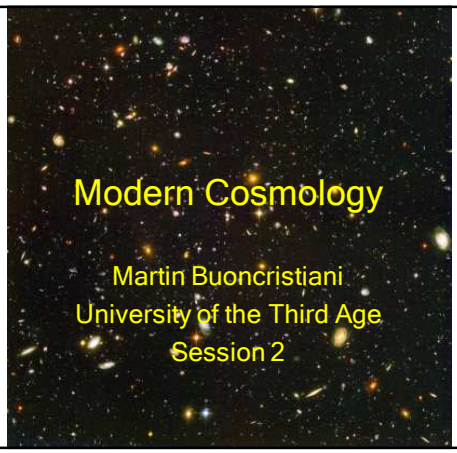


Agenda for Today

The Decade Reports

Measurement in Astronomy:
Location and Brightness of Stars

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

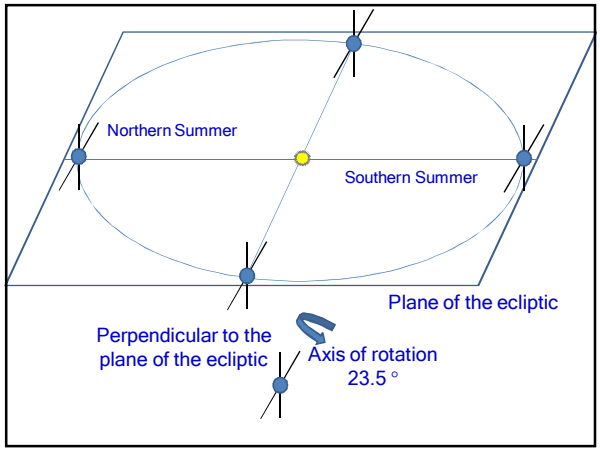
http://www.atnf.csiro.au/nca/DecadalPlan_web.pdf

The priority science objectives for 2012-2021 are:

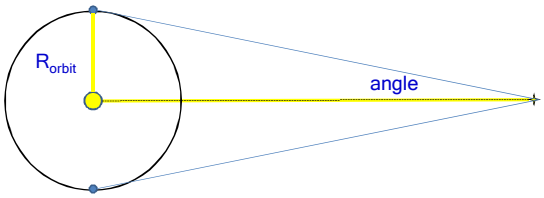
Cosmic Dawn - searching for the first stars, galaxies, and black holes;

New Worlds - seeking nearby habitable planets;

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



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



R_{orbit} = 1 Astronomical Unit = 1 au

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

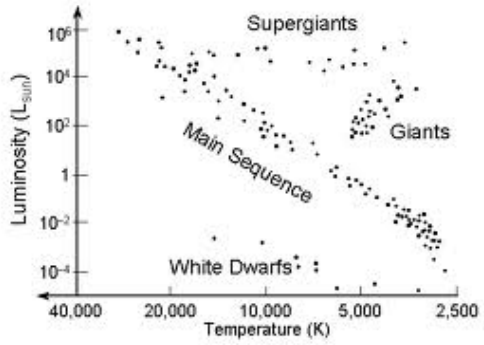
1 parsec = parallax distance of one second of arc
angle = 1/3600 degree = 0.000277 degree

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.

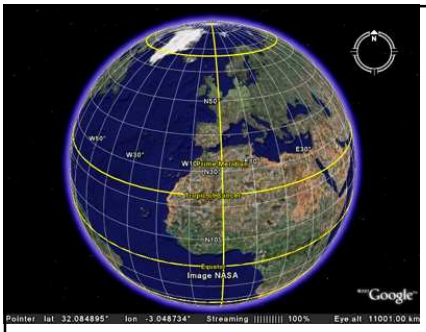


Parallax between 1 AU and about 1000 Ly

Variable stars 100 Ly to 1 ,000,000 Ly

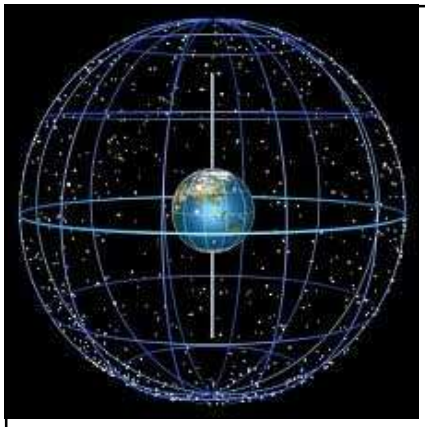
Red shift and Hubble's Law beyond

RADEP (RAdio DEPth) measures all astronomical distances with one technique based on response to radio telescope signal.



On Earth:
Latitude
North 0 - 90
South 0 - 90

Longitude
East 0 -180
West 0 - 180
From Greenwich

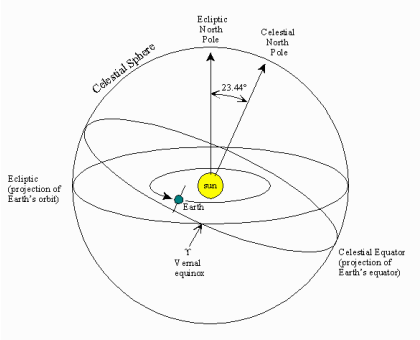


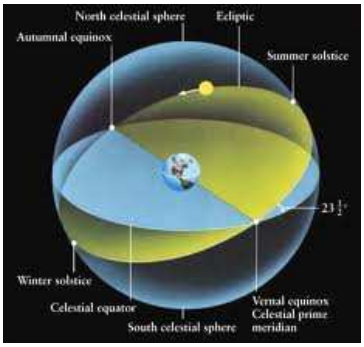
On the Celestial Sphere

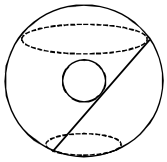
Latitude
North → +
South → -
Declinations

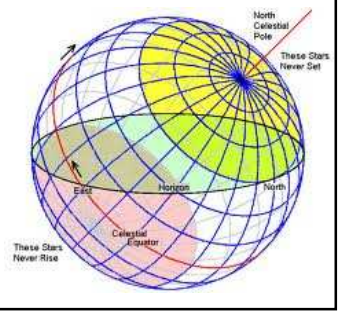
Longitude
Measured eastward from vernal equinox
0 - 360°
or
360 ° /24 = 15°

15° = 1 hour









Now we can locate a celestial object on the sphere.

What can we say about the light from the object?

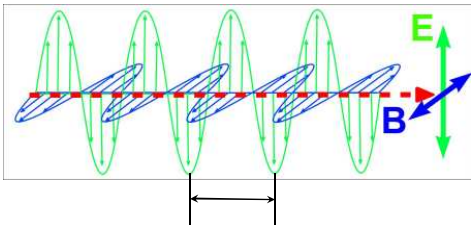
It is either reflected (like moonlight)

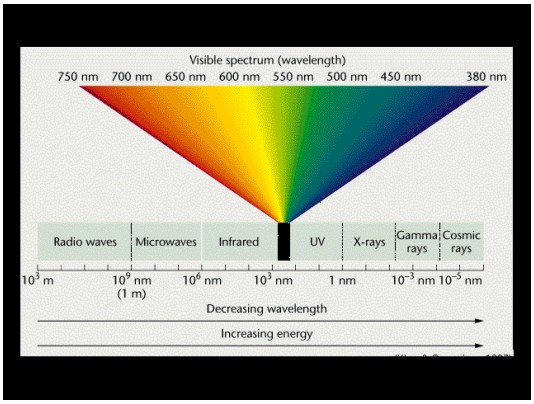
or the object is luminous (like starlight)

(or both).

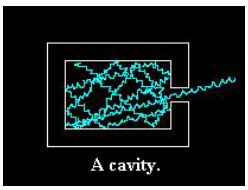
In either case, what we see is light –

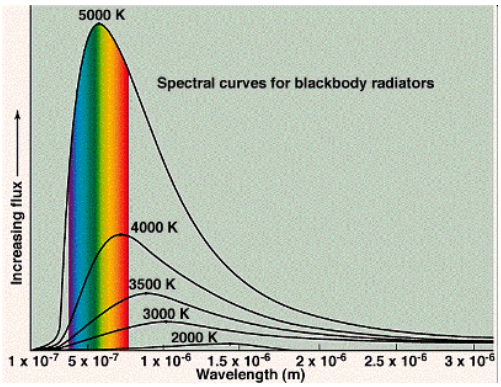
electromagnetic radiation in the visible region of the spectrum

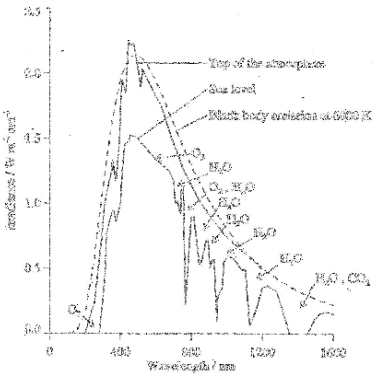


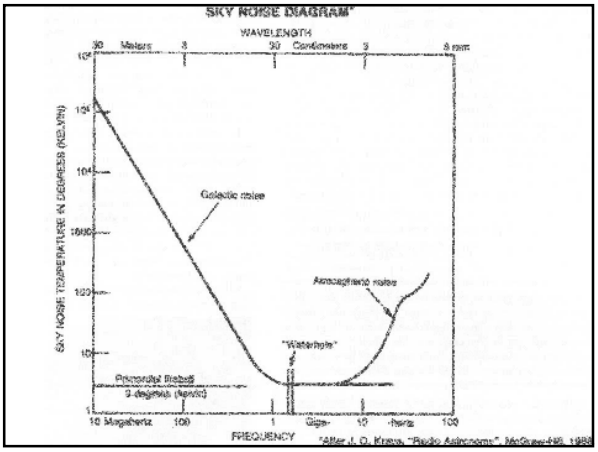


The problem of Black Body Radiation (Cavity Radiation) was solved by Max Planck









Information measured from starlight 1

1) Luminosity is the total amount of electromagnetic energy radiated by the star;
The luminosity of our sun is $3.85\ 10^{26}$ Watts.

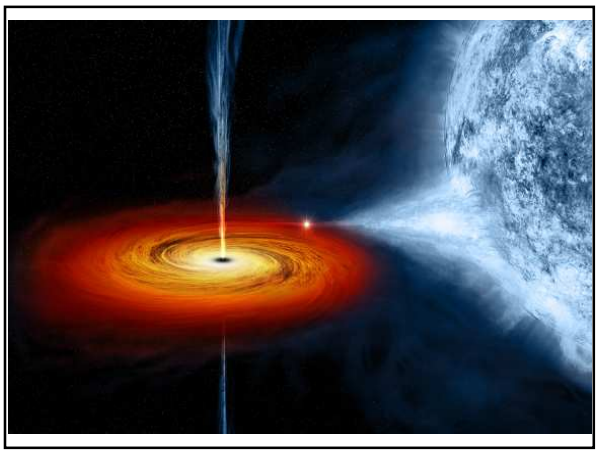
2) From the spectrum of starlight the temperature of the star can be determined, T_{star}
and the relationship between Luminosity, Star radius and Temperature
$L_{star} = A\ R_{star}^{2}\ T_{star}^{4}$ (where A is a known constant)

3) the distance to the star is determined as we have discussed

Information measured from starlight 2

4) For main sequence stars, there is a relationship between a stars mass and its luminosity

$$\frac{L_{star}}{L_{\odot}} = \left(\frac{M_{star}}{M_{\odot}} \right)^{3.9}$$

where $\odot$ a symbol for our sun.

5) Thus, astronomers can measure the temperature, T_{star} the radius, R_{star}, the mass, M_{star} and the distance d to a star.