Astronomy Topic 3

Booster

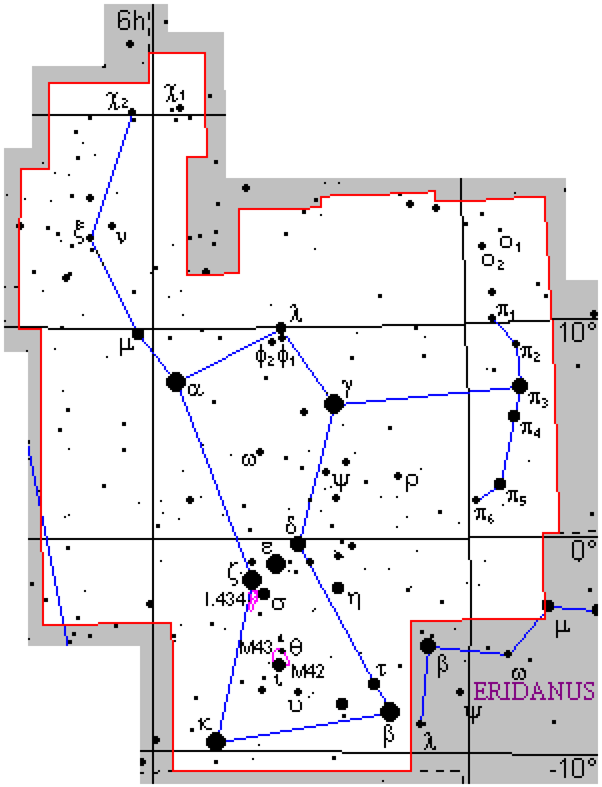
Constellation – a part of the sky. There are 88

Asterism – a pattern of stars in the sky, e.g. the Plough

Open cluster – a group of young stars in the disc, e.g. the Pleiades

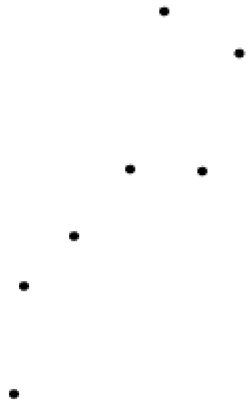
Globular cluster – a group of old stars in the Halo

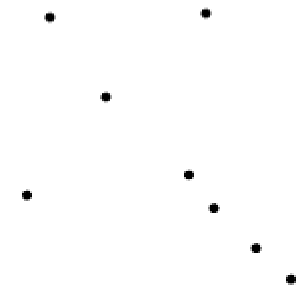
Nebula – a cloud of gas and dust



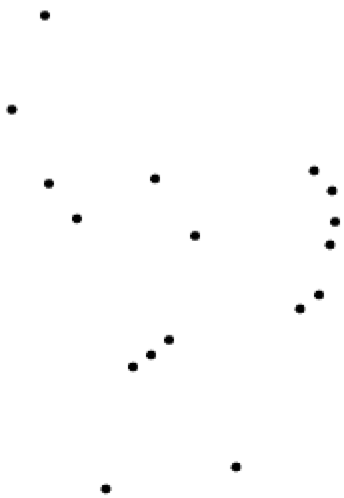
Greek letters are used to put stars in order of brightness

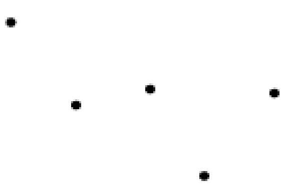
Alpha	α
Beta	β
Gamma	γ
Delta	δ
Epsilon	ε

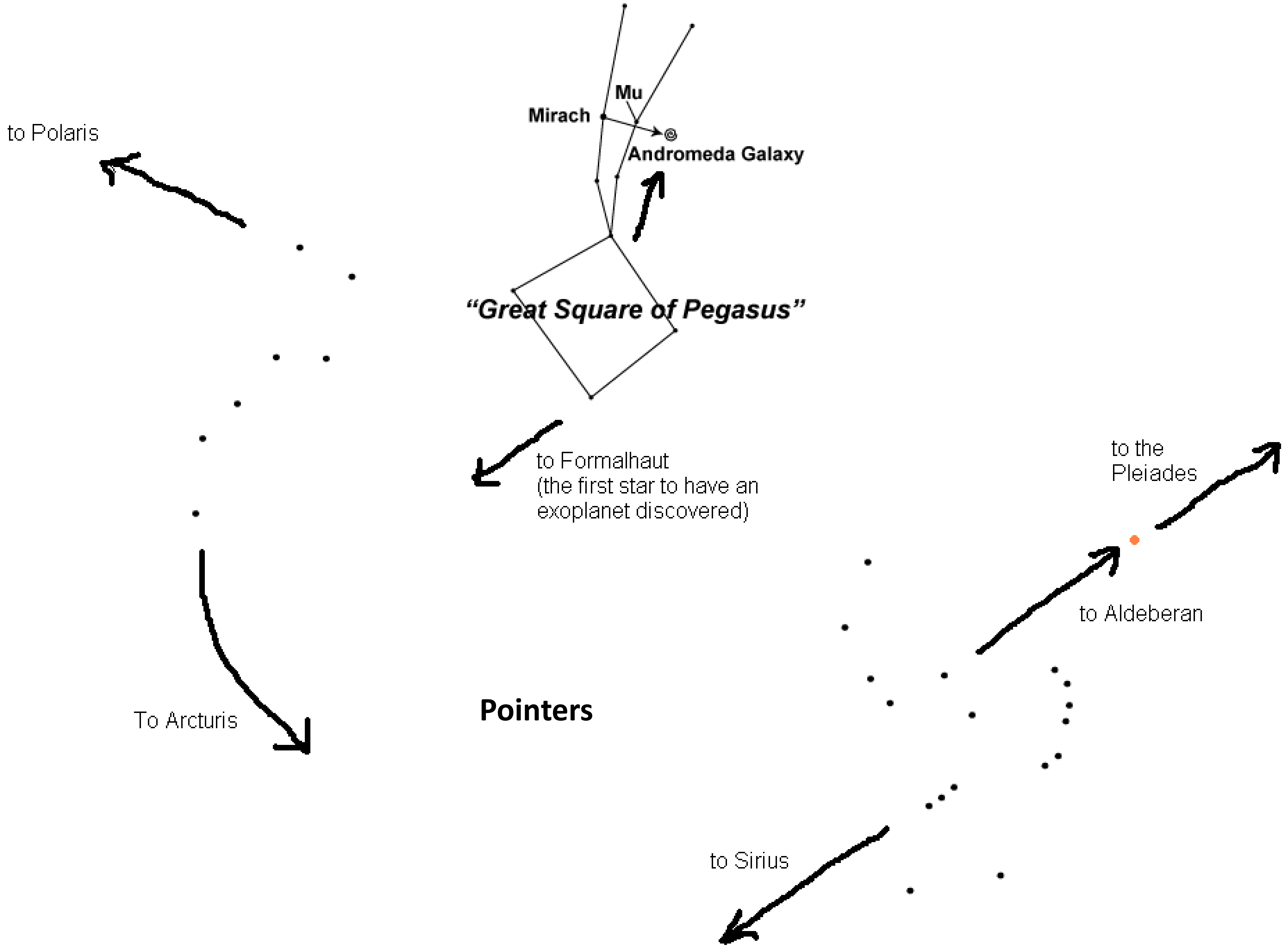




You must recognise these







to Polaris
Mu
Mirach
Andromeda Galaxy
"Great Square of Pegasus"
to Formalhaut
(the first star to have an
exoplanet discovered)
to the
Pleiades
to Aldeberan
To Arcturis
Pointers
to Sirius

Summer	**Winter**	**All Year**
Sagittarius	Orion	Ursa Major
Scorpio	Gemini	Cassiopeia
Capricorn	Taurus	Cepheus

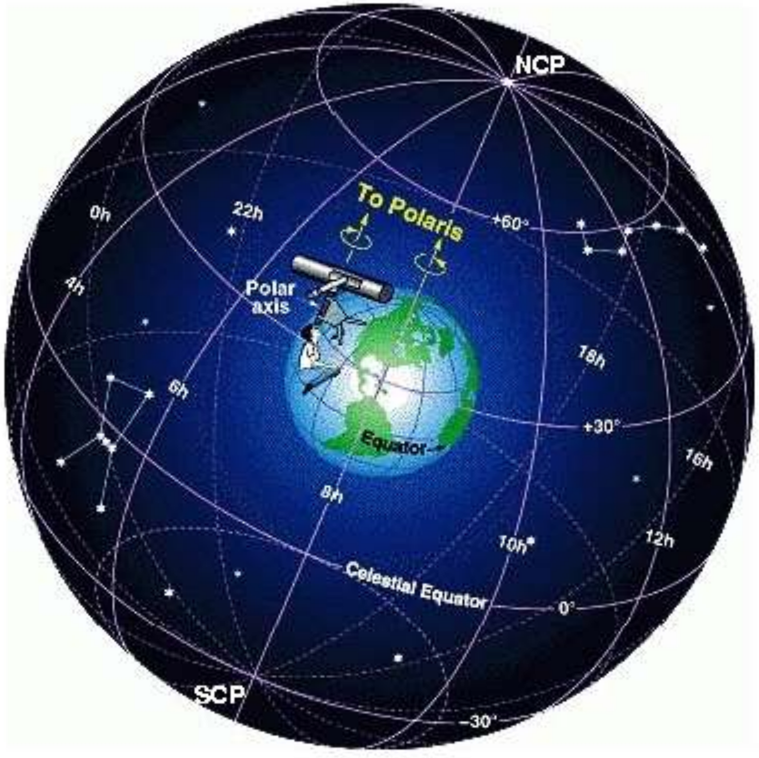
If the Sun is in a constellation then it is not visible at night

The Sun is in Taurus in the summer so Taurus is best viewed in winter

The **Declination** of a star is its angle in degrees above the celestial equator

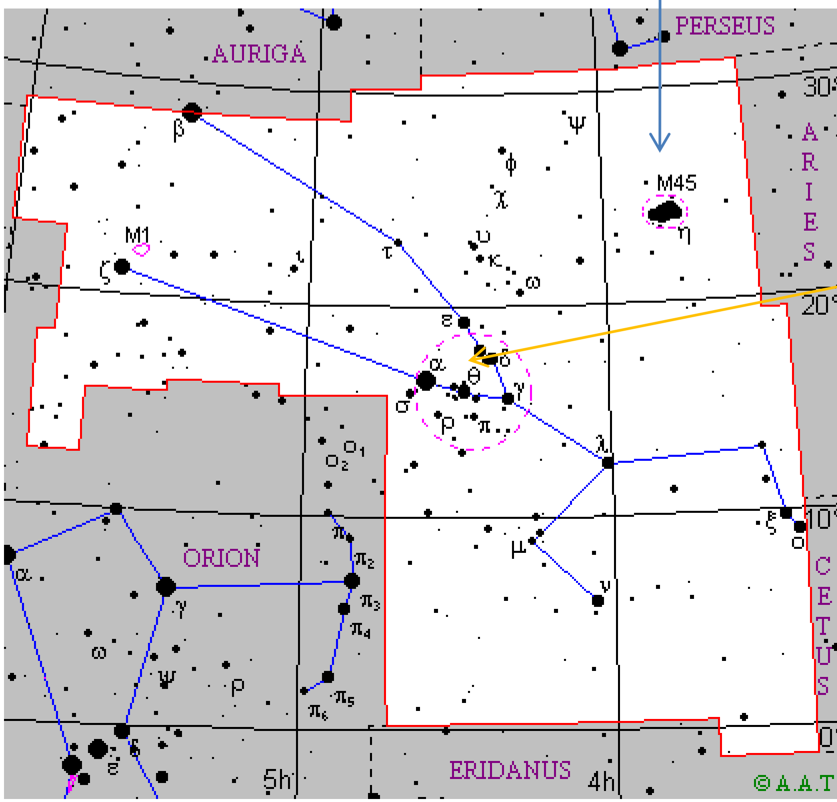
The **Right Ascension** of a star is its “angle” east or west of the celestial prime meridian

It is measured in hours and minutes



Charles Messier catalogued 110 objects

This is one of them



Aldeberan (α Tauri)

R.A. = 4h 34mins

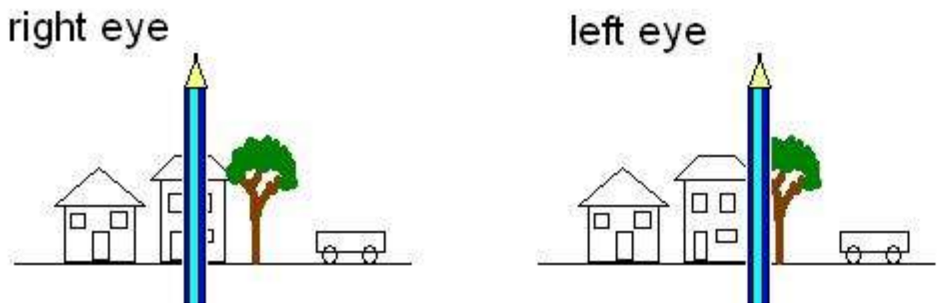
Dec. = 16^0

True binaries

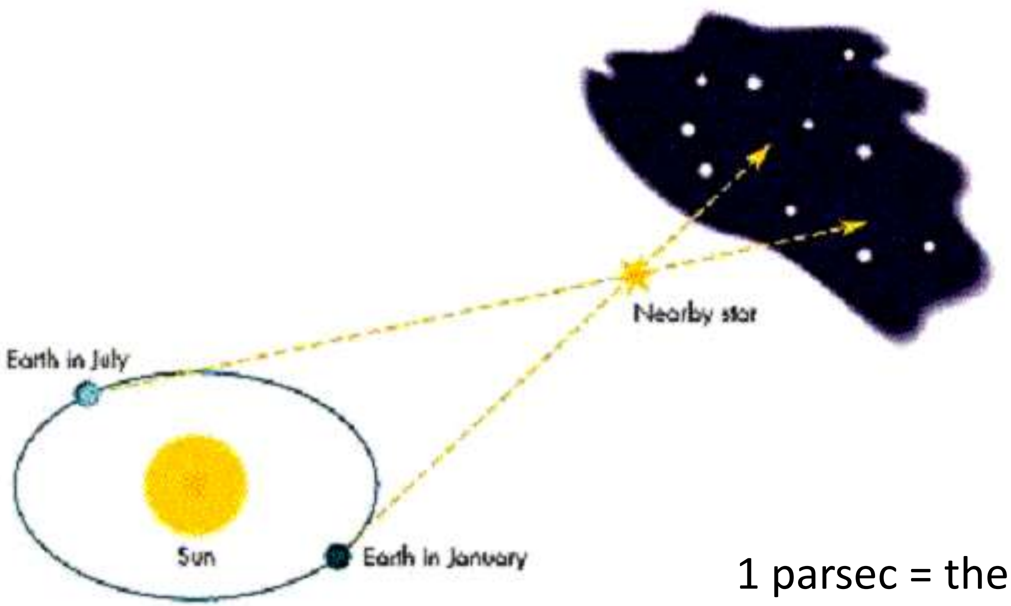
Stars close together that influence each other gravitationally

Optical Binaries

Stars close together in the sky but at very different distances from us



When we look at a nearby object from different angles it appears to move against a distant background
This is called parallax



Nearby stars appear in different positions during the year for this reason.

By measuring the angle we can calculate their distance

1 parsec = the distance that would produce a parallax angle of $1/60^{th}$ of a degree

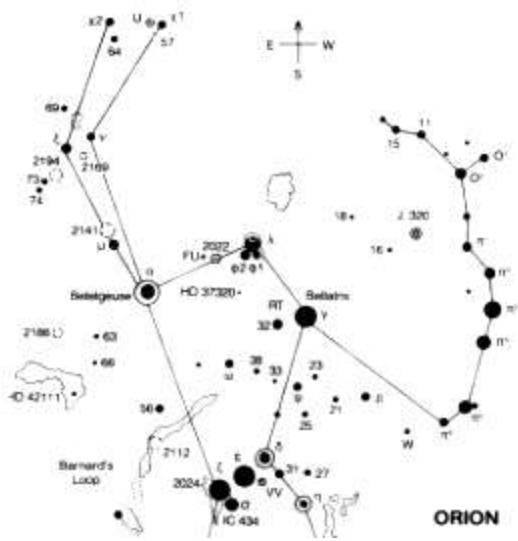
1 parsec = 3.2 light years

According to Hipparchus the **apparent magnitude** m of a star is from 1 to 6

Very bright star m =1   Very dim star m = 6

But m=1 stars are 100 x brighter than m=6

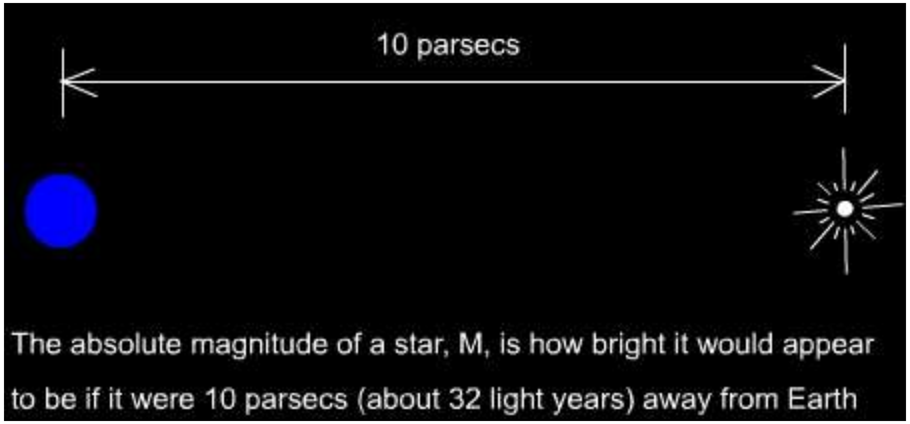
So a difference in m of 1 actually means a difference of 2.5 times (Pogson's Ratio)



If α Orionis is 2.1 and another star is 3.1 then α Orionis is 2.5 times brighter

The apparent magnitude of a star depends on:
a) How far away it is   b) how luminous it actually is

To compare the brightness of all stars they would have to be at the same distance from Earth. We define absolute magnitude M as follows



If we know m and d (distance in parsecs) we can calculate M

$$M = m + 5 - 5 \log_{10} d$$

e.g.

if m = 11.6 and d = 1,000

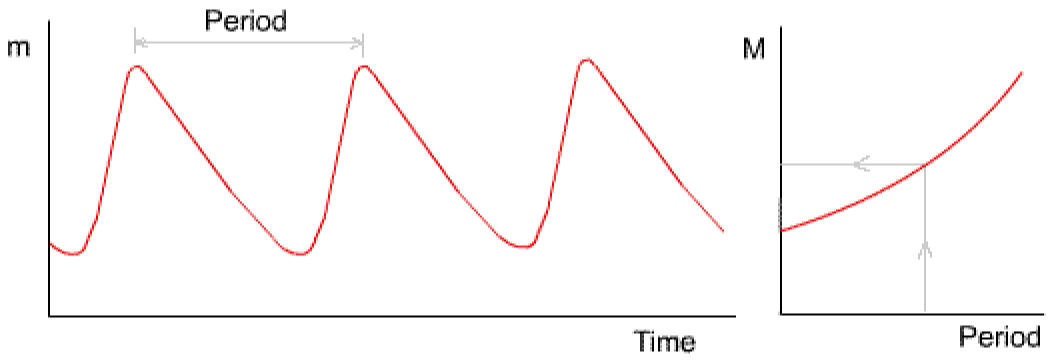
Then

M = 11.6 + 5 – (5 x 3) = 1.6

(in any question you get d will always be 100 or 1,000 or 10,000 etc
$\text{Log}_{10}d$ is just how many zeros there are so $\log_{10} 1{,}000 = 3$)

In most stars gravity and radiation pressure are balanced

In **Cepheid variables** they are not and the star pulses in brightness



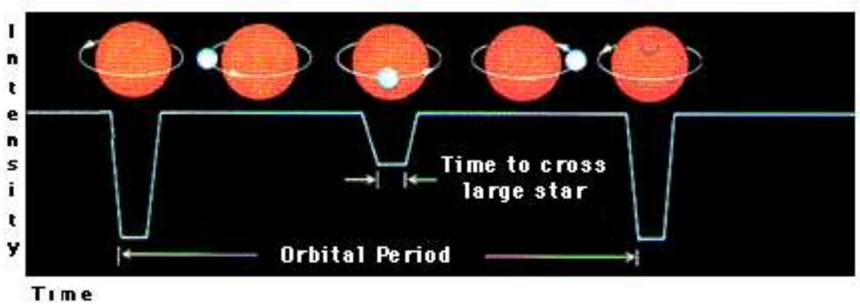
If we measure the period of this variation we can calculate M

If we know M we can calculate how far away it is

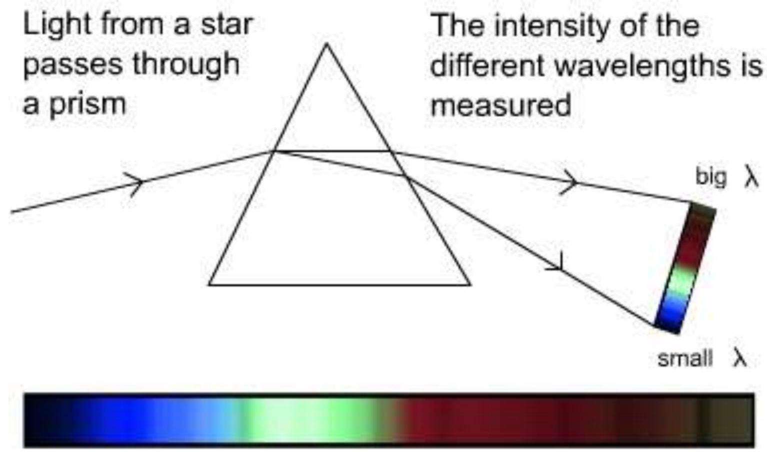
A very useful technique for finding distances to galaxies

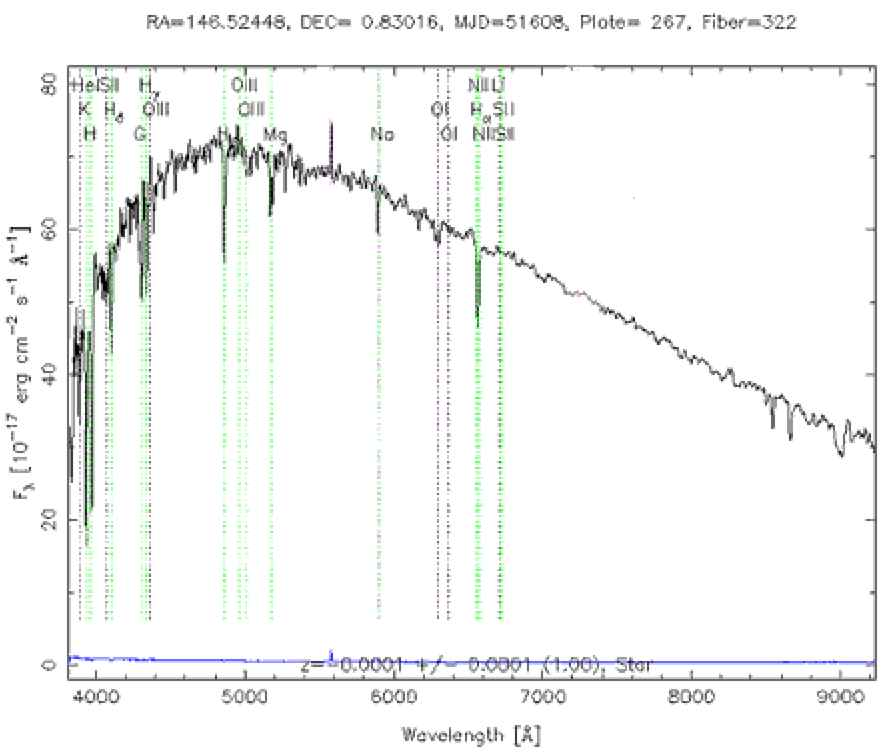
This is the light curve for an eclipsing binary

A large dim star and a small bright star



Stellar Spectra





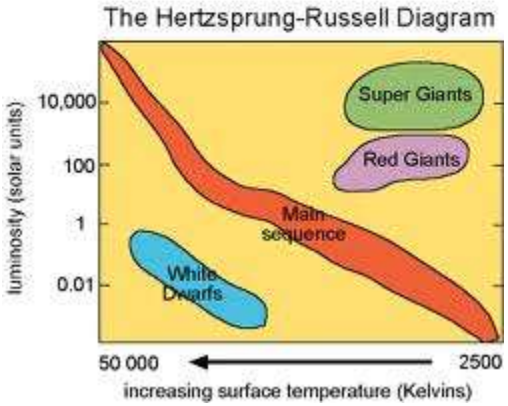
From the spectrum of a star we can work out

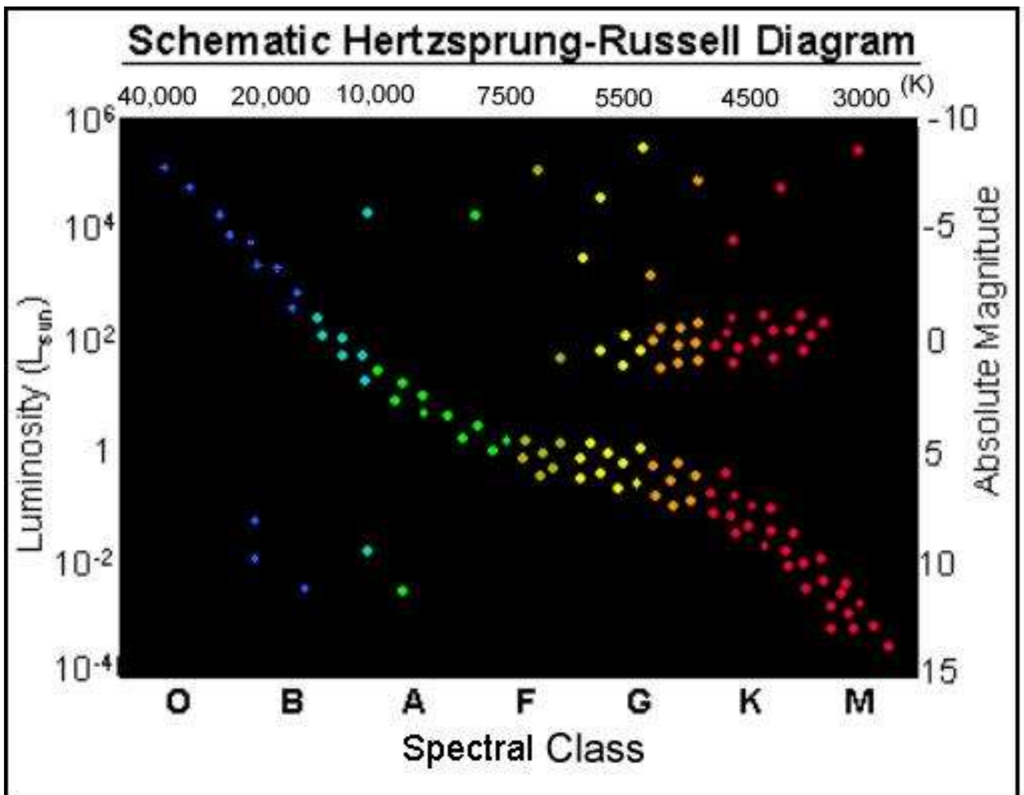
Its age
Its temperature
What elements it contains
Its size
What kind of star it is

Classifying stars

Class	Spectrum	Colour	Temperature
O	ionized and neutral helium, weakened hydrogen	bluish	above 31,000 K
B	neutral helium, stronger hydrogen	blue-white	9750-31,000 K
A	strong hydrogen, ionized metals	white	7100-9750 K
F	weaker hydrogen, ionized metals	yellowish white	5950-7100 K
G	still weaker hydrogen, ionized and neutral metals	yellowish	5250-5950 K
K	weak hydrogen, neutral metals	orange	3800-5250 K
M	little or no hydrogen, neutral metals, molecules	reddish	2200-3800 K

Remember hot stars are blue, cooler stars are red





Where are these?

Red giants

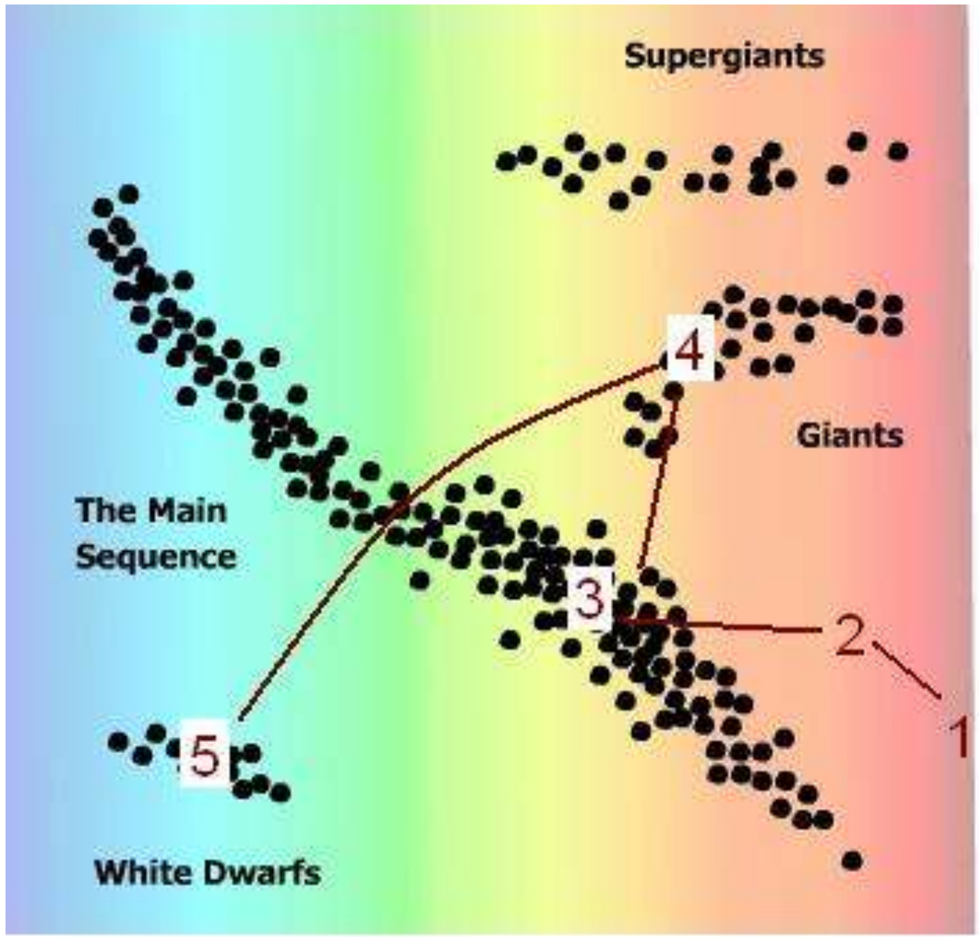
Supergiants

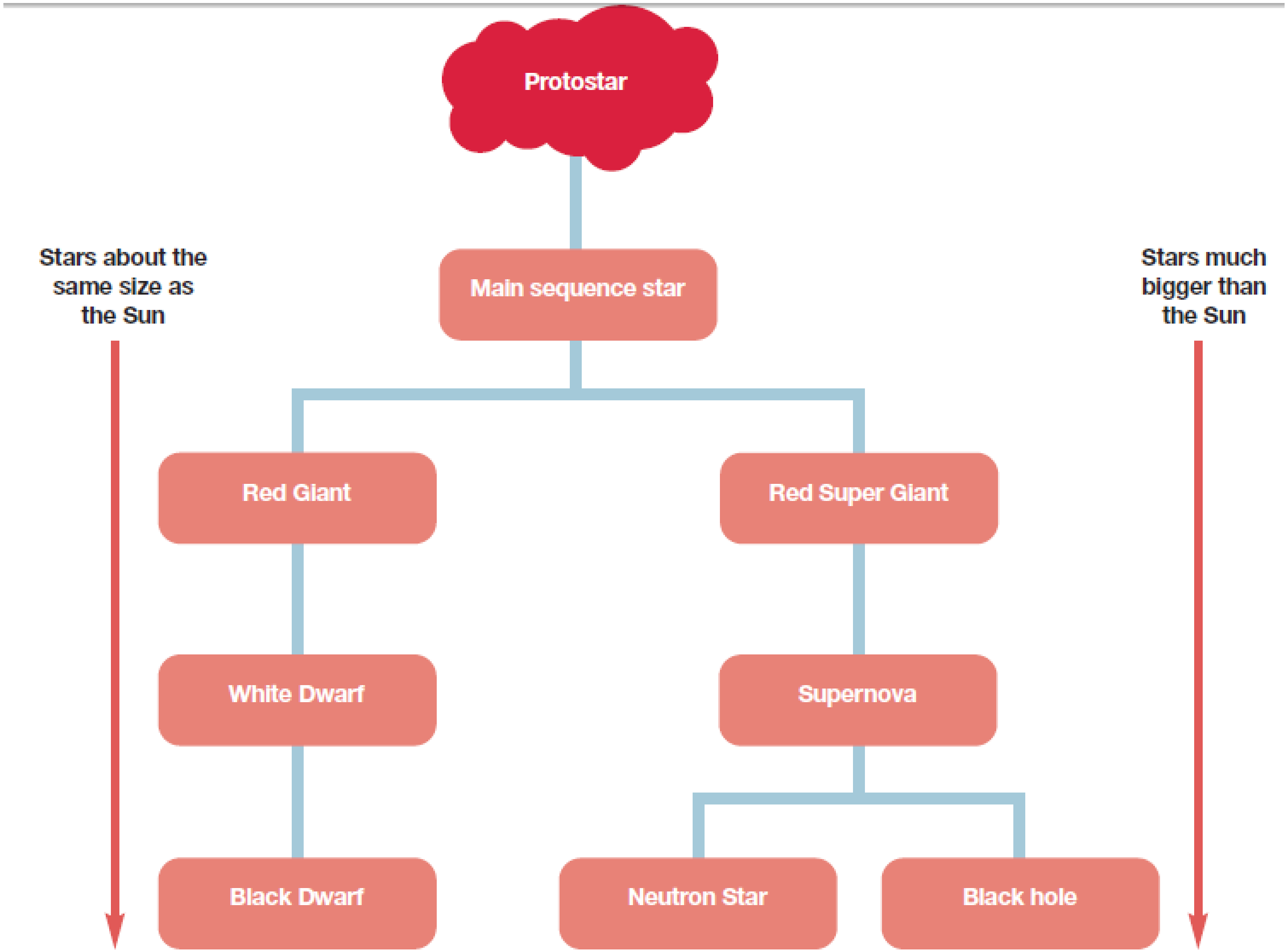
Main sequence stars

White dwarfs

Where is the sun?

The life cycle of our sun




Protostar
Main sequence star
Stars about the same size as the Sun
Stars much bigger than the Sun
Red Giant
Red Super Giant
White Dwarf
Supernova
Black Dwarf
Neutron Star
Black hole

4 types of **nebula**

Emission

Red, hydrogen in the cloud is excited by stellar radiation

Reflection

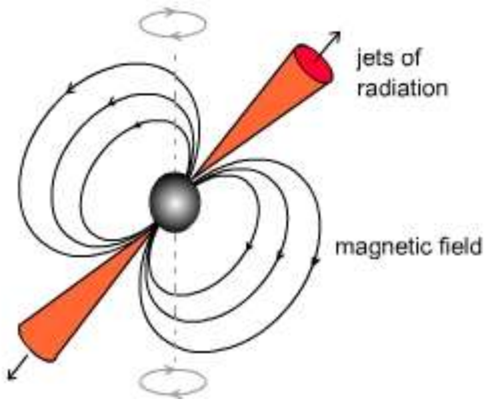
Dust in the cloud scatters light from stars so they appear blue

Absorption (or dark)

Dust blocks out light from stars behind

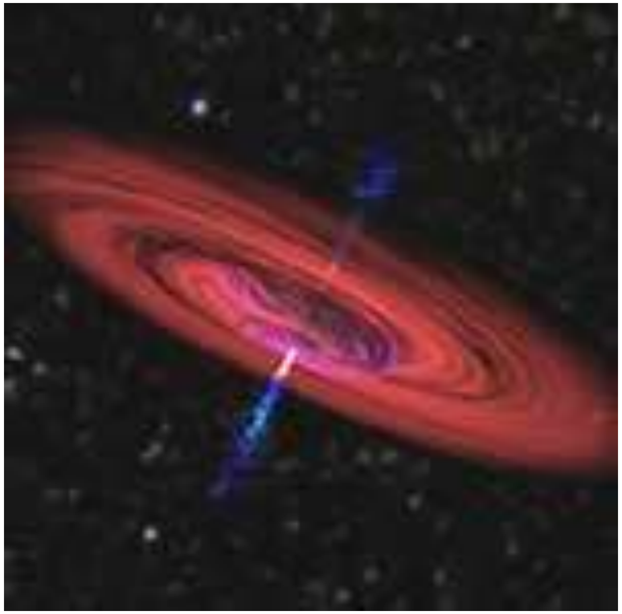
Planetary

The remains of a dying star. Dust and gas ejected into space



Neutron stars

Very dense spinning objects emitting jets of radiation



Black Holes

Their gravity is so strong that light can’t escape.
Spiralling matter produces x rays we can detect.
They may account for much of the hidden mass in the universe