. u-v sampling.* *Synthesis imaging and deconvolution* **Lab #3:** Rooftop interferometer	DM
Apr 11, 13, 15	Interferometry III: Sensitivity and Limitations *Sensitivity. Atmosphere. VLBI.*	DM
Apr 18, 20, 22	Radio Science *Galactic/extragalactic radio astronomy, cosmology*	DM
Apr 25, 27, 29	Current and Future Capabilities: Interferometry *Capabilities, design considerations and key science goals*	DM
May 2, 4	Current and Future Capabilities: Single Dish, SOFIA, Ballooning, Space	CW

CW = Prof Walker DM = Prof Marrone