8.3.1 : QSO-Star Comparisons and the Variability Cutoff

In figure 8-2 we compare the variations in QSO light curves against the light curves derived for the comparison stars. The upper-left graph in figure 8-2 shows the weighted root-mean-square of the light curves points for 83 QSOs and 552 comparison stars. The points are stars, the open squares are optically selected QSOs, and the open triangles are radio selected QSOs. The values are plotted against the median within each light curve value of the calculated error for each QSO or star. The dotted line indicates a RMS value twice the median calculated error. This is a rough variability criterion in the sense that all QSOs above this line, 34% (28/83), may be variable. For comparison, 31% (26/83) of these QSOs have $\log(P)<-3$. One QSO (UM 253,0029+0017) with large variability is indicated with a square and an arrow.

In our unevenly time sampled data base, the root-mean-square values are highly dependent on the number and the distribution of points in time. A somewhat better measure of variability is the maximum deviation, i.e. the faintest magnitude on a given light curve minus the brightest magnitude. The top right graph of figure 8-2 shows the maximum deviations for the stars and QSOs versus median calculated error. Here, we draw the approximate cutoff for variability as a dotted line corresponding to 5.5 times the median error; 34% (28/83) of the QSOs and 4% (23/552) of the stars are above this line.

Note that there appears to be no "significant" difference in variability between the radio selected and optically selected samples. This is consistent with other studies of QSO variability (*cf.* Smith et al. 1991). It is probable that variability in OVV or BL Lac objects (with relativistically beamed synchrotron emission) with variations of $\gtrsim 1$ mag on timescales of days or weeks, represents a different phenomenon than the variability observed in the majority of QSOs with variations of $\sim$0.3 mag on timescales of months or years (*cf.* Giallongo *et al.* 1991). The historical perception of the connection between radio-loud objects and variability may simply result from the correlation of the OVV phenomenon and radio brightness.