Canadian astronomers develop new scientific uses for radio telescopes

New scientific uses for radio telescopes are being developed by a team of Canadian astronomers which pioneered in the use of long baseline radio telescopes for research into quasars. These mysterious star-cluster size objects on the edge of the observable universe radiate extraordinary amounts of electromagnetic energy equal to that of galaxies containing billions of stars.

The Canadian astronomers hope variations of their technique for measuring the diameter of quasars will enable them, among other things, to accurately establish the rate of continental drift and to verify experimentally some of the predictions of Einstein's Theory of Relativity.

In 1967, astronomers from the National Research Council of Canada, the University of Toronto, Queen's University and the Federal Department of Energy, Mines and Resources, developed the technique for measuring the angular diameter of quasars by making simultaneous observations of the emission of radio waves with radio telescopes thousands of miles apart.

From 1960, when the first quasar was detected, until 1967, the diameter of quasars was measured by means of a radio interferometer consisting of a pair of radio telescopes spaced several miles apart but linked by microwave radio. This link enabled the received signals at both stations to be directly intercompared and this inter-comparison gave a determination of the diameters of radio sources. The resolving power (the ability to discriminate small objects and measure their size) is directly proportional to the interferometer spacing. Deteriorating stability of the microwave link limited baselines to less than 100 miles.

The Canadian astronomers removed the necessity for a direct link by recording received signals on magnetic tapes. Through the use of atomic clocks, these were synchronized to better than a millionth of a second and intercomparison made at a central laboratory. First experiments were conducted with a 2,000-mile baseline provided between the NRC 150-foot telescope at Algonquin Radio Observatory in Algonquin Park and the Dominion Radio Astrophysical Observatory's 84-foot telescope at Penticton, B.C. A second series stretched the baseline the 3,200 miles between the ARO telescope and the 250-foot telescope at Jodrell Bank Observatory in England.

The most recent series involved the ARO telescope and the Penticton telescope in a link-up with the Parkes Observatory in the Australian state of New South Wales. This provides an 8,000-mile baseline.

The Algonquin Park-Penticton experiment showed that the angular diameter of 3C273B, believed the nearest of the quasars is less than .02 seconds of arc. In the Algonquin Park-Jodrell Bank experiment the resolution was increased by a factor of two to .01 seconds of arc, producing further evidence that 3C273B is in fact about 100 light years in diameter, compared with a diameter of 100,000 light years for normal galaxies. The increased resolution has enabled the sizes and structure of about 30 quasars to be determined. ⟶

NRC's 150-foot radio telescope at Algonquin Park.

Le radiotélescope de 150 pieds, du CNRC, au parc Algonquin.