Astr 118, Physics of Planetary Systems
Discussion Week 2: Inverse-Square Law
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I'll take the globes around to two groups at a time to do problem 2.

1. In small groups (pairs or groups of three), take a sheet of black paper, a torch, and a ruler. Shine the torch on the sheet of paper from a fixed distance away, and make a note of the diameter on the paper. Do this at a few different distances.
    a. What do you observe about the total amount of light?
    b. What do you observe about the size of the spot on the paper?

2. Due to the tilt of the Earth, the angle at which sunlight comes in changes throughout the year. The northernmost point that gets direct sunlight (at noon on the June solstice) is the Tropic of Cancer, and the southernmost point that gets direct sunlight (at noon on the December solstice) is the Tropic of Capricorn.
    a. Find Santa Cruz (or any other point you'd like) on the globe, and use the torch to illuminate the Tropic of Cancer near it. Observe the amount of illumination that Santa Cruz gets.
    b. Repeat, but illuminating the Tropic of Capricorn. Move the torch closer while maintaining the same angle, and observe the new amount of illumination at a similar distance away.
    c. At its farthest point, the Earth is about 2% farther away from the Sun than its mean distance. How much would you have to move the torch to see this effect? How much of a difference in illumination do you expect this to cause?
    d. (Bonus, ask me for more info) Try to estimate the fractional difference between the maximum (summer) and minimum (winter) illumination at your chosen point.

3. The TRAPPIST-1 system consists of a star and seven known planets. The star's luminosity is about 2×10^{30} erg/s, and the planets have the following mean distances from their star. Which ones might be habitable? Assume zero albedo.

Planet	b	c	d	e	f	g	h
Distance (au)	0.0115	0.0158	0.0223	0.0293	0.0385	0.0468	0.0619