The Milky Way

No, I don't mean the candy bar.

Our galaxy.

What's it like?

How big is it?

What is its shape?

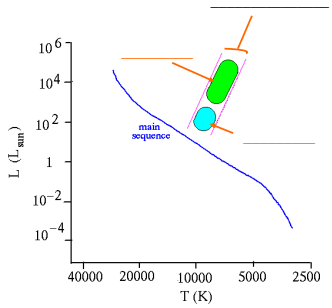
Where are we located in it?

How did it get to be the way it is?

How many calories are in it? - Oops, wrong milky way.

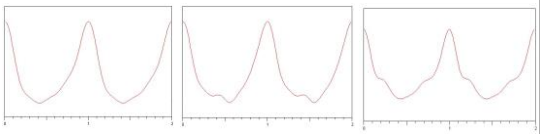
Supergiants and Red Giants In the _____

What does this mean?
They are unstable -
They _____
Two main types



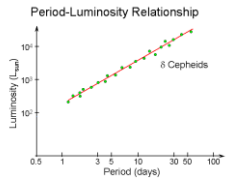
Cepheids

_____ Mass
_____ periods
Very Luminous (bright giants - supergiants)



Cepheids are among the MOST important stars - Why?

1. Very bright
2. _____ - Luminosity Relation – _____ Law _____related to actual brightness (Luminosity or Absolute Magnitude)



You can use Cepheids to get _____ to other galaxies!

RR Lyrae Stars

Similar to Cepheids, but…

Masses _____

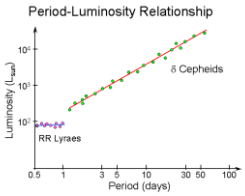
Periods _____

Luminosities _____

Limited to nearby distances

Original question – what is the Milky Way like?

I'll get to that….

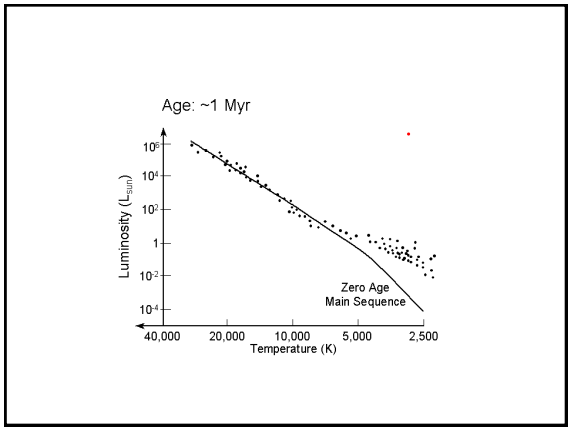


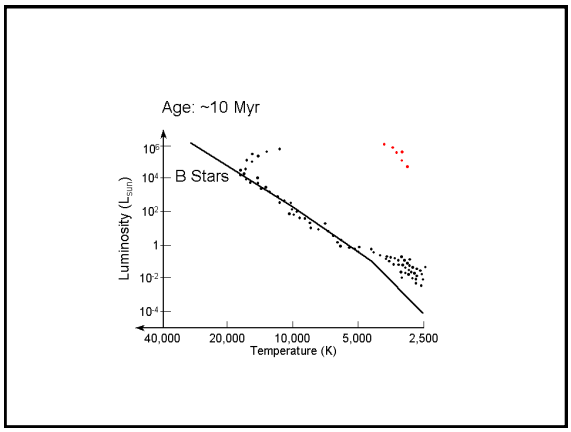
Clusters

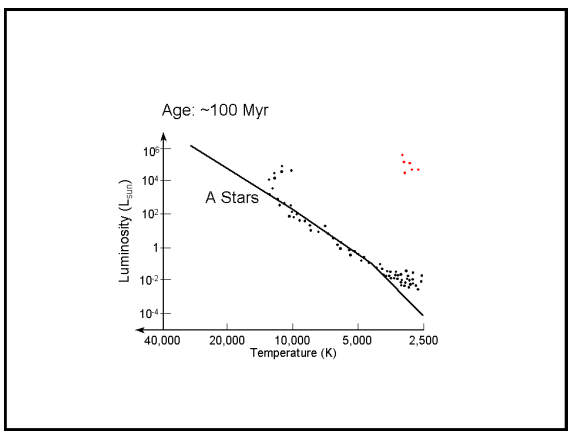
Two main types - Open Clusters and Globular Clusters

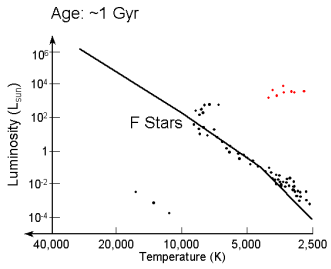
Open Clusters	**Globular Cluster**
_____stars	_____ stars
30 pc wide	25 pc wide - densely packed!
_____stars	_____stars
Composition – _____	Composition – _____
_____galactic plane	_____galactic plane
Can have _____	Can have _____

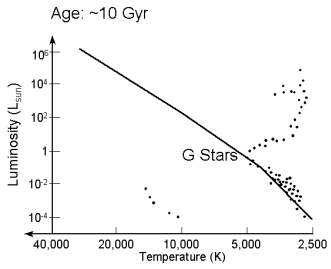

Globular Cluster NGC 6093
Hubble Heritage
PRC99-26 • Space Telescope Science Institute • Hubble Heritage Team (AURA/STScI/NASA)


Age: ~1 Myr
Luminosity (L_{sun})
10^6
10^4
10^2
1
10^{-2}
10^{-4}
Zero Age
Main Sequence
40,000
20,000
10,000
5,000
2,500
Temperature (K)


Age: ~10 Myr
Luminosity (L_{sun})
10^6
10^4
B Stars
10^2
1
10^{-2}
10^{-4}
40,000
20,000
10,000
5,000
2,500
Temperature (K)


Age: ~100 Myr
Luminosity (L_{sun})
10^6
10^4
A Stars
10^2
1
10^{-2}
10^{-4}
40,000
20,000
10,000
5,000
2,500
Temperature (K)

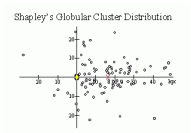




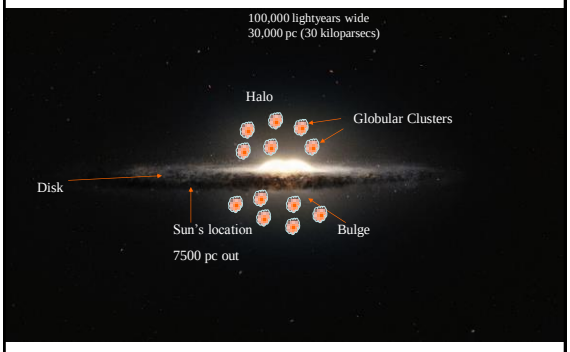
Back to the original question -
What the Milky Way is like?
Harlow Shapley

Look *away* from the disk - _____
_____contain _____stars
Distances!

Sun – not in the center!
Confirmed by modern observations.

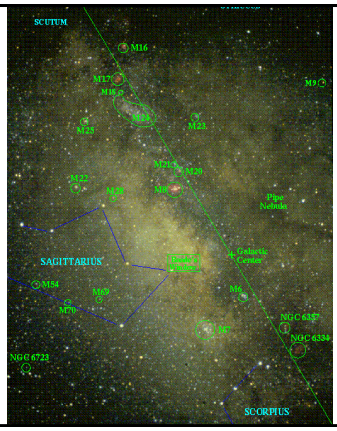


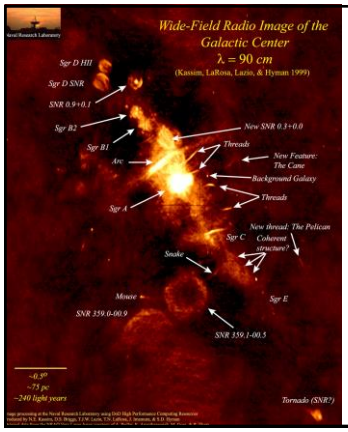

www.eso.org


100,000 lightyears wide
30,000 pc (30 kiloparsecs)
Halo
Globular Clusters
Disk
Sun's location
7500 pc out
Bulge

The Bulge

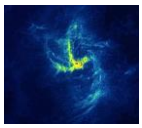
The center of the galaxy
Contains the core
Sagittarius/Scorpius

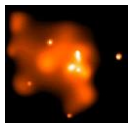




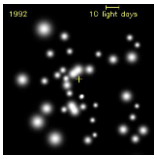
Radio source in the center, Sgr A

Object in the exact center, _____

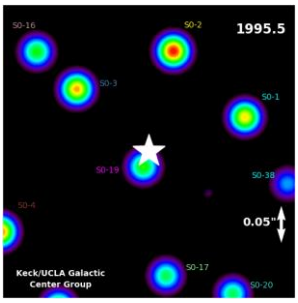


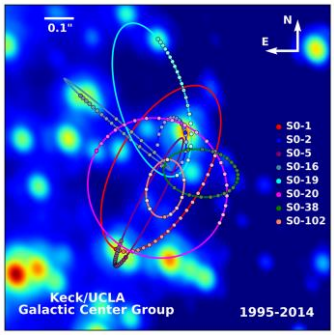


What's in the middle?
Orbital motions



Get "P", "a"
Kepler's law gives the mass as - _____ solar masses!
What could it be?





The Disk

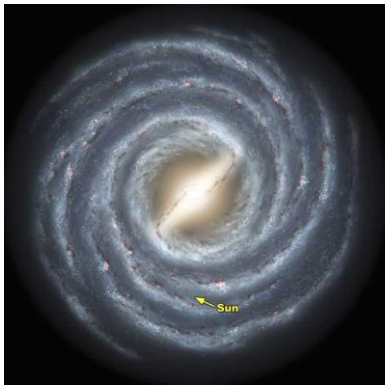
Many stars
Gas and Dust
Difficult to see through
Spiral arms, how many?

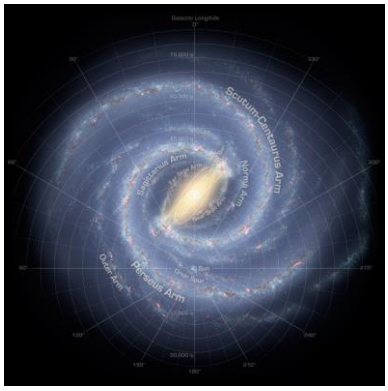
Find the spiral arms, by looking for regions of star formation

_____- Things associated with large scale star formation

And the answer is…….

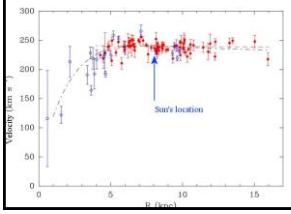
_____!





Disk Rotation

Disk is mainly _____
H I - neutral hydrogen
_____
What do we see?



Sun's velocity = _____ km/s
_____years for 1 orbit
Orbit?
Can we use Kepler's laws?
_____!

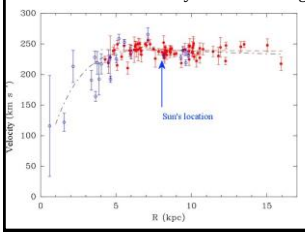
Kepler's Third law -

$M_{galaxy} = a^3/p^2$ (M_{galaxy} is actually mass within your orbit)

Sun's orbit = _____$M_\odot$

Total mass ~ _____$M_\odot$

Problem – velocity not decreasing



_____!

Another problem – wind-up

The Nude Jogger

Traffic moves to the right, jogger moving to left

Compression near jogger, but traffic keeps moving

Compression area moves along with jogger

What does this have to do with spiral arms?

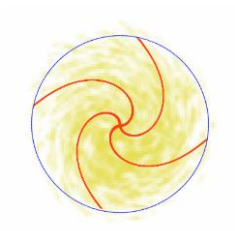
Cars - material in galaxy

Jogger - density wave

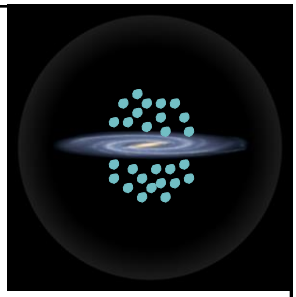
Region of compression - Spiral Arm

Remember - Spiral Pattern

Moves Independently



Halo



Area away from the disk

Globular clusters

A lot of dark matter

That's about all you can say about the halo...

Stellar populations

Stars fuse _____ elements into _____ elements

Stars die and disperse elements out into space

Material in space can get incorporated into new stars

End result - _____

Metal = anything other than Hydrogen and Helium

Population I stars

Stars chemically like the Sun

_____ stars

_____metal content

Associated with active star formation

Population II stars

Not like the Sun

_____stars

_____metal content

No active star formation