Introduction to Astronomy

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MWF 12-1 W-3.502

Lecture 5; Mon Jan 31/2005
Motion of galaxies within local group

Local Group = set of ~40 galaxies, bound by gravity. Includes M31 (And), Milky Way, M33, LMC, M32, SMC. Extends at least 5 million ly from MW

Some galaxy neighbors of MW
- Sagittarius (dE) = 0.08 x 10^6 lyr
- LMC (Irr) = 0.16 x 10^6 lyr
- SMC (Irr) = 0.19 x 10^6 lyr
- M31 (SAb) = 2.5 x 10^6 lyr

Motions of galaxies with local group …. dominated by ‘gravity’ of local members
- SMC and LMC orbit Milky Way & are tidally interacting with it to form Magellanic stream
- Milky Way is moving towards M31 at 83 km/s…. may merge in …?? Gyr
- Sagittarius dE being ‘sucked into’ and ripped apart by MW
Motion of distant galaxies well outside local group
Lunar Cycle

- Moon’s orbital motion about Earth: Period = ?; Distance from E = ?; Sense = ?
- Reason for lunar cycle from New Moon to Full Moon?

The photos show how the woman would see the lunar phases from Earth as she turns to face the Moon in each position as it orbits Earth.

New Moon
Rise: 6 A.M.
Meridian: noon
Set: 6 P.M.

Waning Crescent
Rise: 3 A.M.
Meridian: 9 A.M.
Set: 3 P.M.

Third Quarter
Rise: midnight
Meridian: 6 A.M.
Set: noon

Waning Gibbous
Rise: 9 P.M.
Meridian: 3 A.M.
Set: 9 A.M.

Waxing Crescent
Rise: 9 A.M.
Meridian: 3 P.M.
Set: 9 P.M.

First Quarter
Rise: noon
Meridian: 6 P.M.
Set: 9 P.M.

Waxing Gibbous
Rise: 3 P.M.
Meridian: 9 P.M.
Set: 3 A.M.

Full Moon
Rise: 6 P.M.
Meridian: midnight
Set: 6 A.M.

Rise and set times are approximate.
History and Science of Astronomy
# Astronomy and Temporal Calendars

<table>
<thead>
<tr>
<th>Unit of time</th>
<th>Astronomical connection</th>
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<tbody>
<tr>
<td>1 year</td>
<td>?</td>
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<td>Winter-Summer interval of 6 months</td>
<td>?</td>
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<tr>
<td>1 month</td>
<td>?</td>
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<td>1 week</td>
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<td>1 Day</td>
<td>?</td>
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<td>Hours, Min, Sec</td>
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<table>
<thead>
<tr>
<th>Object</th>
<th>Teutonic Name</th>
<th>English</th>
<th>French</th>
<th>Spanish</th>
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<tbody>
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Determining time of day and night

- Night time: use position of stars in sky if know the date e.g., rise and set time of Orion in Dec; Egyptian sunclocks

- Daytime: use position of Sun on sky. e.g., Shadow of sticks and obelisks. Sundials

Ancient Egyptian Obelisk (83 ft)
Determining time of year and seasons

Stonehenge (2750-1550 BC).
Summer solstice
Determining time of year and seasons

Sun Dagger in New Mexico
Noon on Summer Solstice
Determining time of year and seasons

Templo Mayor in Aztec city  Fall and Spring equinoxes
Lunar Cycle and Metonic Cycle

- Lunar cycle
- 12 month lunar calendar year vs 12 month solar calendar year
- Muslim calendar
- Metonic cycle = 19 year cycle such that …..
History and Science of Astronomy: Overview

- See class notes

- 3000 BC; Chinese astronomy
- 2700-2100 BC; Egyptians & Babylonians
- 625 BC-150 AD; Greek scientists and geocentric models (Thales, Pythagoras, Democritus, Plato, Eudoxus, Aristotle, [Aristarchus], Apollonius, Hipparchus, Ptolemy)
- 300 BC; Expansion of Greek empire into Middle East (Egypt, Mesopotamia)
- 300 BC-400 AD; Library of Alexandria
- 800-1400; Knowledge compiled spreads in Byzantine Empire
- 1453; Capital of Byzantine Empire falls to the Turks. Eastern scholars move to Europe transferring knowledge …. European Renaissance
- 1473—1642; Heliocentric models and birth of modern astronomy (Copernicus, Brahe, Kepler, Galilei)
- 1642-1747; Newton: Laws of gravity
- 1905-1915; Einstein’s Special and General Theory of Relativity