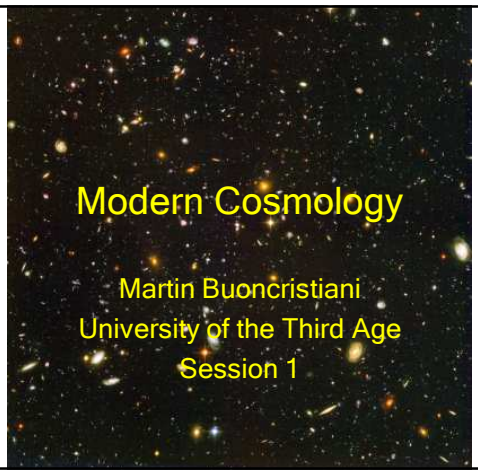


Agenda for Today

Discuss what we want to do in this year

The Decade Reports

Measurement in Astronomy

Video

New Worlds, New Horizons in Astronomy and Astrophysics

Committee for a Decadal Survey of Astronomy and Astrophysics; National Research Council

ISBN: 0-309-15800-1, 324 pages, 7 x 10, (2010)

This is a free PDF downloaded from:

http://www.nap.edu/catalog/12951.html

The Australian Decadal Plan

New Horizons
A Decadal Plan for Australian Astronomy 2006 – 2015

http://www.atnf.csiro.au/nca/DecadalPlan_web.pdf

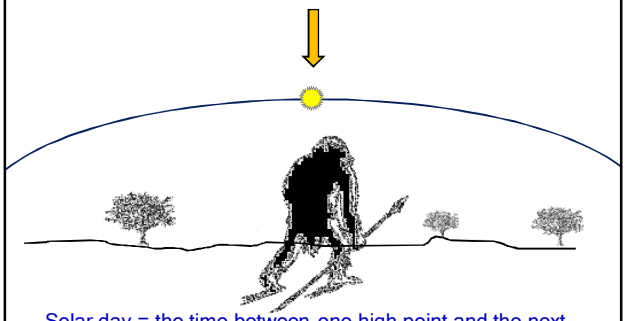
The priority science objectives for 2012-2021 are:

Cosmic Dawn - searching for the first stars, galaxies, and black holes;

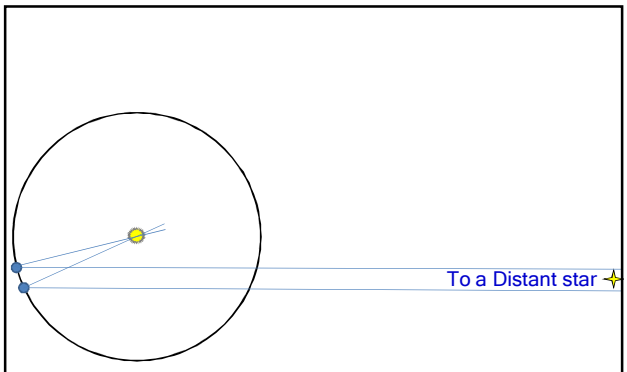
New Worlds - seeking nearby habitable planets;

Physics of the Universe - advancing understanding of the fundamental physics of the universe.

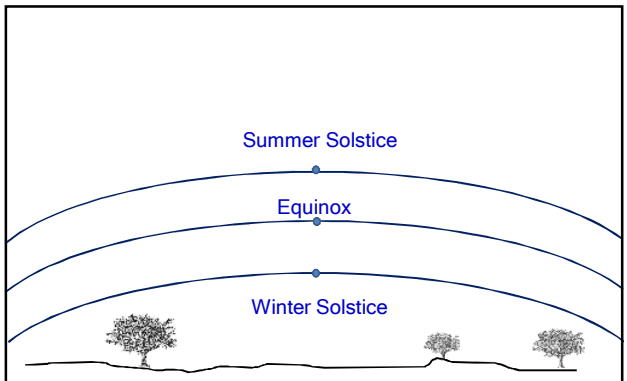
Astronomical Measurements

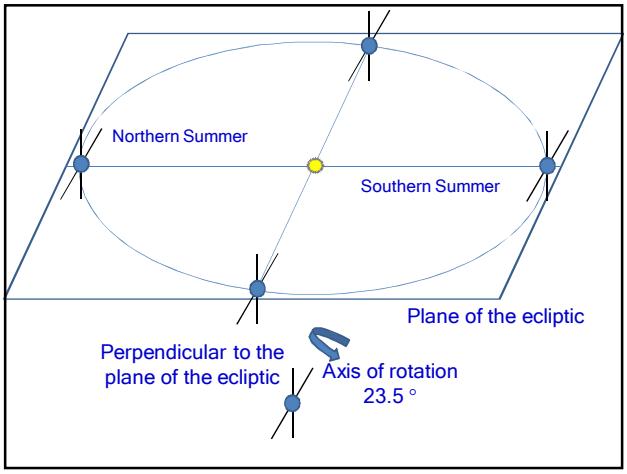


Solar day = the time between one high point and the next

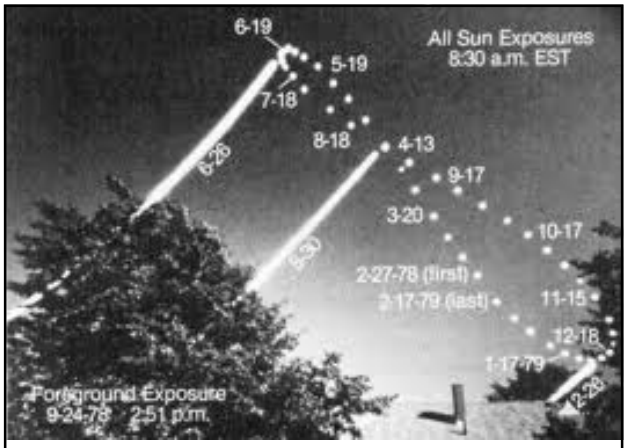


Sidereal time (star time) measured to a very distant star
sidereal noon is on average 4 minutes earlier than solar noon.





Cernan, Gnomen and a crater



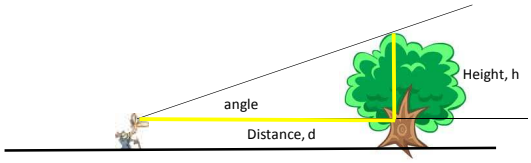
One of Kepler's Laws of Motion describes a relation between the period of a planets orbit around the sun and the radius of that orbit

$$T^2 = \left(\frac{4\pi^2}{G M_{sun}} \right) R^3$$

The periods of the planets can be measured directly and G can be measured in the lab.

Using this information and statistics we can determine the sun's mass and the orbital radii of the planets.

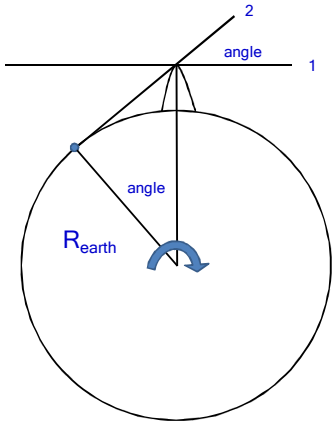
Triangulation



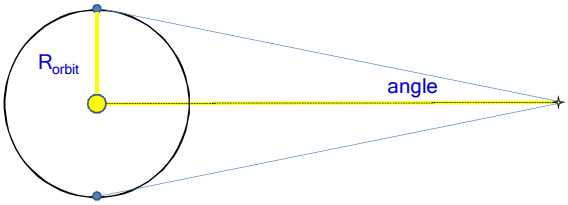
h = tan(angle) x d

al Biruni (973 - 1048) determined the radius of the earth.

The angle is related to the time it takes to rotate from position 1 to 2



Radius of the earth's orbit by parallax (triangulation)



R_{orbit} = 1 Astronomical Unit = 1 au

Distance to the star = R_{orbit} / tan(angle)

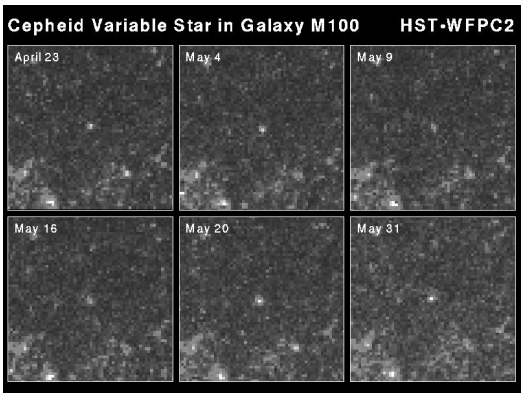
1 parsec = parallax distance of one second of arc
angle = 1/3600 degree = 0.000277 degree

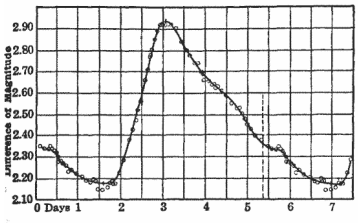
1 parsec = 3.26 light-years
just under 31 trillion (3.1×10^{13}) kilometers

Limit of measurement of parallax angle is about 1 millisecond

Parallax can be used out to about 1,000 Ly

Beyond that astronomers use variable stars.





The Light Curve of δ Cephei

Henrietta Leavit's Discovery

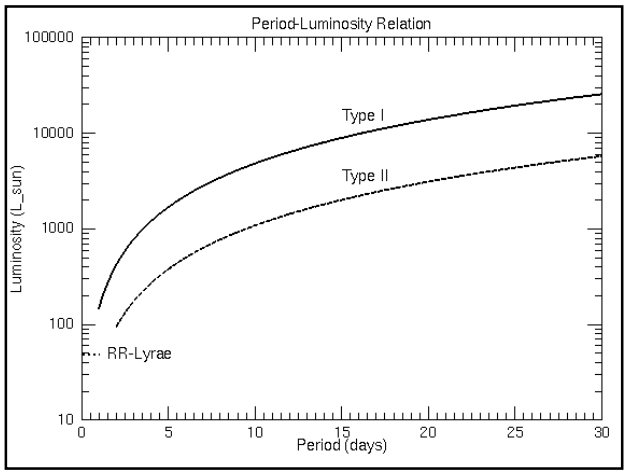
Based on observations of variable stars in the Magellanic clouds

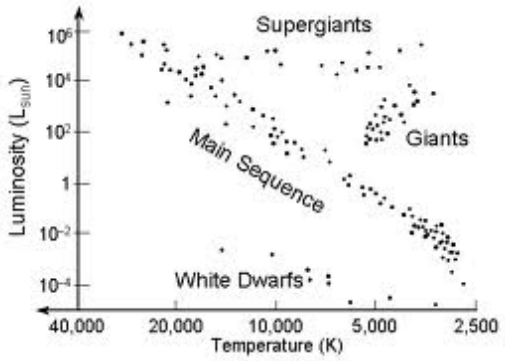
The brighter a variable star, the longer was its period.

Since all of these stars are roughly the same distance from earth this characteristic was a property of the stars

This could be used to find the stars absolute brightness (luminosity).

In turn, this could be used as a measure of distance for any Cepheid variable stars.



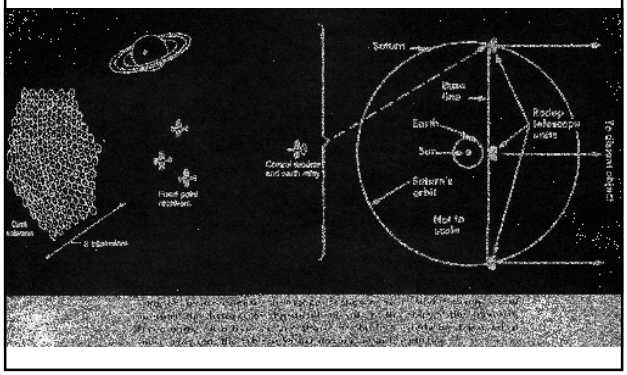


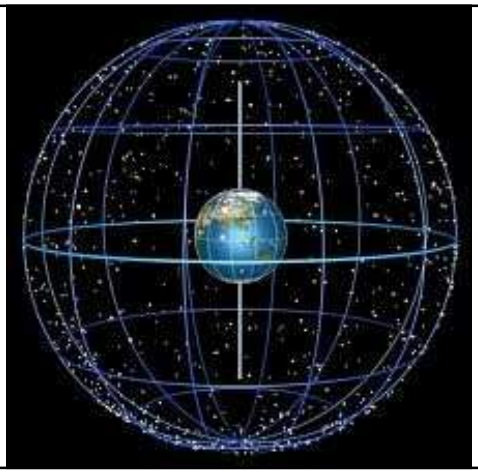
Parallax between 1 AU and about 1000 Ly

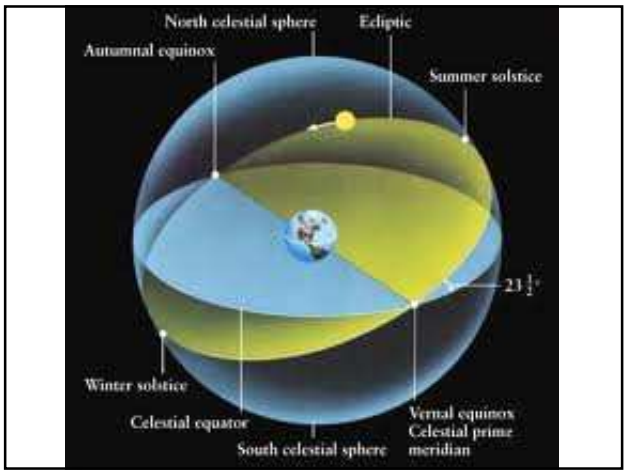
Variable stars 100 Ly to 1 ,000,000 Ly

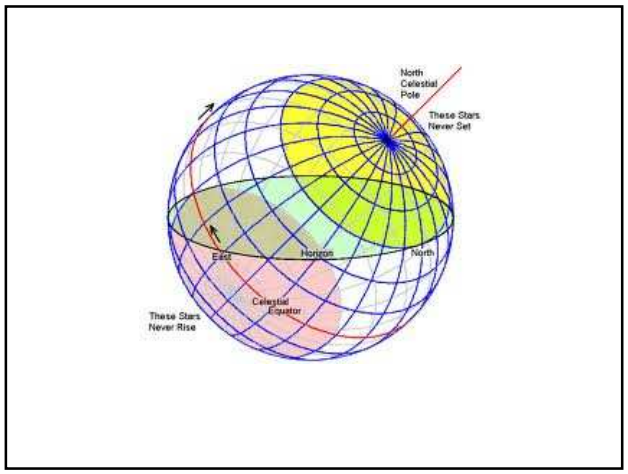
Red shift and Hubble's Law beyond

A new technique, RADEP for RAdio DEPth, measures all astronomical distances with one technique based on response to radio telescope signal.






North celestial sphere
Ecliptic
Autumnal equinox
Summer solstice
$23\frac{1}{2}°$
Winter solstice
Celestial equator
South celestial sphere
Vernal equinox
Celestial prime meridian


North Celestial Pole
These Stars Never Set
East
Horizon
North
Celestial Equator
These Stars Never Rise