

# Origin and Evolution of the Universe

## ASTR 18200/PHSC18200 Winter 2022

### Syllabus

This syllabus is a plan for the quarter, but subject to change. The only things I will keep fixed are the date of the mid-term essay and the date of the final in-class exam.

#### 1/11 Lecture #1

Meet the instructor and the students.

Overview of Cosmology

Goals for the quarter

Models, theories, laws

The Ptolemaic Cosmology

Was it science? Cultural influences; Underpinning; Successes and failures

#### 1/13 Lecture #2

Copernican “revolution”

Once again... Was it science? Cultural influences; Underpinning; Successes and failures

Kepler

#### 1/18 Lecture #3

Homework #1 due (assignment will be posted on Chalk)

Newtonian Cosmology

Was it science? Cultural influences; Underpinning; Successes and failures

#### 1/20 Lecture #4

The Kapteyn Universe

Successes and failures

#### 1/25 Lecture #6

Homework #2 due (assignment will be posted on Chalk)

Einstein’s Special Theory of Relativity

Why him, why then?

#### 1/27 Lecture #7

Einstein’s General Theory of Relativity

#### 2/1 Lecture #8

Homework #3 due (assignment will be posted on Chalk)

Einstein misses the big bang (why?) and proposes the first “steady state” universe (his “biggest blunder”!)

2/3 Lecture #9

Friedmann and Lemaitre discover a big bang as the natural solution

“Origin of the world”

What does origin of the universe mean?

The Friedmann Equation describing the expansion history of the universe.

2/8 Lecture #10

Mid-term essay due.

Hubble discovers the expansion of the universe

Einstein becomes a big banger!

2/10 Lecture #11

The Quantum World

2/15 Lecture #12

Homework #4 due (assignment will be posted on Chalk)

2/17 Lecture #13

The Origin of the Elements, Big-Bang Nucleosynthesis

2/22 Lecture #14

Homework #5 due (assignment will be posted on Chalk)

Inflation: making the universe causal

Inflation: planting the seeds of structure

2/24 Lecture #15

The  $\Lambda$ CDM model

Growth of Structure

3/1 Lecture #16

Homework #6 due (assignment will be posted on Chalk)

Dark Matter

3/3 Lecturer #17

The acceleration of the universe: Dark Energy

3/8 Lecture #18

The multiverse: is it science?

Time = 0.

Emergence of a universe from nothing

3/10 In-class Final Exam