ENERGY DISTRIBUTION AND VARIABILITY OF BL LAC OBJECTS. THE CASES OF PKS 2155-304 AND 3C 66A.

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PKS 2155-304 was repeatedly observed in 1979 and 1980 with the International Ultraviolet Explorer. Variations up to a factor of 2 in one year and by 20% in a day are found. The maximum amplitude of variation in X-rays is similar but the timescales are much shorter (a factor of 2 in one day; Urry and Mushotzky, 1982). In all cases the 1200-3100 A continuum is well fitted by a power law with frequency spectral index α_{UV} between -0.7±0.03 and -0.9±0.03. Optical and ultraviolet observations taken within one day show different spectral slopes (Fig. 1). Separate power law fits in the two bands yield $\alpha_{opt} = -0.46\pm0.01$ and $\alpha_{UV} = -0.80\pm0.02$. The observations by Urry and Mushotzky indicate that the energy distribution steepens further in the soft X-ray region.

3C 66A is characterized by violent X-ray activity, its intensity varying by a factor of 10 with time-scale shorter than 6 months, possibly uncorrelated with optical variations (Fig. 2). An ultraviolet spectrum taken in 1981 August shows a featureless continuum which is best-fitted by a power law with $\alpha_{UV} = -1.79\pm0.03$, steeper than that derived from (non-simultaneous) infrared photometry, thus suggesting a special "break" in the region $10^{14} - 10^{15}$ Hz. The X-rays measured during the maximum intensity peak exhibit a spectral slope similar to the UV continuum, although lying a factor of 100 above its extrapolation (Fig. 3). There is an indication of a spectral steepening when the X-ray flux is low.

Two points should be stressed: i) The interpretation of the observed steepening at $10^{14} - 10^{15}$ Hz as due to radiative losses implies radiative lifetimes much shorter than the variability time-scale in the optical-UV band. Allowing for relativistic motion introduces a dependence of the break frequency, calculated as in Maraschi et al (1980) on δ^5 where δ is the usual Doppler factor (Konigl, 1981). High values of δ ($25<\delta<10$ for PKS 2155-304 and $\delta\simeq40$ for 3C 66A) can obviate the above difficulty. However, it is intriguing that the spectral feature under discussion occurs at a frequency similar to that of the so-called 3000 A bump in QSOs.
ii) Variability in the optical and ultraviolet is much smaller than in the X-rays over comparable time-scales, indicating that the emission regions and/or mechanisms in the two frequency ranges are not strictly related.

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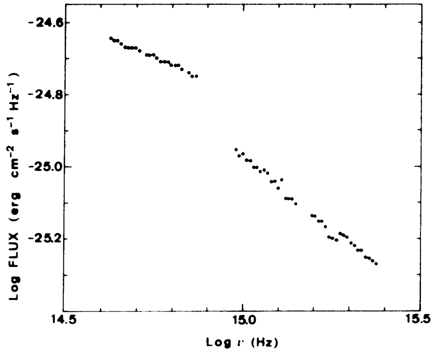

Fig. 1 - Ultraviolet and optical observations of PKS 2155-304, taken one day apart (on November 14 and 15, 1979, respectively).

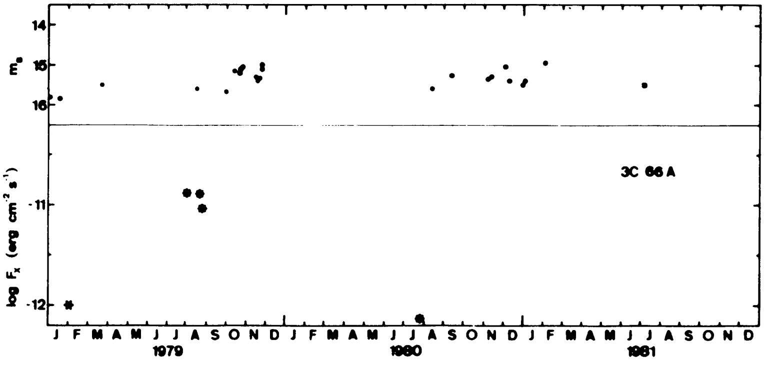

Fig. 2 - Light curve of 3C 66A in the X-rays (lower panel) and in the B passband (upper panel) (Barbieri, private communication; Pica, private communication).

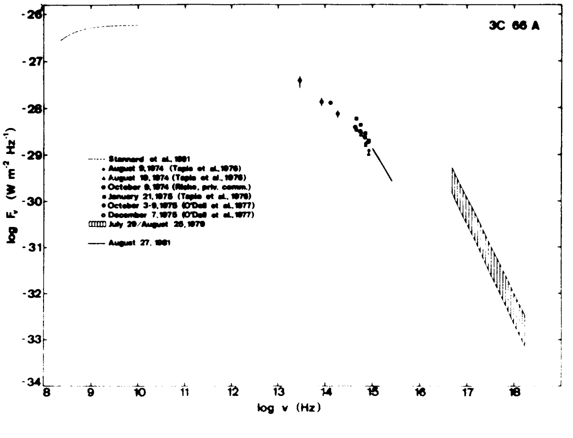

Fig. 3 - Overall energy distribution of 3C 66A obtained combining non simultaneous observations. The X-ray spectrum refers to the highest state recorded during our observations.