

The Universe

Distance To Stars and Galaxies

- the apparent shift in a star's position when viewed from one side of earth's orbit, and then the other side 6 months later
- useful to 1600 ly, then shift is too small to measure

Standard Candles

- objects of _____
 - used as _____
-

• a graph of stars that shows relationship of star color (or _____) to absolute magnitude (or _____)

• once color is observed, absolute magnitude can be estimated, because stars of any given color consistently plot only at a specific absolute magnitude on an H-R diagram

• comparing absolute magnitude to apparent magnitude gives distance

ex: a main-sequence, red star that appears bright, must be _____ because red stars are dim on the H-R diagram

• stars that vary in brightness with a regular cycle

• long-cycle Cepheids are _____ stars

• short-cycle Cepheids are _____

so.... a long-cycle Cepheid that appears dim must be _____

• can be used to tell distances to "nearby" galaxies

Type IA _____

• these gigantic explosions are always about the _____, and we know how bright that is

• they occur in binaries, where 1 star is a _____, the other is a _____ in close orbit

- the white dwarf's gravity steals hydrogen from the outer layer of the red giant

- when the mass of the white dwarf reaches 1.4 sols, a giant _____ occurs

-
- systems containing millions or billions of stars
 - there are _____ galaxies
 - 3 (outside of Milky Way) can be seen without a telescope:
 - _____
 - _____

Galaxy Types (Hubble Classification System):



- round, to flattened-sphere shapes
- the _____ galaxies are of this type



- ex: _____, _____ galaxy,



- like regular spiral, but with a bar
- ex: _____

- no regular shape
- _____ type of galaxy
- ex: Magellenic Clouds

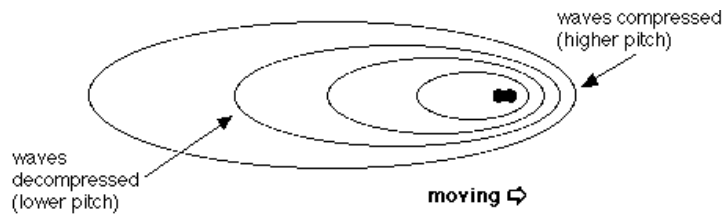
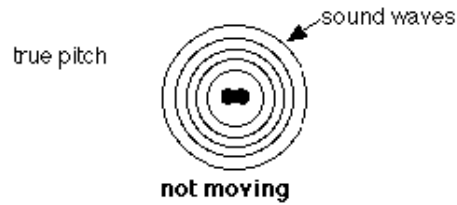
- Quasi-stellar radio source
- most _____ (in space and time) objects known
- give off 100's of times the energy of galaxies
- may be proto-galaxies

ORIGIN AND FATE OF THE UNIVERSE

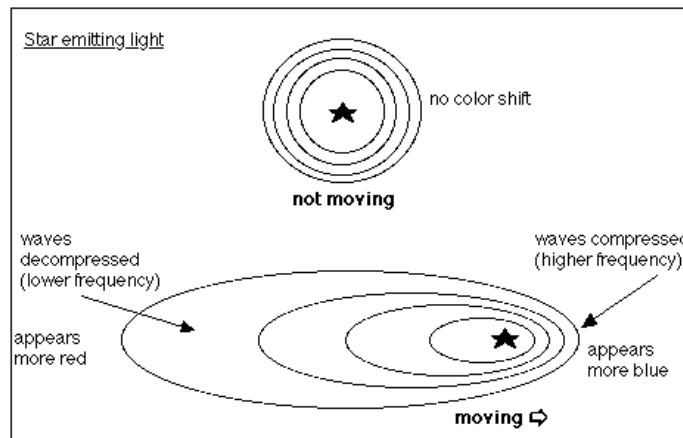
_____ Effect

for _____:

Car sounding horn



• for _____:



• the more _____ or _____, the faster the star (or galaxy) is moving

• nearly all galaxies are redshifted, and the further away they are the _____ they're redshifted, so...

...the universe is _____ like a loaf of raisin bread

Origin of the Universe

- if galaxies are moving apart, they were once _____
- about 14 billion years ago they would have been at a single, inconceivably hot & dense point
- the point contained all the ingredients of our current universe including all the _____, _____, _____, _____, and _____ itself.
- _____, for all intents and purposes, began
- the point exploded as the “_____” and is still expanding

Evidence for the Big Bang theory

- light from all distant galaxies is _____, and the further they are the more redshifted they are
 - this shows the universe is expanding so it must have been smaller in the past
- the elemental _____ of the universe matches predictions made by the theory
- the theory predicted a _____ (CMB) radiation, the light from the big bang, should be visible in all directions, and should be redshifted to microwave frequencies. The CMB has been observed and has even been precisely mapped.

Fate of the Universe

_____ or _____ Theory?

- depends on how much _____ there is:

if there is enough...

- universe will eventually stop expanding and will collapse - the _____
- if this leads to another Big Bang/Big Crunch cycle, we are in an _____

things that oscillate: _____, _____, _____

if there's not enough mass...

- universe will _____
- all nebulae will be used up forming stars
- stars will all burn out
- universe gets _____ forever