RADIO OBSERVATIONS OF THE GALACTIC CENTER

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Low-resolution, radio-intensity maps of the Galactic Center are dominated by two structures: the extended, nonthermal region between $\ell = 0\overset{\circ}{.}0$ and $0\overset{\circ}{.}3$ called Sagittarius A(East); and the bright thermal source at $\ell = -0\overset{\circ}{.}05$ and $b = -0\overset{\circ}{.}05$ called Sagittarius A(West). SgrA(East) is probably a supernova remnant. SgrA(West) is a dense, gaseous region which is the very center of our Galaxy. Within SgrA(West) is a pc-sized cluster of infrared sources -- late-type stars and gas condensations -- swirling about with a dispersion of 250 km s^{-1}. The cluster contains a unique radio source with the following properties: a size not exceeding 10^{15} cm, a radio luminosity exceeding 10^{34} erg s^{-1}, and rather stable properties on a time scale of 10^8 s. This compact, nonthermal object (SgrAcn below) may be surrounded by a 0.1pc infrared source. Models for SgrAcn include both 10^6 $M_\odot$ black holes related to the central objects in radio galaxies and quasars (Oort 1977, van Buren 1978) and 1 $M_\odot$ degenerate stars related to pulsars and X-ray binaries (Reynolds and McKee 1980). We present below the radio intensity spectrum as a basic datum for further development of either class of models.

The radio spectrum of SgrAcn must be measured with interferometers whose resolution falls in the window between confusion from nearby HII regions (3") and the frequency-dependent angular broadening by interstellar plasma ($1\overset{''}{.}0\nu(\mathrm{GHz})^{-2}$). The angular broadening effects have been observed at many frequencies between 1 and 10 GHz.

The flux density of SgrAcn was measured from 1.4 to 85.7 GHz with several radio interferometers. In March 1981 the VLA was used in A configuration to determine flux densities at 1.413, 4.885 and 15.035 GHz. Measurements were made in the visibility domain, and were referred to 3C286 via secondary standards of 1748-253, 1748-253 and NRAO 530, respectively. System temperature and sky absorption corrections were applied. At 1.4 GHz the source intensity was estimated assuming the ν^{-2} apparent size law. In April 1981 observations with the 35-km interferometer in Green Bank provided flux densities at 2.695 and 8.085 GHz referred to 1748-253. Absolute intensities were computed using the VLA spectrum for 1748-253.

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In April 1981 the Hat Creek Interferometer was used at 85.7 GHz. The antennas were on an East-West baseline with projected lengths between 73,000 and 86,000 λ (2"8 -2"4). NRAO 530 was observed as a secondary calibrator. System temperature and sky absorption corrections were applied. Coherent and incoherent integrations gave consistent results. The flux-density of NRAO 530 was referred to planetary observations after the antennas were moved to a short baseline.

These flux-density observations (Fig.1) indicate a continuous spectral distribution up to 86 GHz with an index of +0.25, and an observed luminosity of 1.3 x 10^{34} erg s^{-1}. The turnover frequency must be at or above 100 GHz. As noted by many authors, spectra of the form presented below can be generated either by a superposition of many self-absorbed synchrotron components, or by a smooth distribution of synchrotron emissivity with internal absorption.

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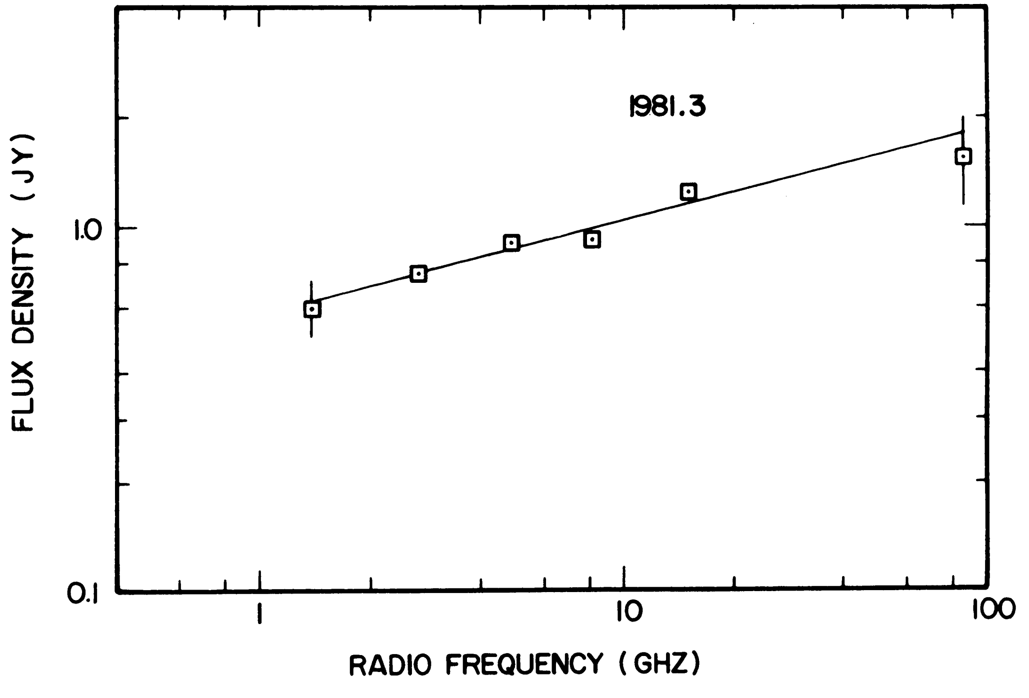

FIG.1 Flux density spectrum for SgrAcn between 1.4 GHz and 85.7 GHz measured in March-April 1981. Solid line corresponds to $\nu^{+0.25}$ spectrum.

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