X-RAY EMISSION FROM CENTAURUS A

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ABSTRACT: Observations of 3-12 keV X-ray emission from NGC 5128 (Cen A) were made by Vela spacecraft over the period 1969-1979. These data are in good agreement with previously reported data, but are much more complete. Numerous peaks of X-ray intensity occurred during the period 1973-1975, characterized by rapid increases and equally rapid decreases (in less than 10 days). Thus it seems probable that most of the X-ray flux from the nucleus of Cen A came from a single source of small size.

The two Vela 5 spacecraft launched in May 1969 were among the first to be capable of X-ray astronomy. Their collimated NaI detectors (6° FWHM) scanned the sky along a great circle as they rotated with a 64-second period, observing X-ray sources in the 3-12 keV range. The entire X-ray sky was surveyed every 56 hours, half of the orbital period. Reasonably complete data were thus obtained on many X-ray sources, until the last detector failed in June 1979. Among the sources observed were X-ray transients such as Cen XR-4 (Conner et al., 1969), X-ray bursts (Belian et al., 1976), and even gamma-ray bursts (Terrell et al., 1981).

Centaurus A (NGC 5128), the nearest active galaxy, was a relatively weak source in 1969, but from 1973 through 1975 its X-ray strength was much higher and showed considerable variability (Beall et al., 1978). The Vela 5 observations of Cen A during this period of peak activity are shown in Figure 1. The data are presented as 10-day averages, based on a weighted sum of all the observations within 8° of the source, corrected for background. Standard deviations shown represent counting statistics only, but systematic errors are believed to be small. The data in Figure 1 are new and have been obtained from a complete reprocessing of the Vela 5B data. Where other observations have been reported the agreement is very good. The sudden increase by a factor of 1.6 reported by Winkler and White (1975) may be seen around April 9, 1973. It was followed by a further large increase and then by a precipitous decline, by a factor of almost 3, to a very low level in June 1973. Other peak fluxes were attained in January 1974, January 1975, and June 1975. Often the increases and decreases in X-ray flux occurred in 10 days or less.

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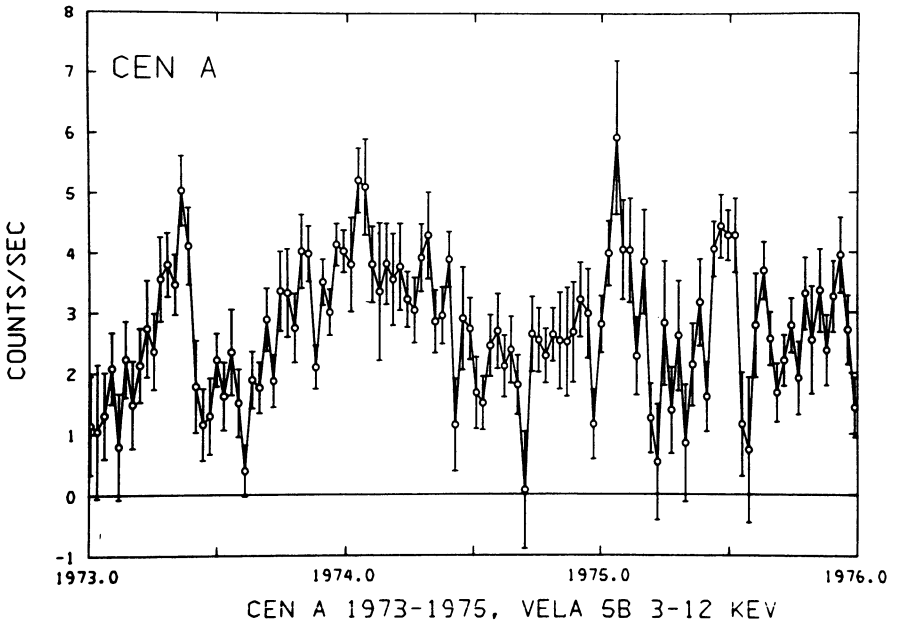

Fig. 1. Cen A 3-12 keV X-ray flux, 1973-1975 (Vela 5B, 10-day averages)

The counting rates in this graph may be converted to energy received in the 3-12 keV range by means of the factor 2.8×10^{-10} ergs/count. For NGC 5128, each count/sec represents $\sim 10^{42}$ ergs/sec emitted by the galaxy, so that the X-ray source was very intense, and doubtless very massive. The large amplitude and short time scale of the fluctuations suggest that most of the X-ray flux came from a single source of size at most a few light-days. It has been proposed that the nucleus of Cen A is a massive condensation ejecting matter at relativistic speeds, in order to account for the immense radio power emitted from regions much further out in the galaxy (Hoyle and Fowler, 1963; Terrell, 1966, 1967, 1975). The X-ray fluctuations reported here give some support to the idea of a massive, condensed, and active galactic nucleus in NGC 5128.

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REFERENCES:

Beall,J.H., et al.: 1978,Ap.J.219,pp.836-844.
Belian,R.D., Conner, J.P., and Evans,W.D.: 1976,Ap.J.206,pp.L135-L138.
Conner,J.P., Evans,W.D., and Belian,R.D.: 1969,Ap.J.157,pp.L157-L159.
Hoyle,F., and Fowler,W.A.: 1963, Nature 197,pp.533-535.
Terrell,J.: 1966,Science 154,pp.1281-1288.
Terrell,J.: 1967,Science 156,p.265.
Terrell,J.: 1975,Nature 258,pp.132-133.
Terrell,J.,Fenimore,E.E.,Klebesadel,R.W.,and Desai,U.D.:1981,Ap.J.,subm.
Winkler,P.F., and White,A.E.: 1975,Ap.J.199,pp.L139-L142.