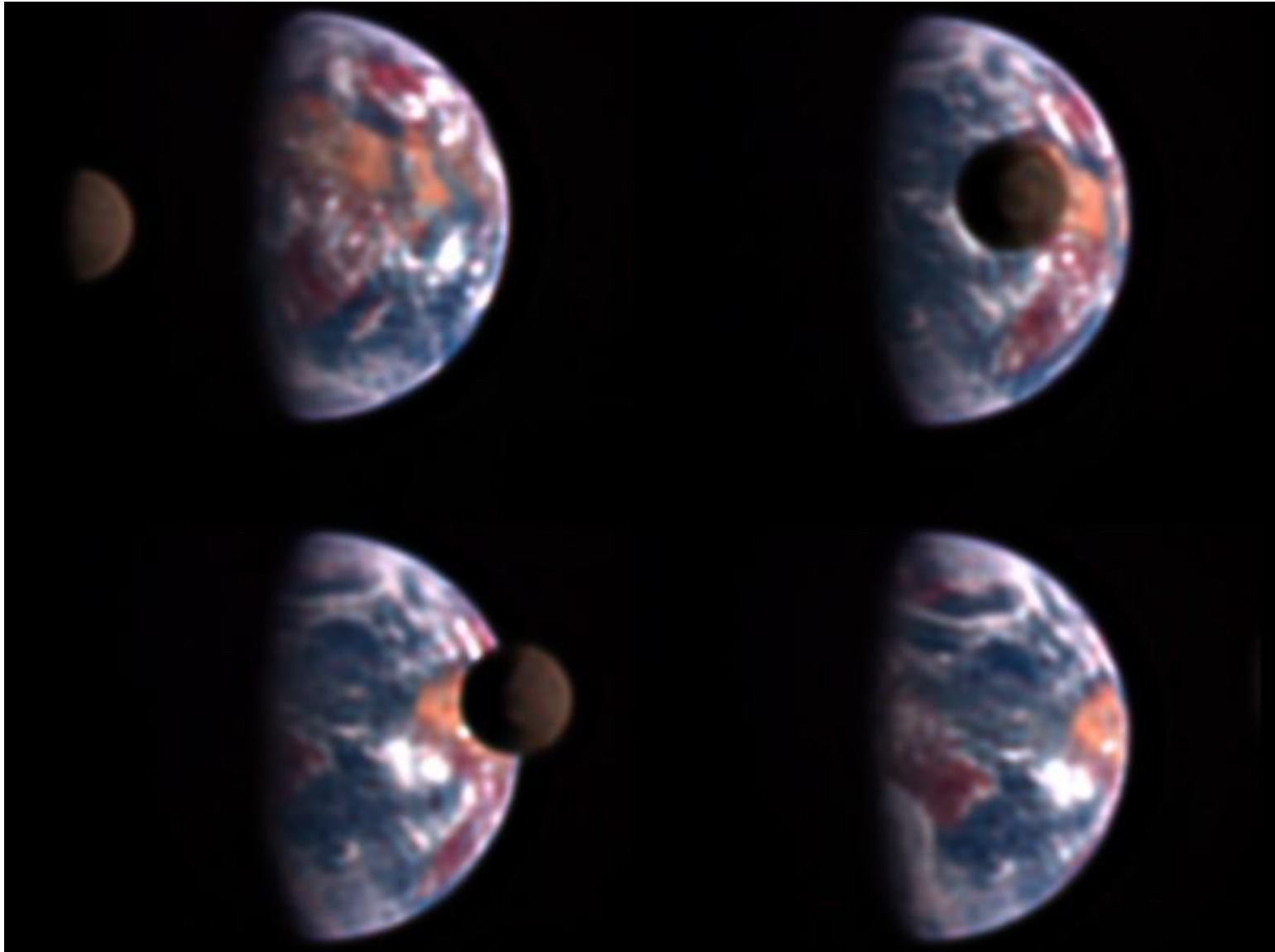


Estimating the Earth's Density



How do we find it?

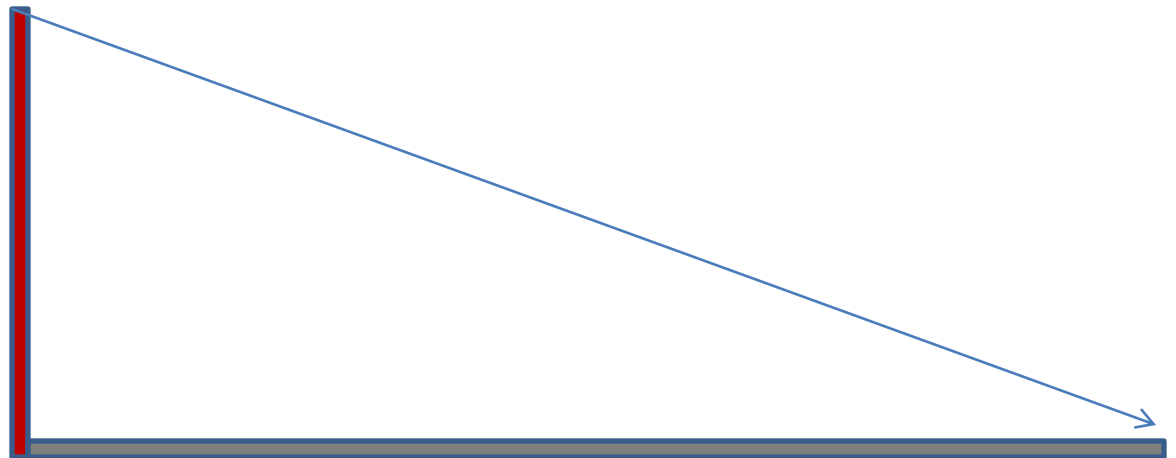
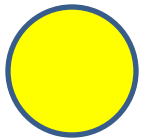
- What do we need to calculate density?

How do we find it?

- What do we need to calculate density?
- Need Mass and Volume
- Can't measure directly as we did earlier in the semester
- Must measure indirectly, using the radius of the Earth and the law of gravity

Step 1: Radius

- Circumference = $2 \times \pi \times \text{radius}$
- Volume = $(4/3) \times \pi \times (\text{radius})^3$
- Eratosthenes' method



Measuring Angles

- Tangent of Angle = (shadow length)/(post length)
- From the difference of the angles we can get a difference in latitude
- If we know the distance in km, we can get a value for the circumference
- $857 \text{ km} \times (360^\circ) / (\text{Boulder Angle} - \text{Average LC Angle})$

Step 2: Mass

- Acceleration = $G \times M/R^2$
- How do we find acceleration?
- Distance = $0.5 \times \text{acceleration} \times (\text{time})^2$
- So if we drop an object a known distance and time how long it takes to drop that far, we can find the acceleration!
- Once we have the acceleration, it is easy to find the mass of the Earth

Putting It All Together

- Volume = $(4/3) \times \pi \times (\text{radius})^3$
- Density = Mass/Volume
- Divide by 1000 to get in units of g/cm³
- Percent Error =
100% x (calculated – actual)/actual