ECLIPSE 101

The Basics of Eclipses

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Greene Family Camp
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Agenda

- What is an eclipse? Why and when do they occur?
- What will we experience?
- Eclipse facts and lore
- How to photograph an eclipse (guest speaker Ophir Palmon)
- Eclipse 201 preview

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What is an Eclipse?

- An **eclipse** happens when sun, moon, and earth line up (called **syzygy**, awesome Hangman word).
- **Lunar eclipse**: Earth casts a shadow on the moon
- **Solar eclipse**: Moon casts a shadow on the earth

lunar eclipse **solar eclipse**

(very much not to scale)
(other arrangements don't happen)

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What is a Solar Eclipse?

- When the moon gets between the sun and the earth, it casts a shadow, just like anything else.

- In most of the shadow, only part of the sun is covered; anyone in that area sees a **partial** eclipse.

- In a small area, the moon *completely* blocks the sun, yielding a **total** eclipse.

- (Why only a small area? Because the apparent size of the moon is almost exactly the same as that of the Sun.)

- The eclipse is visible along a west-to-east path as the moon travels in its orbit.

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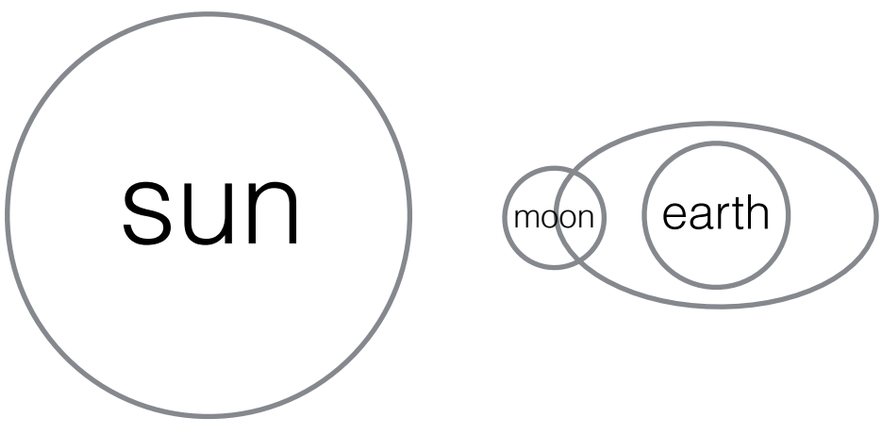
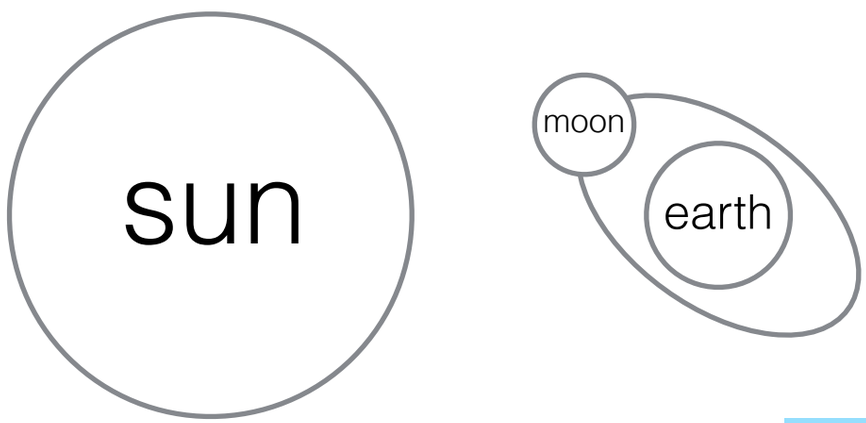
Why not two per month?

- If the moon orbited the earth in the same plane that the earth orbits the sun (called the **plane of the ecliptic**) then we'd have one solar eclipse and one lunar eclipse each month.

- But the moon's orbit is tilted, so eclipses occur only when the moon crosses the ecliptic (a **node**) at the right time. More eclipse geometry in Eclipse 201.





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Types of solar eclipse

- **Total**: The moon entirely covers the sun.

- **Partial**: The moon partially covers the sun. People near but outside the narrow **path of totality** will see a partial eclipse on Monday. Most solar eclipses are partial-only.

- **Annular**: The moon is too far away to completely cover the sun; the sun shows all around it in a ring.

- **Annular-total** (or **hybrid**; rare): An annular eclipse that becomes total as it progresses; the curvature of the earth's surface reduces the distance to the moon.

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Eclipse facts

- Each spot on earth sees a total solar eclipse about once every 375 years. Lunar eclipses are visible everywhere that it's night.

- Longest possible total solar eclipse: about 7.5 minutes.

- The moon is receding at 1.5 inches/year: The last-ever total solar eclipse will occur in about 600,000,000 years.

- The **shortest day** of the year is the winter solstice, usually 12/21. But the **earliest sunset** occurs a couple weeks earlier; the **latest sunrise** a couple weeks later. This has nothing to do with eclipses.

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What we'll experience, 1

- **SAFETY FIRST**: Never look directly at the sun, except during totality! **USE YOUR GLASSES!!**

- **First contact** (C1), 12:20 PM: The disc of the moon touches the sun. Boring for awhile. Use the bathroom.

- Increasing obscuration: shadows sharpen, stars appear, leaves/colander produce pinhole-camera effect.

- If we're lucky: **Shadow bands**: thin moving lines of light and dark, produced by the same air turbulence that makes stars twinkle.

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What we'll experience, 2

- **GLASSES STILL ON!!**

- **Baily's beads**: Points of light caused by the sun shining through the mountains of the moon.

- **Diamond ring**: The very last bead.

- If we're lucky: The moon's shadow rushing toward us at supersonic speed.

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What we'll experience, 3

- **Second contact** (C2), totality. 1:37:34. Whistle blows (if I remember) and your glasses come off.

- The **corona**, the shell of plasma around the sun.

- **Solar prominences**, streaks of burning gas extending from the **photosphere** through the corona.

- Sunset all the way around the horizon, outside totality.

- The **Purkinje effect** ("Poor-kin-ye"): dark reds, bright greens.

- (Much more on this in Nancy Morrison's talk Monday.)

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What we'll experience, 4

- **Third contact** (C3), end of totality. 1:41:37. Whistle blows (if I remember). **GLASSES GO BACK ON!!!**

- Some effects reverse: Beads, shadows, bands, etc. But it's mostly anticlimactic from here out.

- **Fourth contact** (C4), end of partial eclipse, 3:00. Camp activities continue. Lots of traffic between here and the airport.

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Eclipse Lore I

- **Christopher Columbus** used the total lunar eclipse of 2/29/1504 to scare the natives of Jamaica into continuing to feed his crew (they had cut off his food after six months of cheating and theft). Mark Twain adapted this story in *A Connecticut Yankee in King Arthur's Court*.

- **Muhammad**, prophet of Islam, was born in the year of a solar eclipse; his son Ibrahim died 1/22/632 during an eclipse. Islamic theology does not accept these events as signs, positive or negative. Muhammad said "The sun and moon . . . do not eclipse for the birth or death of any man." (Sahih Bukhari, vol. 2, book 18, no. 153)

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Eclipse Lore II

- **Emperor Louis I** ("The Pious"), son of Charlemagne, saw a solar eclipse on 5/5/840 and was so terrified by the omen that he died shortly afterwards.

- **Nat Turner**, antebellum Virginia preacher, planned a slave revolt but wanted a sign from God in confirmation. In 1831 he saw two solar eclipses, 2/12 annular and 8/7 total, and launched the Southampton Insurrection (Nat Turner's Rebellion). Hundreds died.

- According to tradition, Chinese astronomers **Ho** and **Hi** failed to predict the eclipse of 10/22/2137 BCE due to drunkenness and were beheaded for incompetence. Bad choreographers beware.

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How to photograph an eclipse

NOT AT ALL!!!

(You'll just waste time better spent looking at the sky.)
And ***DEFINITELY*** don't use a flash

But if you must, listen to this gentleman (applause):
Guest speaker Ophir Palmon, professional photographer

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What's coming in Eclipse 201

- The **eclipse season**: When can eclipses occur? How many can there be each year?

- The **Saros cycle**: Eclipses recur every 6585.3 days.

- How eclipses helped prove Einstein's General Theory of Relativity and help measure the slowing of the Earth's rotation

- Eclipses in Jewish tradition

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QUESTIONS?

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