

Astro 426/526

Fall 2019

Prof. Darcy Barron

Initial Class Survey

Please fill out before Wednesday's class!

Email me if you have any questions or problems.

https://docs.google.com/forms/d/e/1FAIpQLSeXX72pRRtvqbv6hROJMqUP-zpjein1Jg_84tMPmSW30C64fQ/viewform?usp=sf_link

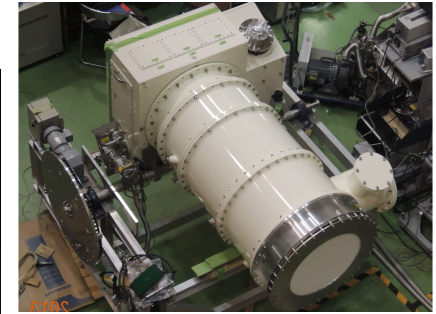
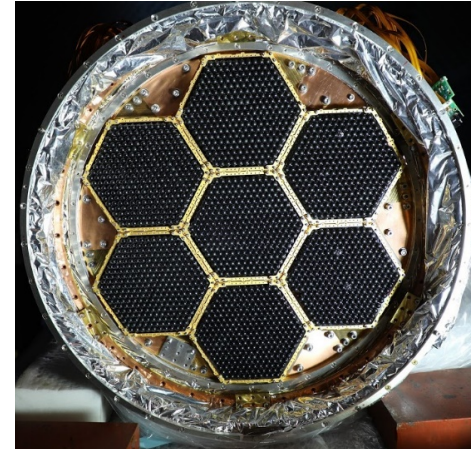
What is this class?

Optics and Instrumentation

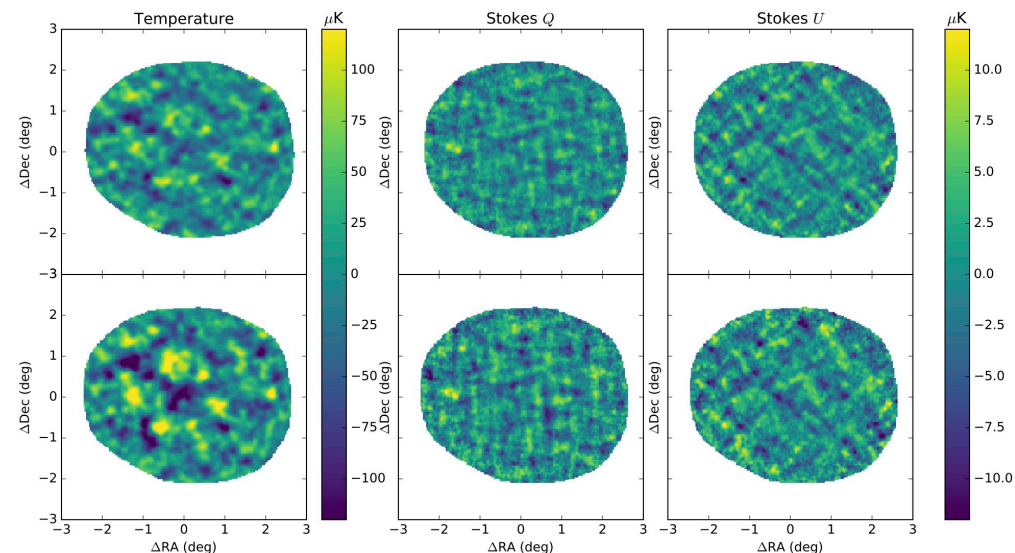
- Principles of optics and quantum physics applied to modern astronomical instrumentation (over a wide range of electromagnetic wavelengths), data acquisition and processing.

Cosmology with POLARBEAR and Simons Array

Prof. Darcy Barron



POLARBEAR/Simons Array is an experiment located in the Atacama desert in Chile, designed to map the cosmic microwave background's B-mode polarization signal. This faint pattern arises from gravitational lensing of the CMB, and is a powerful probe to study the composition and large-scale structure of the universe. A unique B-mode polarization pattern would also be imprinted by inflationary gravitational waves in the early universe. Measuring this signal would provide direct evidence for inflation, as well as provide insight into the mechanism and energy scale of inflation.

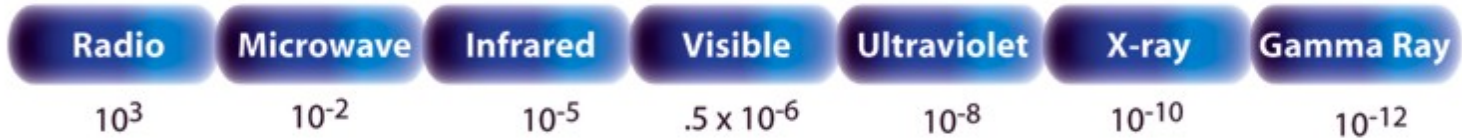


THE ELECTROMAGNETIC SPECTRUM

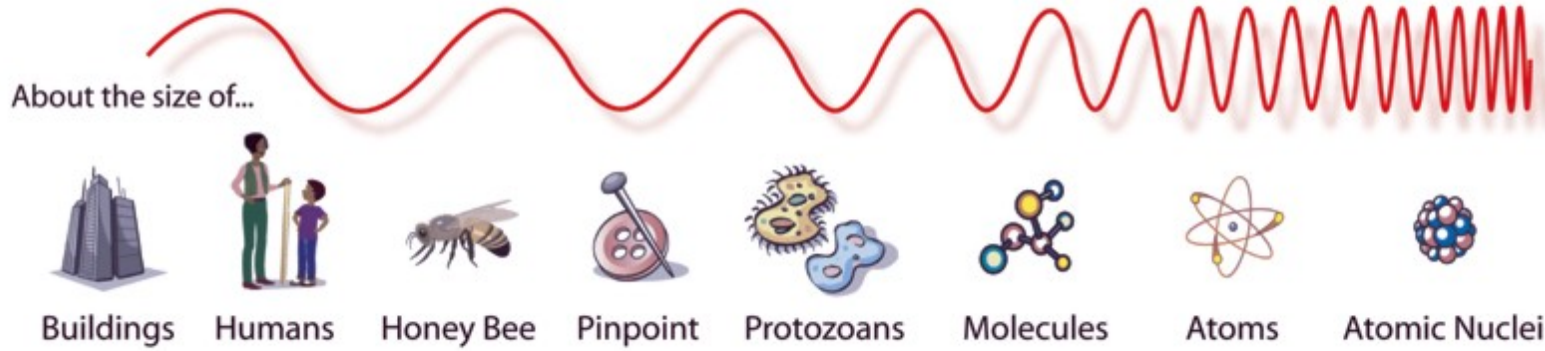
Penetrates Earth Atmosphere?



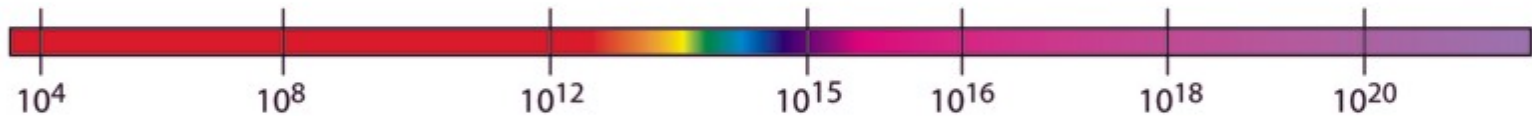
Wavelength (meters)



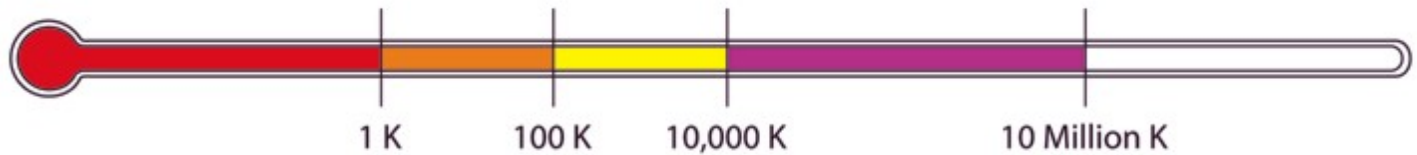
About the size of...



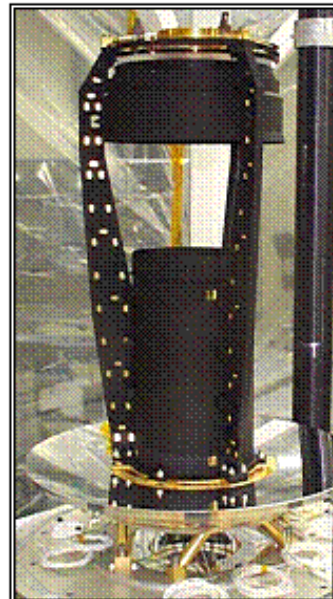
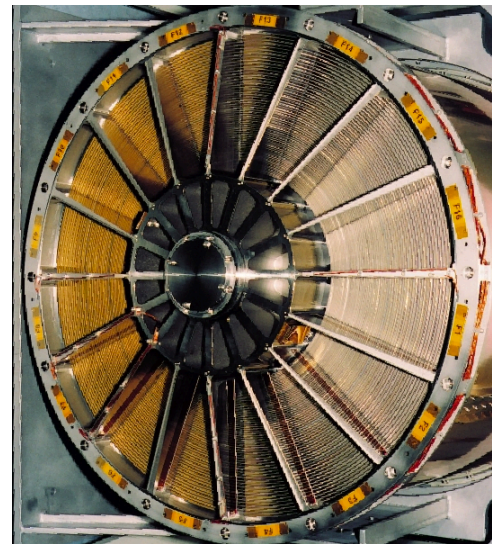
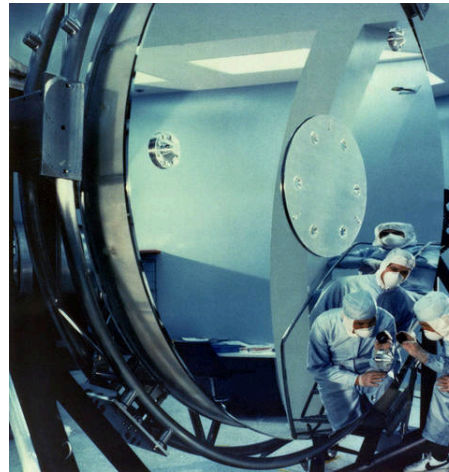
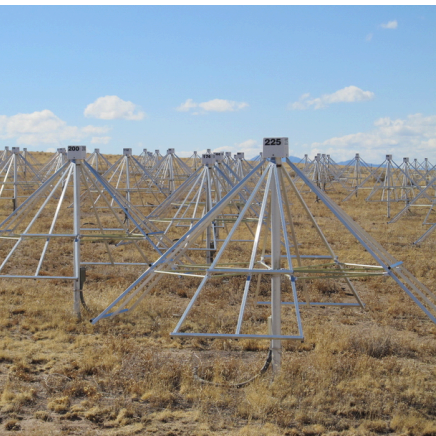
Frequency (Hz)



Temperature of bodies emitting the wavelength (K)

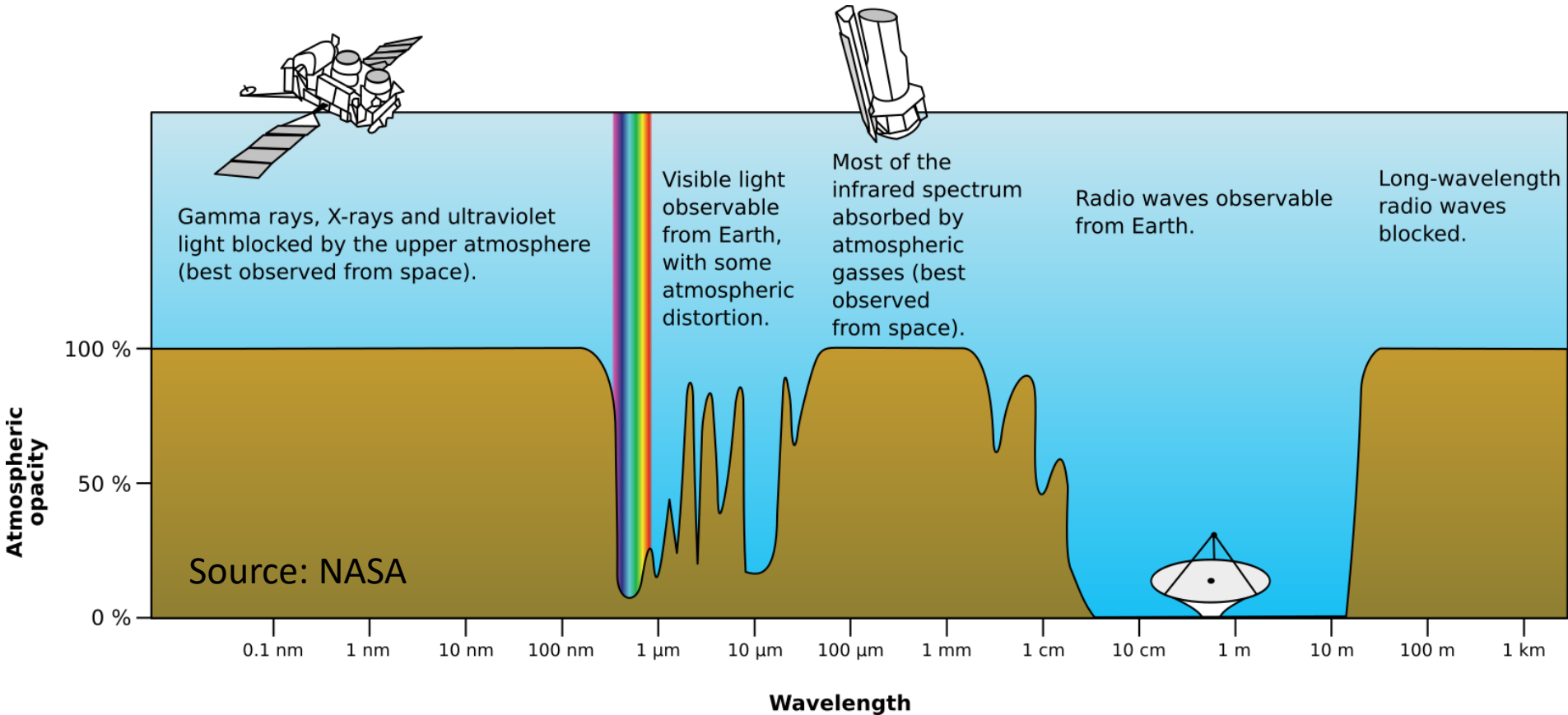


Source: NASA



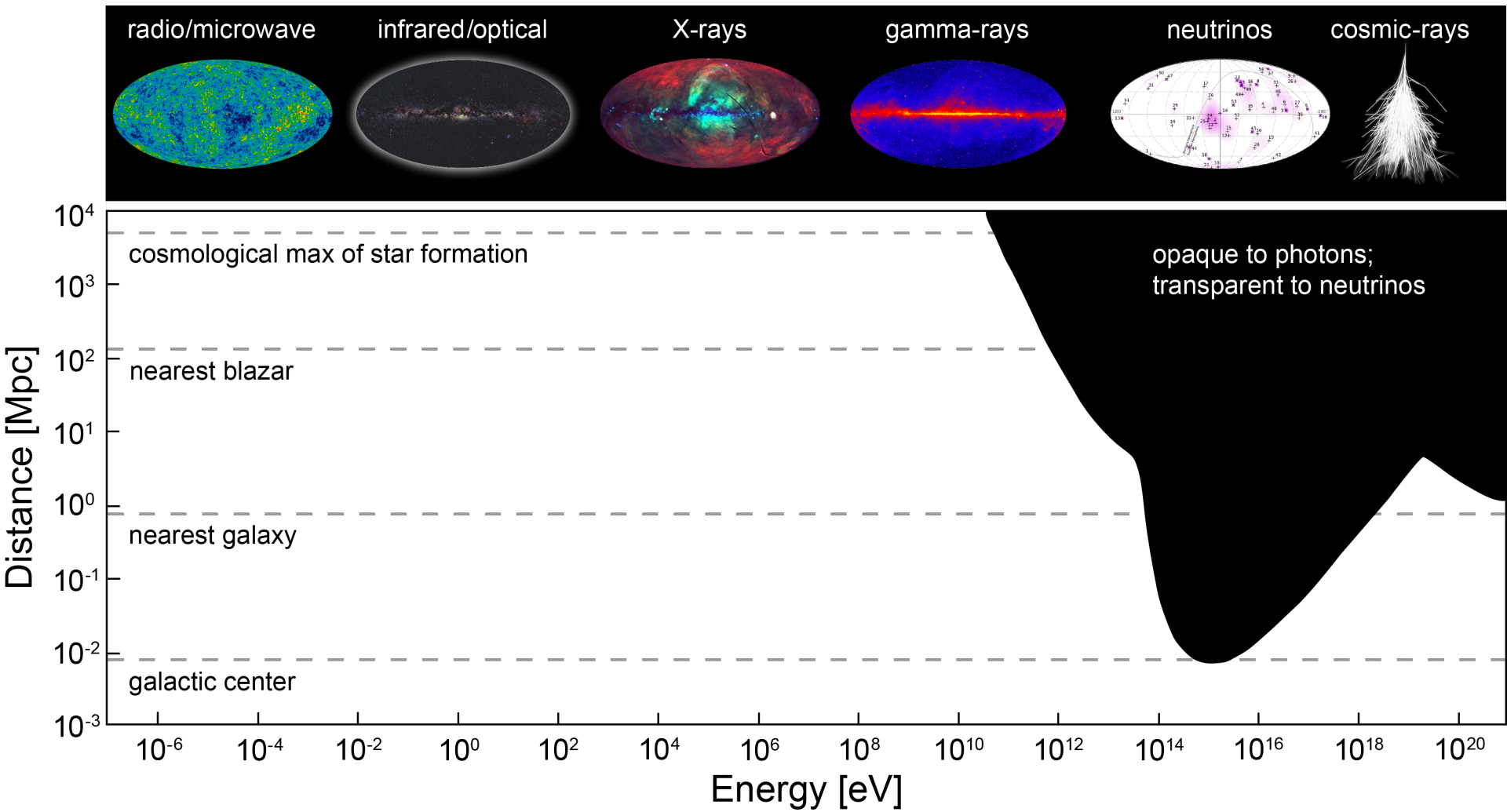


Electromagnetic spectrum and our atmosphere

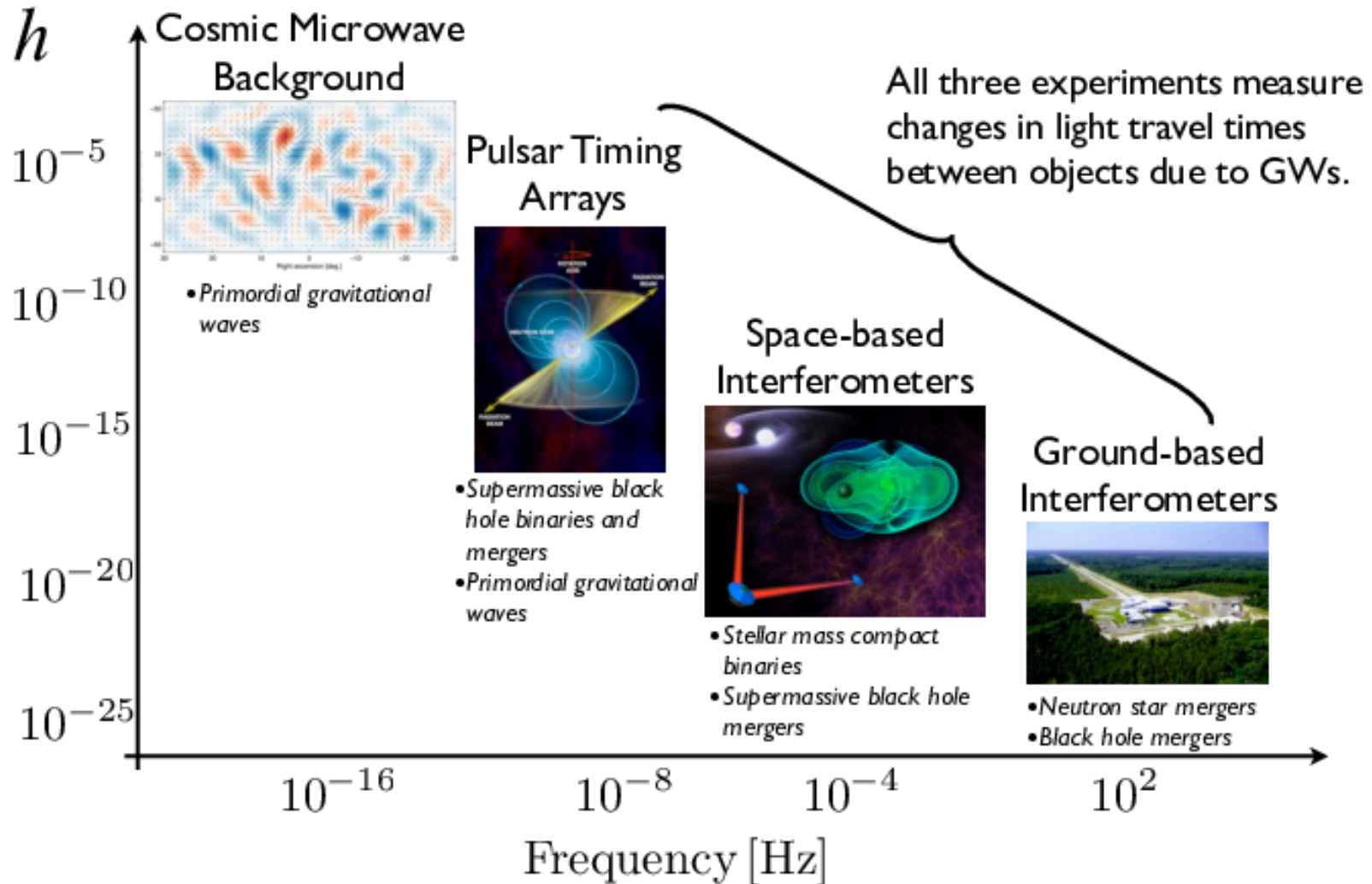


Telescope Names (xkcd)

THE VERY LARGE TELESCOPE	<input checked="" type="checkbox"/>
THE EXTREMELY LARGE TELESCOPE	<input checked="" type="checkbox"/>
THE OVERWHELMINGLY LARGE TELESCOPE	<input checked="" type="checkbox"/> (CANCELED)
THE OPPRESSIVELY COLOSSAL TELESCOPE	<input type="checkbox"/>
THE MIND-NUMBINGLY VAST TELESCOPE	<input type="checkbox"/>
THE DESPAIR TELESCOPE	<input type="checkbox"/>
THE CATAclySMIC TELESCOPE	<input type="checkbox"/>
THE TELESCOPE OF DEVASTATION	<input type="checkbox"/>
THE NIGHTMARE SCOPE	<input type="checkbox"/>
THE INFINITE TELESCOPE	<input type="checkbox"/>
THE FINAL TELESCOPE	<input type="checkbox"/>



The spectrum of gravitational wave astronomy



Contact information

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Office: 1136 Physics and Astronomy

Office Hours TBA, or by appointment

TA: Kayla Mitchell

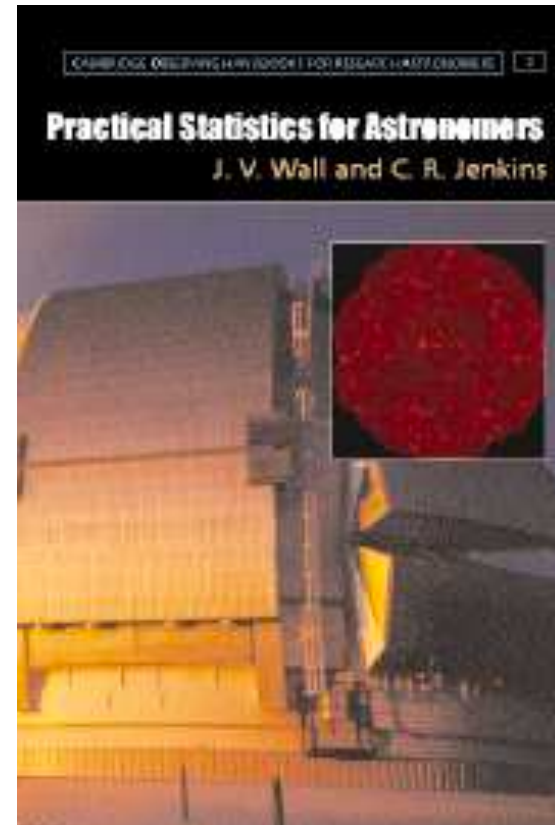
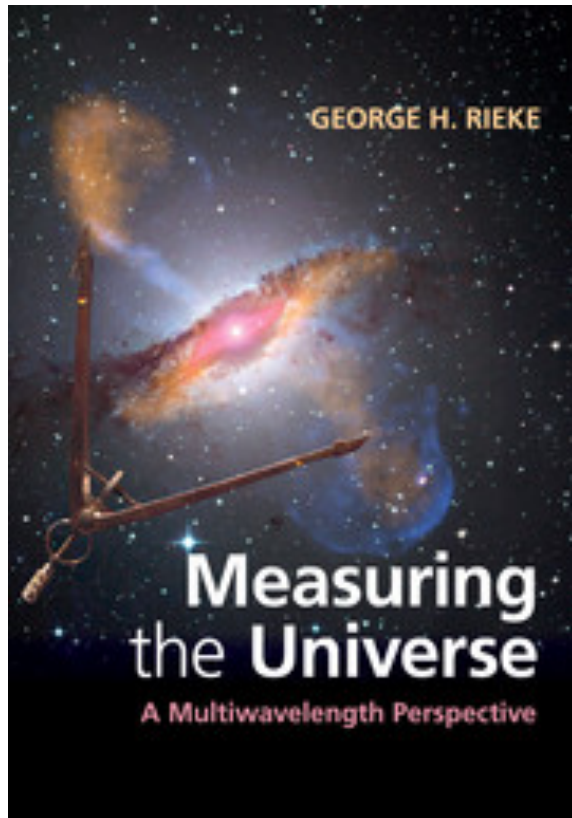
Email: kmitchell3@unm.edu

Course websites

- Learn.unm.edu
 - Will use to post grades and some homework submissions
 - Will post course materials here
- <https://ghz.unm.edu/education/instrumentation.html>
 - Will also post course materials here, along with other resources

Please check your email regularly for course announcements and updates.

Textbooks



http://www.astro.ubc.ca/people/jvw/ASTROSTATS/pracstats_web_ed2.html

Grading

- Mid-term Exam 15%
- Final Exam 15%
- Homework 30%
- Final Project 30%
- In-Class Participation 10%

See full syllabus for details

Tentative schedule

Week	Dates	Topics
1	Aug 19, 21	Course overview; radiation fundamentals
2	Aug 26, 28	Radiometry; Python/Astropy
3	Sept 2, 4	Image formation, telescope design
4	Sept 9, 11	Optical telescopes
5	Sept 16, 18	Detectors overview
6	Sept 23, 25	Statistics, noise, and error analysis
7	Sept 30, Oct 2	Discussion of Project, Review; Mid-term Exam
8	Oct 7, 9	Analysis of Sequential Data
9	Oct 14, 16	Project Proposal Due; Fourier Transforms
10	Oct 21, 23	Optical/IR
11	Oct 28, 30	Data modeling
12	Nov 4, 6	Spectroscopy
13	Nov 11, 13	Submillimeter and radio
14	Nov 18, 20	Interferometry
15	Nov 25, 27	Final Projects Due; Multi-messenger astronomy
16	Dec 2, 4	Student project presentations
17	Dec 10	Final Exam

Any questions?

For Wednesday

- Complete the pre-class survey
- Review the syllabus
- Bring your laptop to class