

# Spaceship Earth

9/2/2009

# Opening Discussion

- Have you seen anything interesting in the news?
- What did we talk about last class?
- Minute Essay responses
  - Are there things we can never see from Earth? The visible Universe.
  - Human progress in a very short time.
  - Life in the Universe. (We will discuss this later today.)
  - How will the Earth die?

# More Minute Essay Responses

- Is space limitless?
- The “center of the Universe.”
- Length of a life in “scaled time.”
- Distance to Mars and challenge of manned missions.
- How big can a planet get?
- How common are impacts in the Solar System?
- Before the big bang.
- How do we know the speed of light?

# Motions of the Earth

- Here in this room we feel like we are stationary when in fact we are not. The Earth is undergoing many different motions right now and we are going along for the ride.
- Some of these motions are in excess of 100,000 km/h. Why don't we feel the fact that the Earth is moving? Could you demonstrate that we are moving to a skeptic?

# Motions in the Solar System

- The Earth rotates about its axis and revolves around the Sun. The rotation axis is offset 23.5 degrees from perpendicular to the plane of the orbit. The Earth spins roughly once each day.
- Why did I say “roughly”? How fast is this motion (Earth's radius is  $\sim 6400$  km)?
- The Earth also orbits the Sun once each year on an almost circular orbit.
- How fast is the Earth's orbital motion?
- Both of these go in the same direction. It is “right handed” pointing north.

# Motions in the Galaxy

- If you pick any small group of stars you will find they are moving relative to one another with speeds of tens of thousands of km/hr.
- In bulk they orbit the center of the galaxy. We are 28,000 ly from the galactic center and orbit in 230 million years.
- Dark matter?

# Stellar Collisions?

- Collisions between stars are rare. Why is that when they are flying around at tens of thousands of kilometers per hour?

# Motions in the Universe

- We are also in motion relative to other galaxies. Our local group of galaxies have random motions and we are headed for a collision with the Andromeda galaxy (M31) at 300,000 km/h.
- More significant is that when we look outside of our local group, all the galaxies are moving away from us. The further away they are, the faster they are moving. The most distant galaxies are moving away at close to the speed of light.
- This motion is a key indicator to the big bang theory (along with the cosmic background radiation). It does not mean we are in the middle of the Universe.



# Discussion Questions

- At this point, I want to gauge how people feel about some different topics.
- Is there life beyond Earth? What is it like?
- Should humans be trying to get to other planets? When will we get there?
- Will humans ever get to planets around other stars? Should we try?
- Is the Earth special?

# Minute Essay

- What is the cause of the seasons on the Earth?  
How do you think we figure out the speeds of distant galaxies?
- Remember to read 2.1-2.2 for next class.