

Chapter 31. Peculiar Galaxies, Explosive Nuclei, and Quasars

Note. Before our discussion of cosmology in Chapter 32, we describe a few of the other exotic objects in distant parts of the universe.

Note. *Radio galaxies* emit unusual amounts of radio radiation. Double lobed structures are often detected near radio galaxies. There are also jets (sometimes a series of blobs) of matter ejected from these. One theory of the energy source of radio galaxies (including explosive events that might eject rays) in the presence of a giant black hole. The matter escapes along the rotation axes of the black hole.

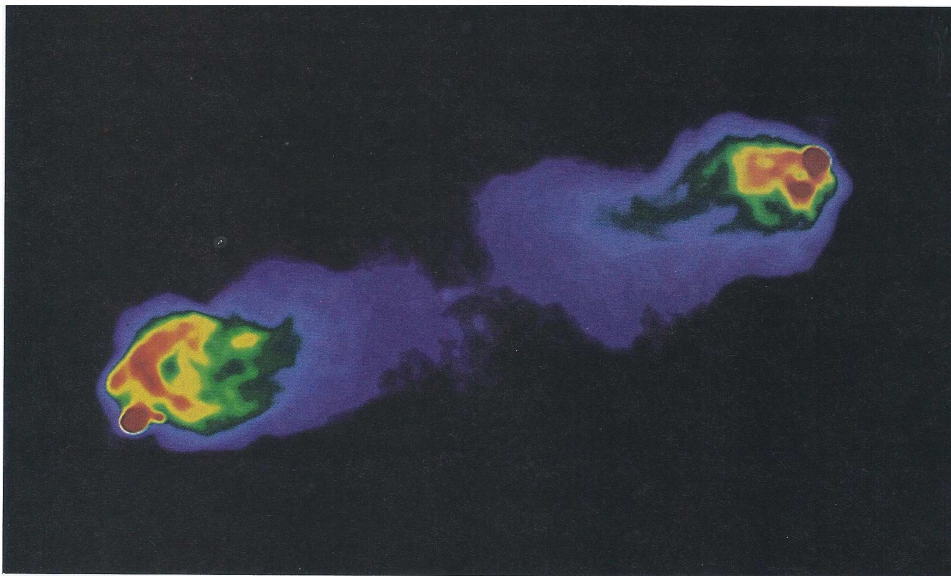


Figure 31.2 Page 598. Radio Image of a Radio Galaxy.

Note. *Seyfert galaxies* have unusually bright nuclei.

Note. In 1960, *quasars* (quasi-stellar objects), were discovered as radio sources. They appeared in photographs as single blue stars. They were distinguished by their incredibly high redshifts. Today, there are 100s of known quasars (few of which are radio sources) one of which has a velocity of 93.4% c .

Note. There is some controversy as to the origin of the redshift. The bulk of the evidence suggests that the quasars are at “cosmological” distances. *BL Lac objects* are elliptical galaxies with very bright nuclei that resemble quasars. If they are as distant as they appear, then quasars must have been objects that lived in the early universe. Given their distances, quasars must be brighter than normal galaxies by factors of 100s or 1,000s. The source of such energy is still not explained.

Note. Some quasars have been observed to have jets of matter associated with them, much like the active galaxies. Many vary in brightness over several days, months or years, indicating that the quasar is not very big.

Note. It now seems likely that the line

quasars \rightarrow Seyfert galaxies \rightarrow normal galaxies

represents an evolutionary sequence. It is likely that all quasars are located in the nuclei of galaxies.

Note. The big question for quasars is “How is the energy produced?” It is suggested that there may be a giant black hole at the center of a quasar. This is similar to what is thought to happen in radio galaxies. This could explain the radio lobes, jets, and small size.

Revised: 4/2/2019