Lecture 2

Announcements:

* Attendance sheet
* Survey - return Friday
* Number sheets.

HW Assignment

* Weekly HW due Friday Aug 30, 2024
* Will be a set of problems / questions:
  - for each write complete explanation / solution
    - verbal description, diagrams, math
  - return a paper copy

(Note: This is how people learn physics).

Friday: Read

Motion of celestial objects

If one looks up on a clear night various objects are visible in the sky. These include: the Moon, stars, planets,... A collection of the nearest objects are primarily controlled by the Sun. These constitute the solar system, which contains

* the Sun
* the Moon
* Earth
* planets
* asteroids

We can ask:

1) how are the objects in the solar system arranged?
2) how do these objects move.

We are only allowed to answer these questions based on observations from the Earth (or nearby the Earth).

Our current notion is that each planet orbits Sun in a roughly circular orbit. Moon orbits Earth in a roughly circular orbit.

DEMO: The Sky Solar System model

→ remove comets
→ two 1 sec = 1 week

What the animation illustrates is a "model" which contains:

* a "picture" or ideas about how the objects are arranged
* rules for how they behave.
* ability to predict what we will observe.

We will consider various models for the solar system, asking:

* what can each model predict?
* how does each model's prediction match observations?
* which models do we regard as incorrect / correct and why?

Again the answers must be based on observations from Earth.

Types of celestial objects

Broadly we consider the following types of celestial objects

1) Sun
2) Moon
3) Stars - appear fixed relative to each other
   - appear to move relative to Earth during one night

DEMO: *Big dipper... Astropix
*CIRO Star Motion

4) planets ~ appear to move relative to Earth during one night ~ similar to stars.

~ appear to move relative to fixed stars as nights pass

DEMO: Jupiter Saturn orbits 2020 APOD

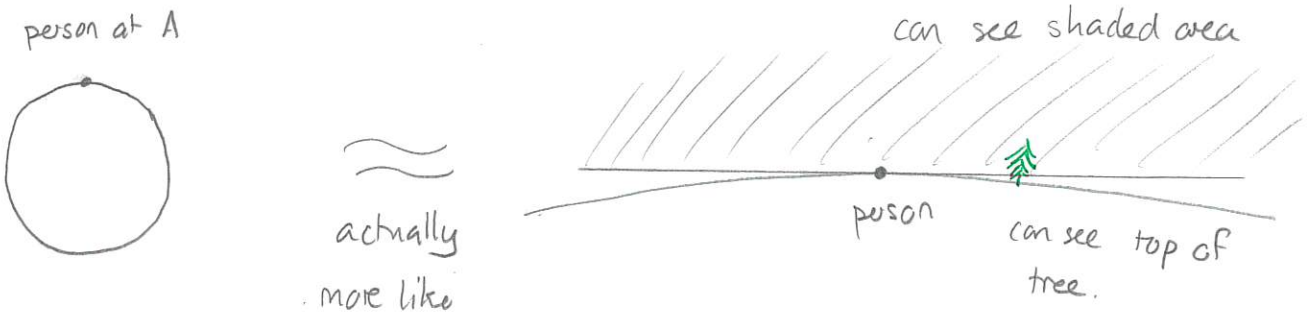
~ visible planets: Mercury, Venus, Mars, Jupiter, Saturn.

Observing planets from Earth

Our goal is to construct a model that describes the motion of the planets as observed from Earth. This model will involve geometrical constructions and reasoning using geometrical diagrams. Consider the possibility of observing from one location on Earth, which is a sphere.

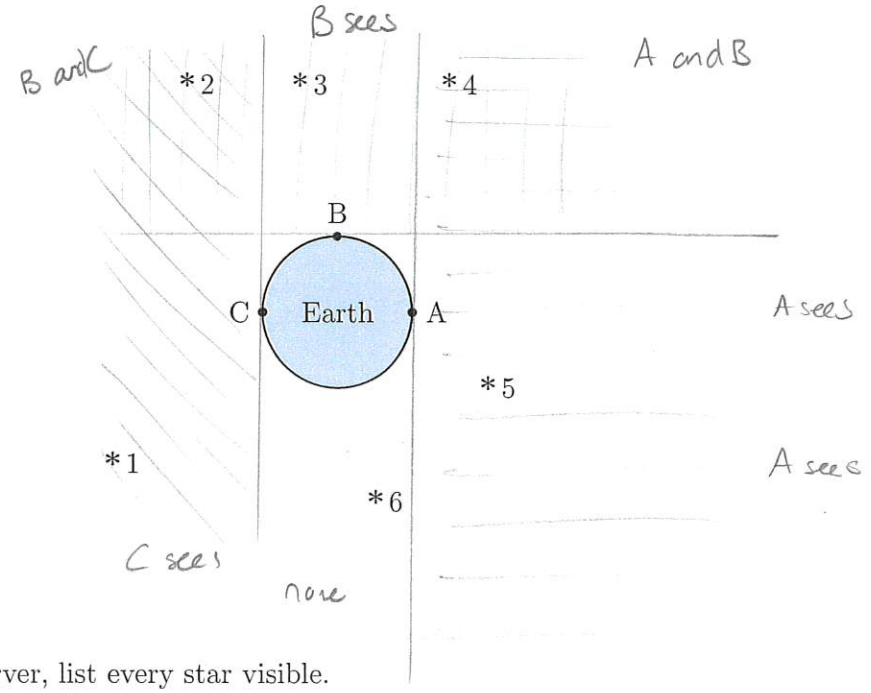
Quiz 1 → Solution slide

We can construct a "field of vision" using a tangent to the surface



1 Observations from Earth

Various stars, labeled $1, 2, 3, \ldots$, are located around Earth as illustrated. People, labeled A, B, C, observe the sky from the indicated locations on Earth's surface.



a) For each observer, list every star visible.

b) Illustrate the region of that is visible to each observer on the diagram.

c) Is there any region of the sky that is visible to all three observers?

d) Is there any region of the sky that is visible to none of the three observers?

a) A 4,5
B 2,3,4
C 1,2

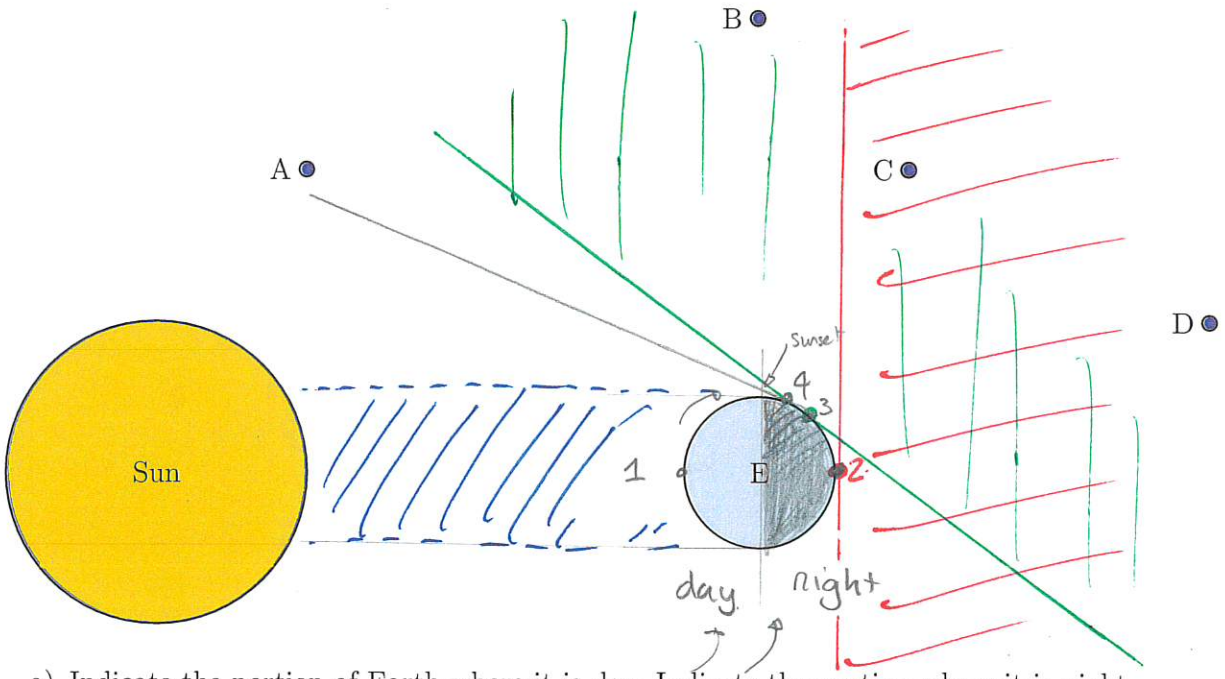
b) see diagram

c) no the regions do not overlap.

d) yes star 6 is in that regia

2 Observing planets

Planets in the solar system can be observed when they reflect light from Sun to the observer. This light is too dim to be observed during the day. Consider Sun, Earth and several planets as illustrated (the diagram is not to scale).



a) Indicate the portion of Earth where it is day. Indicate the portion where it is night.

b) Indicate the location on Earth where it is midday. Indicate the portion where it is midnight.

c) One person observes at midnight. Which planets can this person see?

d) Another person observes halfway from sunset to midnight. Which planets can this person see?

e) Are there any of these planets which are not visible from at least one nighttime location on Earth?

f) Are there any locations where a planet could be so that it is not visible from any nighttime location on Earth?

b) location marked 1 = midday
location marked 2 = midnight

c) midnight sees shaded in red. => C, D

d) this person is at 3 sees shaded green => B, C, D

e) No, A can be see by a person at 4.

f) yes anywhere in the blue