**Quasars**

In 1936, Grote Weber built the first radio telescope in his backyard.

By 1944, he had detected strong radio emissions from the constellations of Sagittarius, Cassiopeia, and Cygnus.

Two of these sources were in our galaxy (Sagittarius A and Cassiopeia A).

The third object, Cygnus A, was a mystery.

Using the 200-inch Hale telescope on Mt. Palomar, a strange-looking, faint galaxy was found to be located at its position.

When it was photographed and its spectrum taken, its light was red-shifted so much that it had to be moving away from us at 14,000 km/s.

This meant that it was 635 million light years away.

Although it was dim optically, its radio output was so great that its total energy output was astronomical!

By the 1950's, items like Cygnus A were turning up all over the sky.

The object 3C 273 was found in 1962-- its spectral lines could not be identified because of its enormous red-shift.

About a year later, they were identified and 3C 273 was found to be receding from us at 15% of the speed of light!

This meant that it was over 2 billion light years away!

Later, 3C 48 was found to be receding from us at around 33% of the speed of light-- 4 billion light years away!

Because they look star-like, these objects were called quasi-stellar objects (quasars)-- over 10,000 are currently known.

Quasars all have speeds of between 6% and 92% of the speed of light.

Active galaxies have outputs between those of quasars and those of regular galaxies.

There are several types of active galaxy:

1) Peculiar galaxies - blowing apart
2) Seyfert galaxies - bright nuclei, strong emission lines
3) BL Lacerta objects - no emission lines at all!
   Their outputs vary-- if less than 1 day then they are called blazars

Quasars have been found to vary their outputs getting brighter and dimmer over time.

By measuring the rate of the brightening and dimming, the size of the quasar can be measured.

Most quasars are very small-- less than a light day across.

Their power source must be tremendous!
Many active galaxies contain double radio sources.

It is now thought that supermassive black holes provide the power for quasars and active galaxies.

**Gamma Ray Bursters** emit tremendous amounts of gamma radiation for brief periods of time.

They are the largest explosions known and are thought to occur when two neutron stars collide or a black hole swallows a neutron star.
Attachments

- Grote Weber
- Grote Weber's radio telescope
- Grote Weber Site
- Grote Weber archive
- History of Radio Astronomy
- Amateur radio astronomy