OPTICAL VARIABILITY OF FAINT QSOS AND AGNS

D. TRÈVESE
Istituto Astronomico, Universitá di Roma "La Sapienza",
Via G. M. Lancisi 29, I-00161 Roma (Italy)

and

R. G. KRON
Fermi National Accelerator Laboratory,
MS 127, Box 500, Batavia, Illinois 60510, USA

We report some results of a new analysis (Trèvese et al. 1993, ApJ (submitted) (T93)) of the variability of the faint QSO sample of SA57 (Koo, Kron and Cudworth, 1986, PASP, **98**, 285), concerning the intrinsic time scales of variability and the dependence of the amplitude of variability on absolute magnitude and redshift. Prime focus plates of SA57 have been obtained with the Mayall 4-m telescope at the Kitt Peak National Observatory since 1974. The present analysis is based on 14 B_J plates spanning 15 years at 11 independent epochs. The digitization, object selection, image classification and photometry are described in Koo (1986, ApJ, **311**, 651) and Trèvese et al. (1989, AJ, **98**, 108 (T89)). The magnitude limit of the sample is $B_J = 22.5$ and stellar objects are selected with a threshold in image size. This criteria give a sample of 694 objects in the field, 34 of which are QSOs whose spectra have been measured with the Mayall 4-m telescope. The r.m.s. error in the B_J band is 0.05 mag at $B_J \approx 22$ mag. All but one of these QSOs appear to be variable according to T93. From the light curves of the individual QSOs is possible to derive an ensemble statistics defining the first order *structure function* : $S^2(\tau) \equiv \langle [m(t+\tau) - m(t)]^2 \rangle$, where $m(t)$ is the magnitude at the epoch t, τ is the time lag and the angular brackets indicate the ensemble average, over the 34 QSOs in the present case. In the rest-frame, a fit of the structure function with the function: $S^2(\tau) = A \times [1 - exp(-\tau/T)] + 2\sigma_n^2$, σ_n being the r.m.s noise, gives $A \approx 0.2$ mag ^{2} and $T \approx 1$ year. The *ensemble autocorrelation function* $C(\tau)$ of our sample is negative from $\tau \approx 1$ year up to $\tau \approx 6$ years. This anticorrelation means that the variability occurs on characteristic time scales up to ≈ 6 years (see T93). Splitting the sample in low/high redshift halves and low/high luminosity halves we obtain that the amplitude of variability : a) increases for increasing redshift, b) decreases for increasing luminosity. The fact that higher redshift objects appear more variable than low redshift ones could be due, at least in part, to an observational bias deriving from spectral variability. In fact, the observing wavelength corresponds to shorter rest frame wavelengths at higher redshifts and this implies a larger variability if luminosity changes are larger, on average, at shorter intrinsic wavelengths. The fact that fainter objects appear more variable than brighter ones could support the notion that the variability of brighter objects is produced by uncorrelated varying subunits.

T. J.-L. Courvoisier and A. Blecha: Multi-Wavelength Continuum Emission of AGN, 412.
© 1994 *IAU. Printed in the Netherlands.*

https://doi.org/10.1017/S0074180900176004 Published online by Cambridge University Press