Meeting 2
January 20, 2021

0. Introduction
Will talk a lot about distance measurements this meeting and next
1. Book discussion
Einstein slide - emphasize homogeneity
Weinberg presents us with a timeline of his book
Slide - in blue is what is covered by the book, black new things since book publication
- Inflation, Guth 1980 - book - solved problems of smoothness
- QGP - CERN at LHC
- Dark energy, big surprise in the at turn of century
- Growth - different eras are dominated by different drivers of expansion
We live in a time where DE has just taken over
- Will talk about DE at end of course
Slide - Einstein - meaning of inertial frame

5 m Break

2. Before "The First Three Minutes" precursor to the discovery of the expansion of the universe

a. Redshift - measure velocity (and distance)
- relativistic doppler shift - stretch and compress waves
- atomic line - same energy - one color
- Spectrograph - separates light
- need slit, long exposures, very trick (later)
- Example: FIRE
Will see more of table later
FIRE and Simcoe in Chile
Pictures, technology challenges
- Great Debate
- Inside Milky Way, do not really know what it looks like - Slide 12
- SMC, LMC
- Slide 13 - negative plate, from Hubble
- see many nebula
- Slide 14 - foreground object s are stars, did not resolve until 1943
- Slide 15 - Nation Research Council/NAS
- both prominent, arguments written and published
- Slide 16 - delta Cepheid, constellation, mythical King
- Slide 17 - Big telescope, clear night point=0.1"
- can find center up to 0.001", Hubble 0.0003"
- convert to radians
- Parallax - people do it all the time, cats
- Slide 18 - Mechanism of Cepheid, 20 solar Masses
- Slide 19 -

- Slide 20 - Ratio of areas
- Slide 21 - Not the first time Hubble was wrong
- Slide 22 - Features
    - equatorial mount, motor drive to track stars
    - physically demanding, cold, long exposures
- Slide 23 - Hubble, HST