CENTRAL SCIENTIFIC COMPANY

31188 Galaxies and the Universe
Slide Set

1. The distribution and increasing number of stars at 10pcs, 100pcs 1,000pcs, and 5,000pcs from the sun. This slide demonstrates how star counts from the sun's position indicate the shape and size of the Milky Way Galaxy.
2. This slide shows the galaxy seen edge-on from a point outside th system. The left side shows the general structure and the sun's position, and the right side shows galactic latitude positions with respect to the galactic plane and the sun. Important constellation regions are noted in terms of galactic latitude.
3. This slide compares the old concepts of stellar populations in various positions in the galaxy (left) with the current concept illustrating spheroidal, halo, disk, and spiral arm populations of stars (right).
4. This diagram shows the face-on view of the galaxy as seen 90° above the galactic plane. The left side shows the positions of the recognized spiral arms (Orion, Cygnus, Perseus, Sagittarius) with respect to the sun. The right side shows every 30° of galactic longitude with th galactic plane constellations noted as seen from the sun.
5. This graph shows the rotation curve for our galaxy. It illustrates that the rotational velocity at various distances from the galactic center is not Keplerian throughout, due to the distribution of mass in th system.
6. This slide shows a map of the spiral structure of our galaxy deduced from 21cm radio observations emitted by neutral hydrogen in the plane of th galaxy. The spiral structure was determined from radial velo observations of hydrogen clouds in the spiral arms. Hydrogen clouds directly toward or away from the sun show no radial velocity, creating the wedges in the sketch.

7. Map of the disk and halo regions of the Milky Way Galaxy showing the distribution of open star clusters along the galactic plane. Open star clusters are relatively young stars formed in the H11 regions in the galactic disk.
8. Edge-on view of the Milky Way Galaxy showing the distribution of the globular star clusters. Globular star clusters are composed of the oldest stars of the galaxy, and probably were formed before the galaxy took shape. This map shows their distribution in the halo and nucleus of the galaxy as members of the spheroidal population.
9. Map of the galaxy showing the distribution of nebulae along the galactic disk. H1 and H11 regions and giant molecular clouds are located in the plane of the galactic disk and are intimately connected to the disk population of the stars. They are the birth places of the disk population.
10. Schematic diagram showing the H11 region and surrounding H1 region. The atomic structure of hydrogen associated with each regi stressed. A typical H11 region

contains hot, luminous stars that ionize the hydrogen. In the adjacent H1 region, the ultraviolet radiation from the hot stars does not penetrate, thus the hydrogen is neutral.

11. Galactic map showing the distribution of discrete radio sources in the galaxy. These are observations near 21cm of continuous emitting radiation concentrated along the galactic plane. The origin of this radiation is among the neutral hydrogen clouds in the spiral arms of the galaxy.

12. Diagram illustrating representative galactic orbits for the disk and spheroidal populations in the galaxy. The sun circles the galaxy in an orbit restricted to the disk oscillating about 1000 light years back and forth across the disk plane. Most of the disk stars have orbits that occupy the disk as much as the sun does. The spheroidal population of stars and globular star clusters have highly elliptical orbits inclined at all angles to the galactic plane.

13. Diagram showing details of the spiral arms in the sun's vicinity. The sun is located on the inside of the Orion arm with the Sagittarius-Carina and Centaurus arms inside and the Perseus arm outside the Orion arm. The approximate location of well known nebulae such as the Rosette, Eta Carina, Trifid, Lagoon, Orion, and the Eagle are noted.

14. Schematic diagram showing the origin of spiral structure in galaxies. Four geometric renditions demonstrate the generation of a spiral density wave from oriented elliptical orbits: (1) elliptical orbits of stars in random distribution; (2) elliptical orbits of the same eccentricity with their axes coincident; (3) oriented ellipses with slightly differin alignments of their major axes; (4) formation of spiral struct through orientation of their axes as their orbits precess at different speeds forming a density wave.

15. Schematic diagram showing spiral density waves forming spiral arms with resulting compressional waves forming a shock front that initiate star formation.

16. Diagram showing the postulated central region of our galaxy out to

about 10,000 lys. Included from the center out: a possible central black hole; a hot ionized gas disk around the central mass; a ring of giant molecular clouds; and the position of two emerging spiral arms.

17. Chart illustrating the four basic types of galaxies and their subtypes. The types are based upon the size of the nucleus, the openness of the spiral arms, the existence of a bar, the existence or absence of dust and gas, and the ellipticity of the body.

Representative Examples of Types of Galaxies:

18. M104, an Sa normal spiral in Virgo. NOAO photo.
19. M81, an Sb normal spiral in Ursa Major. NOAO photo.
20. M74, an Sc normal spiral Pisces. NOAO photo.
21. M84, an SO galaxy in Virgo. NOAO photo.
22. NGC 3718, an SBa (peculiar) barred spiral in Ursa Major. NOAO photo.
23. NGC 5383, an SBb barred spiral in Canes Venatici. NOAO photo.
24. NGC 4535, an SBc barred spiral in Virgo. NOAO photo.
25. Large Magellanic Cloud, a type 1 Irregular galaxy in Dorado.
26. NGC 30777, a type 11 Irregular galaxy in Ursa Major. NOAO photo.
27. M87, an EO giant elliptical galaxy in Virgo. NOAO photo.
28. NGC 4526, an E7 elliptical galaxy in Adromeda. NOAO photo.
29. Diagram showing the Hubble classification of galaxies. In this scheme the type SO is a transitional type between the elliptical and spiral forms. This classification is based upon morphology and did not originally include the irregular types. It does not indicate an evolution of one type into another.
30. Exploded schematic diagram showing the morphology and structure of a normal spiral galaxy. This includes several distinct areas: spheroidal population; disk population; giant molecular clouds; neutral hydrogen (H regions); H11 regions and O and B