DYNAMIC SPECTRA OF LOW-FREQUENCY VARIABLES +

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A wide range of models have been proposed to account for low-frequency ($\lesssim$ 1 GHz) variability in cosmologically-distant radio sources. To address these models we (Payne et al. 1982) are monitoring the 0.3-1.4 GHz spectra of such sources. Results from three years of monitoring indicate that two distinct types of low-frequency variables may exist.

The first, and rarer, type is that exemplified by AO 0235+16. For both outbursts seen (Fig. 1), it appears that the amplitude was greatest at 1.4 GHz, with a decaying, and probably delayed, amplitude at lower frequencies. These characteristics and the time-dependent spectra (Fig. 2) suggest that the variations in AO 0235+16 result from relativistically moving clouds. The only other similar low-frequency variable is BL Lac (Aller and Aller 1982, Fanti et al. 1983). It is of considerable importance to determine whether variations of this type are characteristic of BL Lac objects in general.

Most low-frequency variables, however, exhibit time variable spectra of a decidedly different nature. We illustrate this with the case of 1611+34 (DA 406) which has undergone a fairly dramatic variation at low-frequencies (Fig. 3). From the lack of a large increase at 0.9 and 1.4 GHz, it is straightforward to show that if this event is a synchrotron outburst, then the causative particles must have an exceedingly steep spectrum above energies corresponding to 0.6 GHz (Cotton and Spangler 1979). Most interesting is the spectral evolution during the flux increase (Fig. 4). The dynamic spectra are not indicative of simple evolution of expanding synchrotron components, rather the spectra seem to suggest that major changes in opacity may be occurring. The spectral turn-up around ~0.3 GHz could be due to the larger size of the emitting region exceeding the opaque portion of the source. Qualitatively similar spectra are observed in other low-frequency variables. We are currently exploring theoretical models involving opacity changes.

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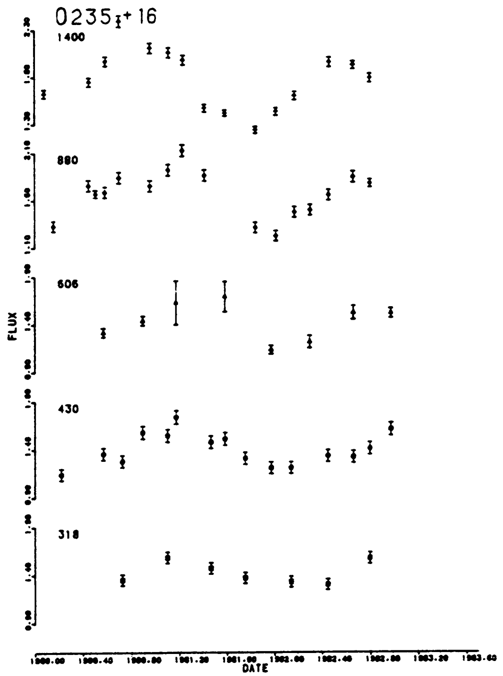

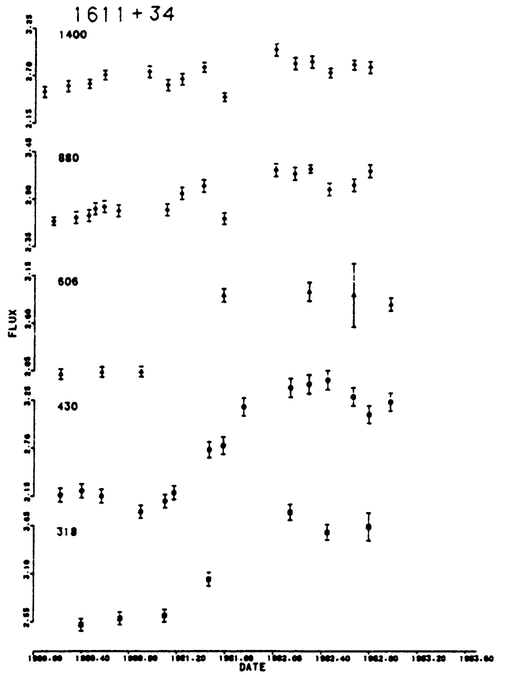

Fig. 1 - Light Curves of AO 0235+16. Fig. 3 - Light Curves of DA 406.

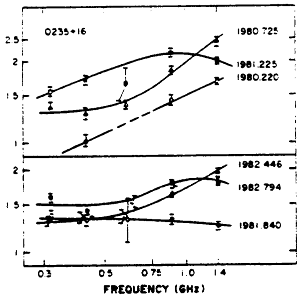

Fig. 3 - Dynamic Spectra of AO 0235+16.

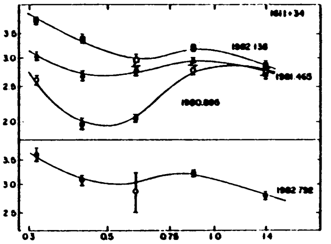

Fig. 4 - Dynamic Spectra of DA 406.

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