

Stars may be spheres, but not every celestial object is spherical.

Objects in the universe show a variety of shapes: round planets (some with rings), tailed comets, wispy cosmic gas and dust clouds, ringed nebulae, pinwheel-shaped spiral galaxies, and so on.

But none of the shapes on this list describes the largest single entities in the universe.

These are the double radio sources, galaxies with huge clouds of radio emission that dwarf the visible galaxies, sometimes by a factor of a hundred or more.

Stretching over distances greater than a million light-years, these radio-emitting regions resemble twin turbulent gas clouds, typically forming dumbbell-like shapes with the visible galaxy (when it is visible) in the center.

These double radio sources present astronomers with a puzzle.

Their radio emission arises from the synchrotron process, in which electrons accelerated to nearly the speed of light move through magnetic fields.

However, in view of the rate at which the radio sources emit energy, they should disappear in a few million years as their electrons slow down and cease producing radiation.

Somehow new electrons must be continually accelerated to nearly the speed of light, otherwise, by now almost none of the double radio sources would be observed.

With the advent of high-resolution radio interferometers during the late 1970's, part of the answer became clear: the electrons are produced in jets that are shot out in opposite directions from the center of galaxy.

Remarkably narrow and highly directional, the jets move outward at speeds close to the speed of light.

When the jets strike the highly rarefied gas that permeates intergalactic space, the fast-moving electrons lose their highly directional motion and form vast clouds of radio-emitting gas.

Cosmic jets have ranked among the hottest topics of astronomical research in recent years as astronomers strive to understand where they come from.

Why should a galaxy eject matter at such tremendous speeds in two narrow jets? And why are such jets not seen in the Milky Way?