Astronomy 585/485 – Radio Astronomy
Spring 2018

INSTRUCTORS:	Professors Chris Walker	Dan Marrone
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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 the textbook, "TeraHertz Astronomy" written by Professor Walker. The book can be purchased via the web (Amazon, CRC Press, etc.) and is available in the UA main library, as well as the Steward library. Pdfs of the pertinent sections of the draft version of the book will be made available to students in the class. For the interferometry portion of the class, Thompson, Moran & Swenson, "Interferometry and Synthesis in Radio Astronomy" is required. It can be purchased ($60) or downloaded as a free PDF directly from Springer: http://www.springer.com/us/book/9783319444291

MIDTERM EXAM: An in-class, closed-book midterm is tentatively scheduled during the normal lecture time on February 23rd.

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	Interferometry Theory	Future Observatories
Coherent Receivers	Interferometric Observations	

DRAFT SCHEDULE:

Jan 12, 17	Introduction to Radio Astronomy: History & Science **(Martin Luther King, Jr. Day: Jan 15)**	CW
Jan 19, 22	Antennas and Diffraction *Source-Beam Coupling, Diffraction, Convolution, Efficiencies*	CW
Jan 24, 26	Gaussian Beam Optics *Theory, Illumination, Design* **Lab #1:** Gaussian beams	CW
Jan 29, 31, Feb 2	Coherent Receivers I *Types, Theory of Operation, Limiting Sensitivity*	CW
Feb 5, 7, 9	Coherent Receivers II: Signal Processing and Calibration *Spectrometer Types, System Temp*	CW
Feb 12, 14, 16	Incoherent Detection *Types, Theory of Operation, Limiting Sensitivity* **Lab #2:** Detector Lab	CW
Feb 19, 21, 23	Practical Radio Astronomy *Atmosphere, Real telescope capabilities, Heterodyne/incoherent comparison, Mapping speed of arrays* **Midterm (Feb 23)**	CW
Feb 26, 28, Mar 2	Emission Processes I: Radiative Transfer and Continuum **(UA Spring Break: Mar 5-9)**	CW
Mar 12, 14	Emission Processes II: Radio Propagation Effects *Interstellar scintillation, dispersion, Faraday rotation*	DM
Mar 16, 19, 21	Fourier Transforms *1D and 2D FT, digital sampling* **Lab #3:** Digital Lab	DM
Mar 23, 26	Interferometry I: Theory *Van Cittert-Zernike theorem. Two-element response*	DM
Mar 28, 30	Interferometry II: Practice *Building an interferometer, u-v sampling*	DM
Apr 2, 4, 6	Interferometry III: Images *Synthesis imaging and deconvolution* **Lab #4:** Rooftop interferometer	DM
Apr 9, 11, 13	Interferometry IV: Sensitivity and Limitations *Sensitivity. Atmosphere. VLBI.*	DM
Apr 16, 18, 20	Current and Future Capabilities: Single Dish, SOFIA, Ballooning, Space *Galactic/extragalactic radio astronomy, cosmology*	CW
Apr 23, 25, 27	Current and Future Capabilities: Interferometry *Capabilities, design considerations and key science goals*	DM
May 2	Review	DM/CW

CW = Prof Walker DM = Prof Marrone