The Sun-Earth-Moon System

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Communicating Astronomy 101 School
Cape Town, 10 – 12 March 2010
THE EARTH – OUR HOME
EARTHLY ROTATIONS
THE CELESTIAL SPHERE

At North Pole

At Equator

At intermediate latitude
Finding your Latitude and Longitude

**Latitude:**
Watch the stars long enough to establish the point around which the stars appear to rotate (the celestial pole). The angle between that point and the horizon gives your latitude. To figure out if you're in the Southern or Northern hemisphere look at the direction of rotation.

**Longitude:**
Hopefully you have a watch, which is still set on South African time and can remember what time the sun was rising in Cape Town. See what time the sun rises in your new location according to your watch. If the sun rises three hours earlier than it did in Cape Town you know that you are about three time $15°=45°$ east of Cape Town. Cape Town has longitude of about $30°E$ so you have a longitude of $~75°E$. 
EXPLAINING THE SEASONS
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Credit: Tom Ruen, Full Sky Observatory
ELLiptical Orbits

Perihelion

Apheion

Equal Areas in Equal Times
A MOON CHANGING SIZE

Apogee

2006-02-13
405,978 km
29.87 arc-mins
Altitude @ 69.17°

Perigee

2006-09-08
357,210 km
33.89 arc-mins
Altitude @ 45.36°
LIBRATION OF THE MOON

2007 Apr 3 08:50:54 UT

Images generated from software by Tom Ruen
THE PHASES OF THE MOON

http://jove.geol.niu.edu/faculty/stoddard/JAVA/moonphase.html
TIDES

Orbit of Earth around Sun (365-day cycle)

Lowest high tides

Highest high tides

Lowest high tides

Orbit of Moon around Earth (28-day cycle)

Tidal bulges

Earth rotates about axis (1-day cycle)

Earth
ECLIPSES
ECLIPSES

- Umbra
- Penumbra
- Antumbra
The progression of the Solar eclipse of August 1, 2008 over Russia
LUNAR ECLIPSES

Lunar eclipse 1999 in Belgium, Credit: Luc Viatour
Total Solar Eclipse of 2010 Jul 11

Ecliptic Conjunction = 19:41:39.5 TD  (= 19:40:27.3 UT)
Greatest Eclipse = 19:34:37.6 TD  (= 19:33:31.4 UT)
Eclipse Magnitude = 1.0580  Gamma = 0.6788
Saros Series = 146   Member = 27 of 76

Sun at Greatest Eclipse
(Geocentric Coordinates)
R.A. = 07h23m57.8s
Dec. = +22°02'11.0"
S.D. = 00°15'43.9"
H.P. = 00°00'08.7"

Moon at Greatest Eclipse
(Geocentric Coordinates)
R.A. = 07h23m15.8s
Dec. = +21°22'29.3"
S.D. = 00°16'26.7"
H.P. = 01°00'20.9"

External/Internal
Contacts of Penumbra
P1 = 17:09:37.6 UT
P4 = 21:57:14.3 UT

External/Internal
Contacts of Umbra
U1 = 18:15:12.1 UT
U2 = 18:18:29.9 UT
U3 = 20:48:19.8 UT
U4 = 20:51:41.0 UT

Local Circumstances at Greatest Eclipse
Lat. = 19°44.9'S  Sun Alt. = 47.1°
Long. = 121°52.5'W  Sun Azm. = 13.5°
Path Width = 258.6 km  Duration = 05m20.2s

Geocentric Libration
(Optical + Physical)
I = -3.25°
b = 0.86°
c = 6.62°
Brown Lun. No. = 1083


FOR ECLIPSE INFO
SEE:

http://eclipse.gsfc.nasa.gov/eclipse.html
Size of the Sun ~ 1400 000 km
Size of the Earth ~ 13 000 km
Size of the Moon ~ 3500 km

Mean Sun-Earth distance ~ 150 million km
Mean Earth-Moon distance ~ 380 000 km

So if the Sun was the size of a soccer ball, the Earth would be about 24 m away and the size of a sand grain. The moon would be the size of a quarter sand grain and about 6 cm away from the Earth.
THE ANALEMMMA