Reports

Flux Density of Cassiopeia-A at 3.0 Megacycles per Second

Abstract. *The flux density of Cassiopeia-A was measured at 3.0 megacycles per second by an interferometer alternately responding to the power in the ordinary and extraordinary modes. The flux indicates attenuation in the path between the source and the solar system by the ionized hydrogen clouds.*

The flux density of the radio source Cassiopeia-A (*1*) (declination 58°40′N, right ascension $23^{h}21^{m}$) has been obtained (*2, 3*) at the frequencies $f \gtrsim 12$ Mc/sec. Since the ionospheric critical frequencies are significantly low in the arctic latitudes and, in the winter nights of the solar minimum epoch, often less than 2 Mc/sec, an attempt was made at College, Alaska (latitude 65°N), to obtain the flux density of this source at 3.0 Mc/sec. The interferometer consisted of two antennas of effective area 8.3×10^{3} m^{2}, separated by 2 km in the east-west direction. The effective area was determined from the theoretical polar diagram (*4*). The interferometer fringes were thus separated by 3°. Each arm consisted of folded half-wave dipoles along the sides of a square of side 0.4 λ, at 0.15 λ above ground. On the ground were laid 8-gauge aluminum wires to form a square grid of side 1.25 λ, with mesh openings of one-hundredth of a wavelength. A system of matching boxes and phasing cables enabled the channeling of the ordinary mode (left-circular) and the extraordinary mode (right-circular) powers into separate outlets. Once every 3 seconds the interferometer alternately responded to the power from the ordinary mode and from the extraordinary mode. This dual-polarization technique was found necessary to account for the ionospheric attenuation (*4, 5*). At each mode, the outputs from the two arms were combined after a rapid (1000 cy/sec) insertion-and-removal of an extra 180° phase angle in the path of one of them; a phase-sensitive detector, which was fed by the main receiver of $\approx$ 8 kc/sec bandwidth (mechanical filter), enabled the Cassiopeia flux to be isolated and the typical sine-wave-like pattern to be recorded separately at the ordinary and extraordinary modes.

Despite the severe limitations imposed by the ionosphere at the low frequencies (high values of critical frequencies, inhomogeneities which introduce excessive scintillations, attenuation, and man-made interference), it was found that the conditions were favorable for brief spells during a few nights in the 1966–67 winter. Figure 1 shows some examples of the Cassiopeia-A pattern during such spells. It consists of four nights of data; the top channel is 3 Mc/sec E-mode, and the middle is 3 Mc/sec O-mode. Also shown is the bottom channel which displays the wide-beam (70°) 2-Mc/sec (O-mode) galactic noise, which confirms the very low values of ionospheric critical frequency and minimal attenuation. (For example, the 2-Mc/sec level at about 2300 hours on 8 November implies that the critical frequencies were $\ll$ 2 Mc/sec and the attenuation at 2 Mc/sec was $\lesssim$ 2.0 db; this channel is decibel-linear so that, if the level dropped to halfway in the chart, the effective attenuation would be $\approx$ 10 db.) The interferometer channels are power-linear, and by means of a noise-generator calibration the full scale deflection, either side of the central line, was found to correspond to a flux

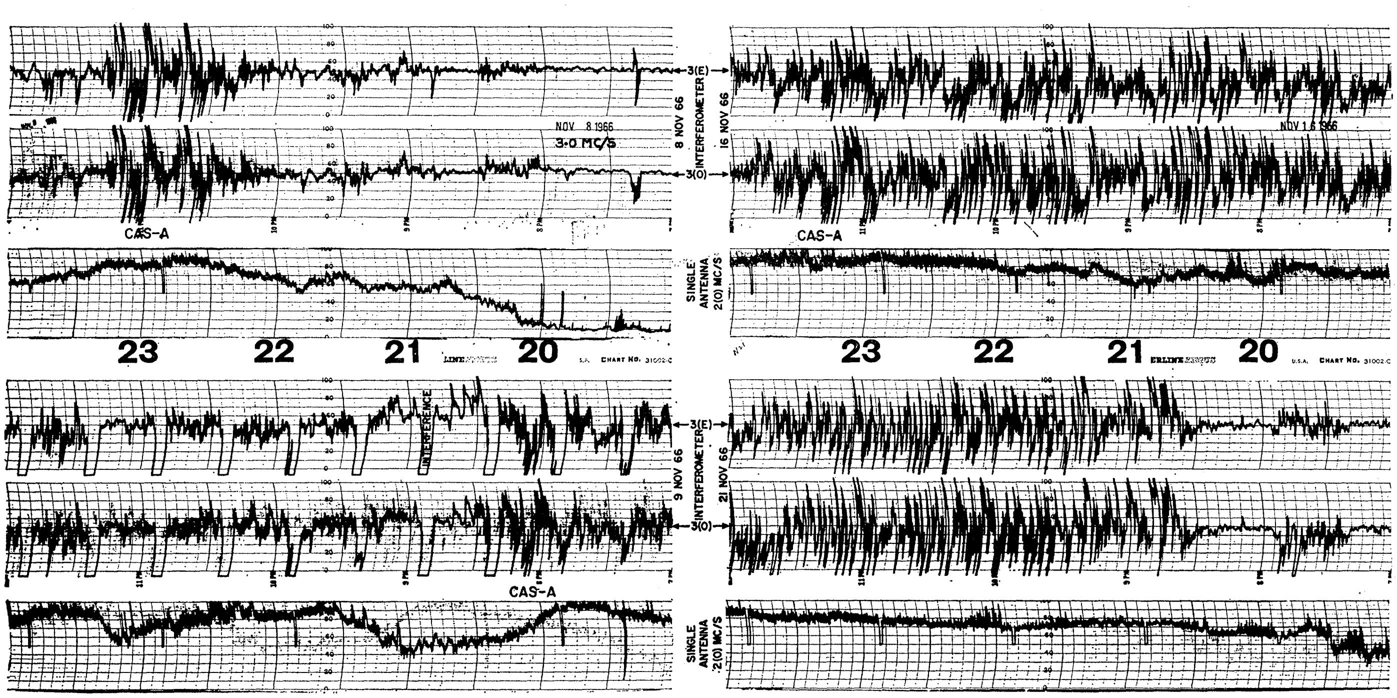

Fig. 1. Records for four nights of the 3.0-Mc/sec interferometer system in the E-mode (top channel) and the O-mode (middle). The bottom channel is 2.0-Mc/sec (O-mode) single-antenna intensity of background cosmic noise.

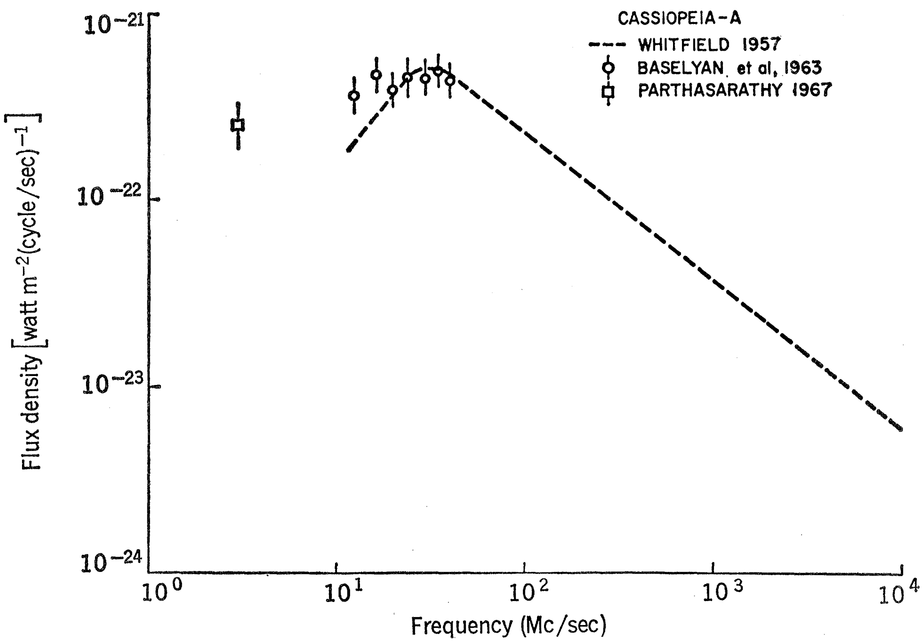

Fig. 2. Flux density of Cassiopeia-A.

density from a source of about 4×10^{-22} watt m^{-2} $(cy/sec)^{-1}$. The Cassiopeia-A can be readily recognized at 2215 to 2315 hours on 8 November, in both modes, at 1945 to 2015 hours on 9 November, at least in the O-mode, and at 2245 to 2330 hours on 16 November, in the O-mode. The pattern is absent at other times either because of high critical frequencies (for example, on 8 November) or because excessive scintillations (for example, on 21 November) nearly destroyed the sine-wave-like trend. From the patterns where the O- and E-mode levels were nearly equal (for example, at about 2300 hours, 8 November, about 2000 hours, 9 November), the flux density of Cassiopeia-A could be derived as $(2.5 \pm 1.0) \times 10^{-22}$ watt m^{-2} $(cy/sec)^{-1}$.

Figure 2 shows our 3-Mc/sec data along with those at higher frequencies. The dashed curve (*2*), a mean of several observers, clearly underestimates the low-frequency flux, since the 16.5-Mc/sec flux included a datum (*6*) which is low by an order of magnitude. Data of Baselyan *et al.* (*3*) from the Soviet arctic are compatible with our 3-Mc/sec data. Bridle (*7*) has obtained a somewhat lower flux, 2.8×10^{-22} at 10 Mc/sec, than Baselyan *et al.*

Numerical estimates reveal that the source is unlikely to be intrinsically a poor emitter below about 30 Mc/sec; the decline in the spectrum is more plausibly due to attenuation along the path. The 3-Mc/sec flux is about 12 decibels weaker than the value that may be obtained by extrapolating the trend at the frequencies $\gtrsim 50$ Mc/sec. To convert this attenuation into the "emission measure," $\int N_e^2 ds$ (where N_e = electron density per cubic centimeter in the ionized hydrogen clouds, and ds is measured in parsecs),

$$A\ (\text{db}) = 1.3 \times 10^{-3}\, T_e^{-3/2} \lambda^{2.1} \int N_e^2\, ds$$

where λ is in centimeters and T_e is electron temperature. With $T_e \approx 10^4$, we obtain the "emission measure" to be ≈ 100. Since Cassiopeia-A is located at about 3×10^3 parsecs, this could mean either that absorption occurred uniformly along the path, with $N_e \approx 0.18$, or that a single, typical, H-II cloud of $N_e \approx 10$ and diameter 1 parsec intervened in the path. As pointed out by several workers [see, for example, Bridle (*7*)], one can readily derive an integrated emission measure along the 3 kiloparsecs from about 50 to 200 by assuming plausible values of N_e and T_e.

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References and Notes

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Gangliosides in Isolated Neurons and Glial Cells

Abstract. *Gangliosides occur in much greater amounts in clean isolated neurons and in the neuropil teased from immediately around the neuron cell body and dendrites than in isolated clumps of glial cells. Since the zone of neuropil adjacent to neurons is richest in terminal axons and synaptic endings, these findings indicate a specific concentration of these sialoglycolipids in synaptic membranes.*

Within the central nervous system there is considerable indirect evidence of a specific neuronal localization of gangliosides, a group of complex acidic membrane sialoglycosphingolipids (*1*). Brain regions rich in neurons have a high ganglioside content. The distribution of these lipids in subcellular fractions of adult and developing rat brain shows the highest concentration in nerve-ending particles and certain synaptic or dendritic membrane fractions (*2–4*). Fractions of synaptosome ghost-membrane recently isolated (*4*) contain the highest relative specific concentrations not only of gangliosides but also of acetylcholinesterase, adenylcyclase, and a particulate phosphodiesterase. Although gangliosides are present in white matter and occur in small concentrations in purified myelin fractions, it appears they are not constituents of myelin (*5*) but rather of the axon, probably the axolemma (*6*). Deposition of gangliosides during development occurs predominantly before myelination, corresponding to the period of active neuronal increase and expansion of dendritic surface area (*2*). There is no relationship between ganglioside content in various brain regions and the quantitative distribution of neurohormones such as acetylcholine, catecholamines, or 5-hydroxytryptamine. The distribution of these lipids in brain parallels more closely that of γ-amino-