

Spaceship Earth

8-31-2005

Opening Discussion

Printable PDFs.

How fast can humans go? Accelerating Universe?

Have you seen anything interesting in the news?

What did we talk about last class?

Do you have any questions about the reading for today?

<http://deepimpact.jpl.nasa.gov/gallery/images.html>

Scales of Time

Not only are lengths in astronomy large, so are timescales. The Universe is roughly 14 billion years old. Our solar system formed about 4.6 billion years ago.

Your book goes through a really nice “scaling argument” looking at the history of the Universe as being a single year.

In this analogy, how many years does one second represent?

What parts of this analogy did you find surprising? Do you think that intelligent life is common in our galaxy? Why?

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 ~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 even 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 gage 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 2.1-2.3 for next class.