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Optical Periodicity Analysis of 3C 446 using Period04

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Abstract. All the data of the blazar 3C446 at 8, 4.8, 14 and 22 GHz, presented in publications from 1977 to 2006, have been compiled to generate light curves. The light curves show violent activity of 3C446. Using Period04 analysis method, we have found that there is a period of 7.2 yr, which is consistent with the results that we found using wavelet analysis method. We get the instability region as $r = 123.83 r_g$.

Key words. Blazar 3C446—Period04—Fu Liye transform—radio flux.

1. Introduction

Blazar is a subclass of active galactic nuclei which emits non-thermal radiation and shows large amplitude flux variation on all possible time scales. Studies on the characteristics of long period yield its orbit and rotation characteristics. The methods mainly used are the structure function method, the method of wavelet analysis, discrete correlation function method, Jurkevich and power spectrum (Zhang *et al.* 1998; Jurkevich 1971; Zhang *et al.* 2000). There are some limitations in these methods. Period04 (Stellingwerf 1978) is a specialized package which can process interrupted time series data. It can extract the cycle of an intermittent information data. There is a very convenient interactive interface to fit periodically. We collected the effective data points of the analysis from literature. We drew the light curve of 3C446. There is an intense change in 3C446 as is evident from the curve.

2. Observation data and results

We analyse the data of 3C446 using Period04. Based on Breger *et al.* (1993), we considered the period which has a signal-to-noise ratio not <4. Therefore, we selected the frequency as shown in Table 1 to calculate the period. We got the period as 7.02, 7.2, 7.0, 6.84 yr of 8, 4.8, 14, 22 GHz. We derived the period as 7.2 yr of 3C446, which is a very useful result. According to this period, we can get the thermal instability area. We use the formula from Wallinder *et al.* (1992): $p - 3.2 \times 10^{-4} \alpha_{\rm visc}^{-1} [x^{0.5}(x-1) M_8]$, where $x = r/r_g$ is the thermal instability, M_8 is the centre mass of the black hole, and $\alpha_{\rm visc} = 0.5$, from the literature (Xie *et al.* 2004).

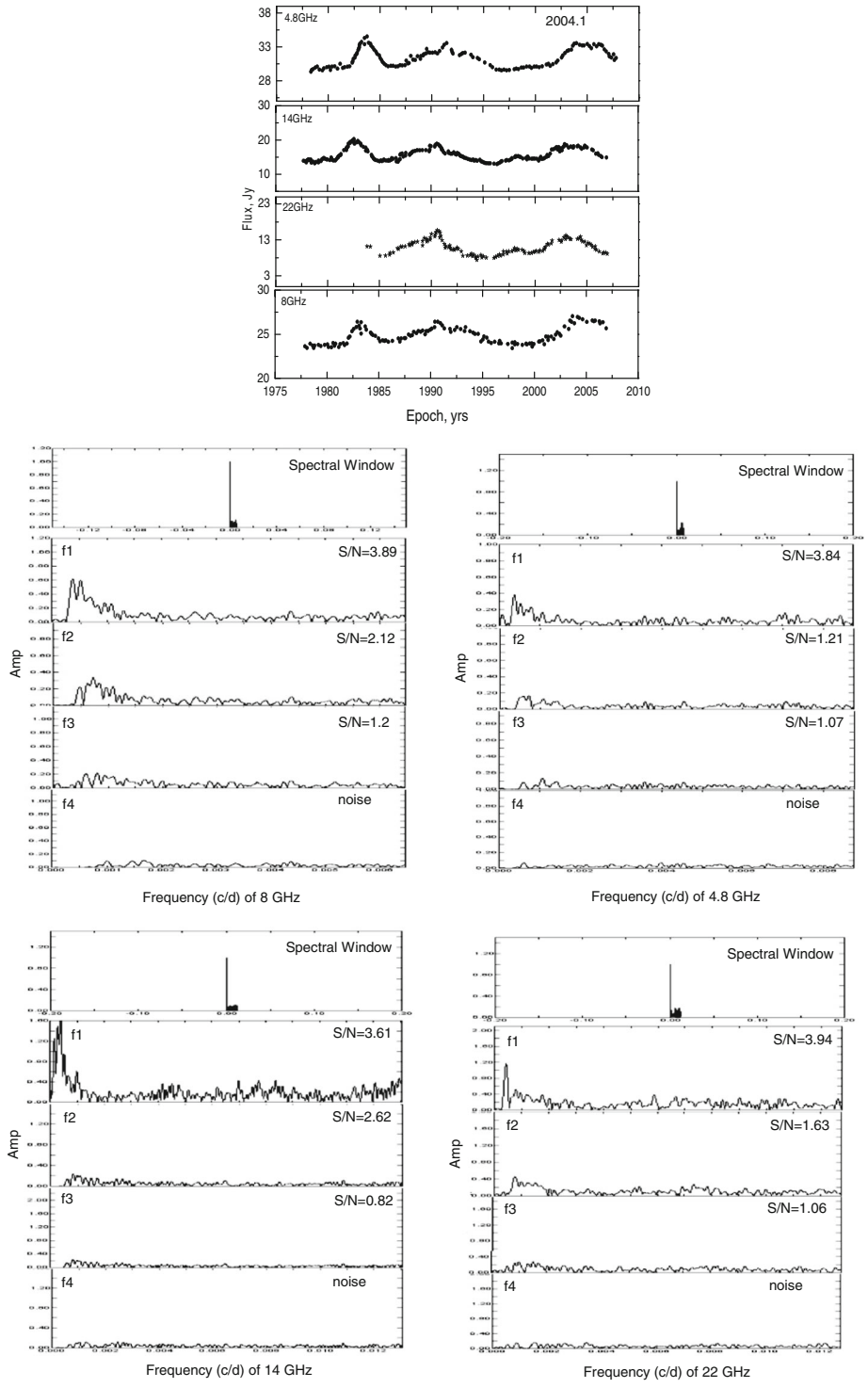

Figure 1. The light curve and the spectrum of 3C446 in 8, 4.8, 14 and 22 GHz the radio flux.

Table 1. Results in 8, 4.8, 14 and 22 GHz of 3C446.

Wave	Frequency (c/d)	Amplitude (mag)	S/N	Period (yr)
8 GHz	0.0003898	0.6208	3.89	7.02
4.8 GHz	0.0003726	0.3842	3.84	7.2
14 GHz	0.0003839	1.6557	3.61	7.0
22 GHz	0.0004079	1.1714	3.94	6.84

We got the centre mass of the black hole as $1 \times 10^{7.9} M_{\odot}$. Then, we get the instability region as $r = 123.83 r_{\mathrm{g}}$ (Fig. 1).

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