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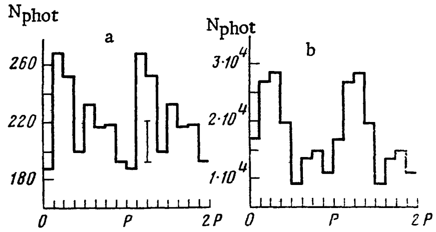

FIG. 2. Pulse profile derived by superposing measurements with a trial period: a) P = 8.6 ± 0.6 sec (Kosmos 856); b) P = 8.1 ± 0.1 sec (Cone experiment).

period observed on 1979 March 5 is real; but if it is, rather than merely resulting from statistical error, then it suggests that the pulsar spin has accelerated by 5% in 2.5 yr.

Preliminary attempts to shrink the error box (3° × 3°) by making use of the triangular shape of the collimator beam have been unsuccessful, both because the statistics are not extensive enough and because the amplitude of the pulsating component might be variable. Nevertheless, the evidence acquired does indicate that the hard x-ray pulsations recorded by Kosmos 856 belong to the flaring x-ray pulsar FXP 0520−66. The mean flux density detected is $\approx 1.4 \cdot 10^{-3}$ photon · cm^{-2} · sec^{-1} · keV^{-1} (or $\approx 10^{-8}$ erg · cm^{-2} · sec^{-1}). If the source is at, say, 100-pc distance[2] the corresponding luminosity would be $L_X = 1.1 \cdot 10^{34}\ [d/(100\ pc)]^2$ erg/sec, or some 1000 times lower than the mean luminosity of the pulsating component of the 1979 March 5 burst. On the next scan, $\approx 1^h.5$ later, the peaks in the periodogram completely disappear, so in an interval of $1^h.5$ the flux from the source dropped by a factor of more than 3, to a level below $5 \cdot 10^{-4}$ photon · cm^{-2} · sec^{-1} · keV^{-1}.

The authors are grateful to I. S. Shklovskii and R. A. Syunyaev for their continuing interest, and to E. P. Mazets for making available data on the 1979 March 5 burst of FXP 0520−66.

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Simultaneous radio spectra of 3C 84 (NGC 1275) from RATAN-600 observations at 16 frequencies

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(Submitted May 9, 1980)

Pis'ma Astron. Zh. 6, 617–619 (October 1980)

Simultaneous multifrequency radio spectra have been obtained for the source 3C 84 (the Seyfert galaxy NGC 1275) with the RATAN-600 radio telescope at two epochs, 1979.5 and 1980.0. The energy of the particles and field is confirmed to be growing at a rate of about 15% annually.

PACS numbers: 98.50.Rn, 98.70.Dk

The letter presents the results of multifrequency observations of the radio galaxy 3C 84 (NGC 1275) with the RATAN-600 radio telescope, carried out with a bank of regular radiometers covering the 1.35-31 cm wavelength range.[1)] By observing variable radio sources in this manner one can interpret interferometric observations more fully, and in some cases, as shown in a recent letter,[3] one can obtain an independent estimate for the velocity at which the components of a radio source are receding from each other (or expanding).

The object 3C 84 is one of a number of bright radio galaxies displaying strong activity in a nucleus with well-studied multicomponent structure. It has therefore been placed on the list of radio galaxies and clusters to be kept under observation from time to time by the RATAN-600

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TABLE I. Radiometer Specifications

No.	λ, cm	δT°K (for τ = 1 sec)	Δf, GHz	Instrumentation package
1	1.38	0.070	1	High-sensitivity system
2	2.0	0.200	0.6	Solar radiometers
3	2.08	0.030	1.5	High-sensitivity system
4	2.1	0.025	1.2	Sky-survey radiometers
5	2.3	0.120	0.6	Solar radiometers
6	2.7	0.120	0.6	The same
7	3.2	0.190	0.6	" "
8	3.45	0.023	1	Sky-survey radiometers
9	3.9	0.015	0.7	High-sensitivity system
10	4.0	0.100	0.6	Solar radiometers
11	4.5	0.200	0.6	The same
12	6.2	0.100	0.01	Spectroscopy system
13	8.2	0.008	0.5	High-sensitivity system
14	13.0	0.1	0.25	The same
15	18.0	0.09	0.01	Spectroscopy system
16	21.0	0.09	0.01	The same
17	31.0	0.05	0.13	High-sensitivity system

TABLE II. Flux Density Measurements

No.	λ, cm	Epoch 1979.5		Epoch 1980.0	
		date of observation	$F_f \pm \sigma_{F_f}$, Jy	date of observation	$F_f \pm \sigma_{F_f}$, Jy
1	1.38	19–20.V 1979	37±15	29–31.XII 1979	43.5±5
2	2.0	22–24.V	44±7		
3	2.08	19–20.V	44±6	29–31.XII	51.8±5
4	2.1	27–28.V	46.5±8		
5	2.3	22–24.V	44±5		
6	2.7	22–24.V	45.5±12		
7	3.2	22–24.V	50±4		
8	3.45	27–28.V	51±3		
9	3.9	19–20.V	50.2±2	29–31.XII	56.9±1.5
10	4,0	22–24.V	50.6±6		
11	4.5	22–24.V	53±7		
12	6.2	25.V	50.5±5		
13	8.2	19–20.V	43.9±1.5	29–31.XII	47.6±1.5
14	13.0	19–20.V	28.9±4	29–31.XII	29.4±5
15	18.0	28.V	17.4±7	16–17.II.1980	18.9±7
16	21.0	15.VII	13.5±7	4, 6, 12–14.II	15.3±5
17	31.0	19–20.V	17–6±3	29–31.XII 1979	8.8±3

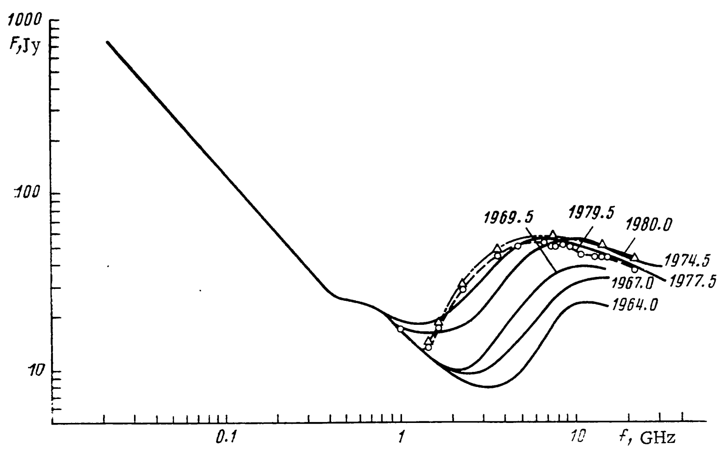

FIG. 1. The spectrum of the radio galaxy 3C 84 (NGC 1275) at several epochs. The RATAN-600 observations (dashed and dot-dash curves) were made at epochs 1979.5 and 1980.0, respectively. The earlier observations are those given in the summary by Preuss et al.[6]

at many different frequencies.

Observations. Table I summarizes the specifications of the radiometers used in the measurements reported here, while Table II gives the integrated flux density of the source 3C 84 at each frequency and at two different epoches, 1979.5 and 1980.0. These flux densities are plotted in Fig. 1. NGC 7027 was adopted as a reference source for the centimeter wavelength range,[4] and Cygnus A for decimeter wavelengths.[5] Although the flux density measurements have an absolute uncertainty of 5-10%, the large number of wavelengths employed permits the form of the spectrum to be determined considerably more accurately.

Discussion. The most striking result is that the high-frequency part of the spectrum very nearly conforms to the standard spectrum of a single source experiencing self-absorption, even though interferometric data reveal five features at centimeter wavelengths, all of about the

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same intensity. This circumstance has been interpreted by two of us[3] as evidence that the several optically thick components are separating at a low velocity. However, we would not rule out two other possible explanations: a) a single source may be undergoing gravitational fragmentation; b) an H II region may be modifying a source with a standard spectrum.

Another noteworthy property of this radio source is the rise in the power of the high-frequency component with time, a behavior previously reported by Preuss et al.[6] Our observations confirm that the energy of the particles and field in the source has been growing monotonically over the past 16 yr, at a rate of ≈15%/yr.

We would finally point out that at epoch 1979.5 the measurements at all wavelengths shorter than 3 cm exhibit a feature in the spectrum corresponding to the emergence of a new emitter whose flux contributes ≈7% of the integrated radiation of the nucleus in this wavelength range. Perhaps we have recorded the new feature that was detected[7] in 1.35-cm interferometry carried out in 1977. We intend to continue monitoring the spectrum of 3C 84 at numerous different wavelengths.

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The secular decrease in the 2924-MHz flux of Cassiopeia A

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(Submitted May 5, 1980)

Pis'ma Astron. Zh. 6, 620–622 (October 1980)

Measurements of the radio flux ratios of Cas A and Cyg A at 2924-MHz frequency obtained in September 1962 and in December 1979 imply that the Cas A radio flux is diminishing at an annual mean rate of (0.80±0.07)%. Comparison with measurements at lower frequencies confirms that in the centimeter–meter range the Cas A spectrum tends to become flatter with time.

PACS numbers: 98.40.Ne, 95.85.Dj

In an effort to study further how the secular decline in the radio flux of Cassiopeia A depends on frequency, measurements were made in December 1979 of the ratio of the radio flux densities of Cas A and Cygnus A at a frequency of 2924 MHz (λ = 10.25 cm). These measurements have been compared with absolute flux densities of Cas A and Cyg A determined at the Gor'kii Radiophysics Institute in September 1962 at the same frequency by one of us.[1] The results indicate that the annual mean decrease in the 2924-MHz flux of Cas A is (0.80 ± 0.07)%.

In 1962 the absolute measurements of S_{Cas} and S_{Cyg} were carried out with the RT-4, a 4-m radio telescope that was calibrated against the radio emission of a "black" disk. In 1979 the relative measurements of S_{Cas} were made with a 10-m antenna, the RT-10. Table I gives basic data on the two radio telescopes and the circumstances of observation.

On the whole, the measurement technique was much the same as we have used previously[2-4]: the radio emission of Cas A and Cyg A relative to reference fields was

TABLE I

	RT-4	RT-10
Epoch of measurement	1962.8	1979.95
Antenna diameter, m	4	10
Main lobe beamwidth,* $\theta_H \times \theta_E$	1°40′×1°40′	41′×51′
Transmission,* MHz	30	17
Fluctuation sensitivity threshold,** °K	0.1	0.2
Antenna temperature due to Cas A, °K	2	9
Polarization of radio emission	Horizontal	Horizontal

* At half-power level.
** For a 16-sec time constant.

0360-0327/80/05 0324-03 $02.00
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