


AST1002



Developing Perspective

Chapter 1
Our Place in the Universe

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Basic Astronomical Terms

- Planet
- Moon
- Asteroid
- Comet
- Star
- Solar System
- Galaxy

- Universe

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Basic Astronomical Terms

• Planet	Orbits a star; does not "glow"
• Moon	Orbits a planet
• Asteroid	Small rocky object orbiting a star
• Comet	Small icy object orbiting a star
• Star	Glowing dense ball of hot gas
• Solar System	A star with orbiting planets, etc.
• Galaxy	Large group of stars held together by gravity
• Universe	The site of all matter and energy

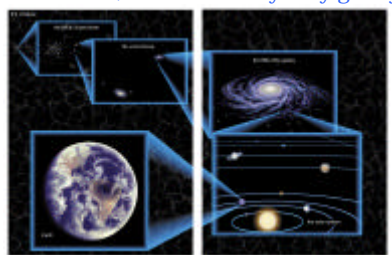
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Our Cosmic Address

- The Earth is not the center of the Universe, nor is the Sun, nor is the Milky Way galaxy



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Our Cosmic Origins

- The atoms in our bodies, this room, this planet, this solar system started as hydrogen and helium in the Big Bang



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Images of Time

- It is almost impossible to comprehend astronomical distances. It helps to think in terms of how long it takes light to travel from there to here ***The Andromeda galaxy***




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 **Images of Time**

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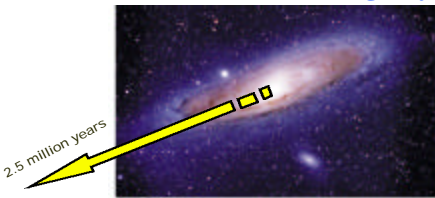


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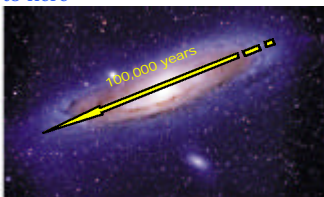


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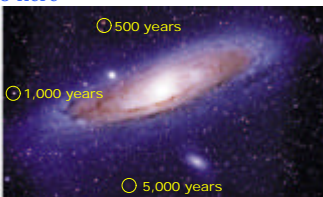


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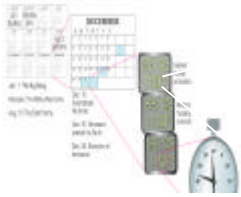


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 **The Scale of Time**

- The Universe was formed 10 to 16 billion years ago, our solar system about **4.6 billion** years ago, human ancestors appeared perhaps 5 million years ago, and our recorded history is less than 10,000 years old.

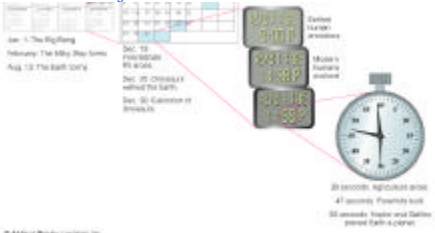


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 **The Scale of Time**

- Human ancestors appeared perhaps 5 million years ago, and our recorded history is less than 10,000 years old.



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Spaceship earth

- Rotation – the Earth spins on its axis once per day

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Spaceship earth

- Revolution – the Earth orbits the sun once per year

perihelion: nearest point to the Sun in orbit
147.1 million km

aphelion: farthest point from the Sun in orbit
152.1 million km

average orbital speed = 108,000 km/hr

astronomical unit (AU)
1 AU = average distance of Earth from Sun = 149,600,000 km

1 AU = 150 million km

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Spaceship earth

- Revolution – the Earth orbits the sun once per year in the **ecliptic plane**

The Earth's axis is tilted **23½°**

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The seasons

- Time out to Think ...
 - Why do we have seasons?
 - Are the seasons the same in the US as they are in Australia?
 - Are the seasons the same on the equator as they are in Gainesville?

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The Seasons

- Angle at which Sun's rays hit the ground
 - In Summer, the sun is high overhead and sunlight is concentrated in a **small** area; lots of heating effect

Summer:

Note! The sun is not really yellow

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The Seasons

- Angle at which Sun's rays hit the ground
 - In Winter, the sun is low in the sky and sunlight is spread over a **large** area; less heating effect

Winter:

Zenith
Horizon

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Duration of Daylight

Gainesville (30N Latitude)

- Summer: Days are long

Up for more than 12 hours

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Duration of Daylight

Gainesville (30N Latitude)

- Equinox: Days equal Nights

Up for 12 hours
Down for 12 hours

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Duration of Daylight

Gainesville (30N Latitude)

- Winter: Days are short

Up for less than 12 hours

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The Seasons

- Spring Equinox March 21
- Summer Solstice June 21
- Fall Equinox September 21
- Winter Solstice December 21

1. Spring Equinox: Spring begins in the Northern Hemisphere, fall in the Southern Hemisphere.
2. Summer Solstice: Summer begins in the Northern Hemisphere, winter in the Southern Hemisphere.
3. Fall Equinox: Fall begins in the Northern Hemisphere, spring in the Southern Hemisphere.
4. Winter Solstice: Winter begins in the Northern Hemisphere, summer in the Southern Hemisphere.

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The Seasons; NOT

- Although technically the sub-solar point is closer to the sun than other locations, this is not the cause of the seasons. The maximum difference is very small (less than 0.004%) and the effect entirely negligible.

Winter: Zenith, Horizon

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The Seasons; NOT

- The Earth's orbit is (almost) a circle
- The Earth is closest to the sun (but only slightly; +/- 1.7%) early in January
 - January 147,000,000 km
 - July 152,000,000 km

January, April, July, October

Not to Scale!

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The Seasons

- Important factors
 - Angle at which Sun's rays hit the ground
 - How long the Sun is above the Horizon
- Not a factor
 - Extra distance beyond the sub-solar point; the maximum difference is very small (less than 0.004%) and the effect entirely negligible
 - The slight change in distance to the sun does not contribute to the seasons. The Earth's orbit around the sun is nearly a perfect circle.

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Spaceship earth

- Precession – the Earth's axis slowly changes direction, taking **26,000 years** for a full circle. The tilt remains fixed at $23\frac{1}{2}^\circ$

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Spaceship earth

- Traveling in the Milky Way Galaxy

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Spaceship Earth

- Orbits are caused by gravity. The Sun's orbit is controlled by **dark matter**

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Spaceship Earth

- The Expanding Universe

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Questions and/or Comments?

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or visit <http://www.astro.ufl.edu/~oliver/>