SPRING 3 NOTES (May)

GALAXIES: gravitationally bound, migration common, varied chemistry, observed in various stages of evolution; RED shifted spectra indicate earliest formed, BLUE shifted indicate more "recent" formation
usually interconnected in networks or clusters or super clusters; largest structures in universe

EX: *Virgo*: Virgo cluster, over 1300 galaxies centered at +/- 54 million Ly from earth; 17 are Messier Objects; Virgo Super Cluster, Local Cluster
M87 (M87* or Virgo A*) strongest radio source in cluster; first ever imaged
EX: *Leo*: Leo Cluster: M95, M96, M105; 11 other galaxies
Leo Triplet: 35 MLyrs from Earth; 3 Galaxies M66, M65, NGC 3628

Elliptical: older star group, similar chemistry, spherical shape usually
EX: M104 (Virgo/Corvus) Sombrero; NGC 4595; 31.1MLyrs from earth;
unusual combination of Spiral and Elliptical Galaxy
EX: M32, M49, M86

Spiral: younger or rejuvenated star group, spherical (S) or barred (SB), varied chemistry
EX: M51a (*Whirlpoo*l in Canes Venatici)
EX: *Milk Way*
EX: M101 (*Pinwheel* in Ursa Major) (UV, Visual, X-ray)

Irregular: shape not well defined; probably the result of collisions
EX: M82 (*Cigar* in Ursa Major)

NEBULAE:
Often used incorrectly; Confused observations by ancients into the middle ages
Actual "clouds" of dust, gas, organic molecules, debris, etc.
Telescope views usually include several different types in one image

Planetary Nebulae: Once thought of as the beginning of planet formation
The **final phase of a main sequence star** of less than 2-3 solar masses
Usually contains 1 or more Helium stellar cores or white dwarfs
EX: NGC 3242 (Ghost of Jupiter in Hydra)
EX: M57 (*Ring* in Lyra)

Wolf-Reyet Ring or Wind Nebulae: The **final stage of O stars** (red supergiant or blue luminous variable stars); larger than 25 solar masses; identified by specific spectra (H,He,N,O); rare
EX: M1-67 around WR124 (not a Messier object)

Emission Nebulae: energized cloud, produces it own light; pref RED
EX: NGC 2237 (*Rosette* in Monoceros)

Reflective Nebulae: radiated by star(s) near (usually "behind" the cloud; pref BLUE
EX: IC2118 *Witch Head* in Orion)

Dark Nebulae: high density dust and gas blocks light from the cloud
EX: Barnard 59 (*The Pipe* in Ophiuchus)

All three EX: M20 (*Trifid* in Sagittarius*);* NGC 2170 (*Angel* in Monoceros)

ASSOCIATIONS: Group of stars that share some kind of a common factor, usually gravitationally related, smaller than star clusters

O-B association: involves stars of the same age, chemistry, motion and magnitude
not gravitationally "bound" like a cluster
still expanding (see slide)
Arthur Eddington, Victor Ambartsumian
EX: Orion OB1b; three "belt" stars

T association: very young stars, evolving into main sequence stars, same chemistry (Spectra) and motion, variable stars
EX: T Tauri associations;

NAMING: **Alpha, beta, gamma vs A,B,C**

STAR: Greek alphabet letter or number BEFORE constellation name = apparent magnitude (brightness) within a constellation
EX: α Lyra
STAR: Double = apparently related or spectrographically related; period unknown
STAR: Binary = orbit verified, actually gravitationally related
Given capital letter A,B,C etc after STAR name
EX: Sirius A, Sirius B; no designation of Double or Binary
STAR: Capital Letter R thru Z before star name indicates what type of variable (complicated)
EX: T Tauri variable in Taurus (description is detailed and technical)
EX: R Leonis variable (+- a year period)

Verified PLANETS orbiting a star: Star name followed by b, c, d etc (never a):
EX: Fomalhaut b or α Pices Astrinus b

Black Hole or Active Galactic Nuclei (AGN): Constellation name followed by an A
(Usually only one);
addition of an *indicates an "excited" radio source.
Ex: Sagittarius A* of Milky Way galaxy
X if a large Xray source:
Ex. Cygnus X

Catalogue designation: Name or letters of a Catalogue or Institution etc followed by a number
Applied to an object of a specific catalogue type (galaxy, cluster, gamma ray burst (GRB), etc)
Catalogues can have very complicated and technical classification
Ex: NGC 3242 (New General Catalogue);
Ex: M44 (Messier Object)
EX: HD 101197 (Draper Catalogue)
EX: WR 137 (Wolfe-Rayet star)