

1.11 Eclipses

PRE-LECTURE READING 1.11

- *Astronomy Today*, 8th Edition (Chaisson & McMillan)
- *Astronomy Today*, 7th Edition (Chaisson & McMillan)
- *Astronomy Today*, 6th Edition (Chaisson & McMillan)

VIDEO LECTURE

- Eclipses¹ (19:13)

SUPPLEMENTARY NOTES

Lunar Eclipse

- See Lunar Eclipse².
- Order: Sun, Earth, Moon
- Earth's shadow is large; the moon is small.
 - Entire moon can fit in Earth's shadow.
 - Eclipse visible to entire night side of Earth.
 - Total eclipse: Entire moon in umbral shadow up to 107 minutes.
 - Partial and total eclipses: Part of moon in umbral shadow up to 4 hours.
 - Penumbral eclipses: Do not dim the moon enough for human eye to notice.

Solar Eclipse

- See Solar Eclipse³.
- Order: Sun, Moon, Earth
- The moon's shadow is small; Earth is large.
 - Entire Earth cannot fit in the moon's shadow.
 - Eclipse visible to only some locations on Earth's day side.
 - Total eclipse: Locations in the umbral shadow up to 7 minutes.
 - Partial and total eclipses: Locations in the penumbral shadow up to 157 minutes.

¹<http://youtu.be/bZEbl-oryP8>

²http://en.wikipedia.org/wiki/Lunar_eclipse

³http://en.wikipedia.org/wiki/Solar_eclipse

Annular Eclipse

- The moon's orbit around Earth is eccentric.
- Consequently, the moon's distance to Earth can vary, by up to 14%.
- Consequently, the moon's apparent, angular size varies, between 29.3' and 34.1'.
- The sun's angular size varies between 31.6' and 32.7'.
- If the moon is directly between you and the sun, and:
 - If the moon's angular size $>$ the sun's angular size, then total eclipse.
 - If the moon's angular size $<$ the sun's angular size, then annual eclipse.
- Note: The moon is moving away from Earth at a rate of 3.8 cm/year. Consequently, there will be no more total solar eclipses in about a billion years.

EXERCISES

- Experiment with UNL's Eclipse Shadow Simulator⁴.
- Your thumb at arm's length subtends about two degrees. (There is some variation from person to person, but people with bigger thumbs tend to have longer arms and vice versa, so these differences tend to cancel out.) Using your thumb, estimate the angular size of the moon.

ASSIGNMENT 1

Do Question 8.

⁴<http://astro.unl.edu/classaction/animations/lunarcycles/shadowsim.html>