A MILLIMETRE/SUBMILLIMETRE STUDY[+] OF OPTICALLY SELECTED QUASARS

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During the past decade many kinds of optical surveys have discovered hundreds of quasars most of which (~90 %) are radio quiet (<10 mJy at 5 GHz). We have observed two samples of quasars brighter than $17^m.6$ found by their emission lines and by their ultraviolet excess. We have also selected quasars with redshifts known to be greater than 3.00. A brief description of the observing technique is given by Sherwood et al. (1981b). We have compared our millimetre photometry of flat radio spectrum quasars with that of Ennis and Werner and find excellent agreement. For four of the 8 sources in common the data have been published: Kreysa et al. (1980) and Jones et al. (1981). In addition, analysis of our "noise" shows it to be white, gaussian distributed about zero. The three samples are summarized as follows.

1. Osmer and Smith (1980) published a list of 125 confirmed quasars discovered on objective prism plates. For our study the sole selection criterion was that the magnitude be brighter than $17^m.6$. There are 17 optically discovered quasars in our sample and all have now been detected. Q0420-388 was detected in September 1979 and confirmed in July 1980 and 1981 (Sherwood et al. 1981b). Twelve other quasars were detected in July 1980 and confirmed in 1981. Only 6 of the 17 are known to be radio sources (Smith and Wright, 1980; Condon et al., 1981; Sherwood et al. 1981a). If we compare the excess in the number of positive pairs (see Sherwood et al. 1981b) over the natural uncertainty in the total number of measurements as an indication of the "quality" of the detections then this sample has been detected in the mean at the 15-sigma level corresponding to a flux density of 3 Jy.
2. Green (1976), and Green and Schmidt (1978) have published a list of confirmed quasars having ultraviolet excess found in the Palomar-Green survey. All are brighter than $17^m.6$. From ESO, La Silla, we measured the 5 with $\delta < +10^o$ plus IIIZw2 and PG0026+129. Although 4 are radio sources only two were detected for certain at 1 mm: IIIZw2 and PKS1302-102. The quality of the sample on average is only

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3-sigma corresponding to an average flux density of 0.7 Jy.

3. It can be seen by comparing samples 1.) and 2.) that apparent magnitude is not the key to detecting optically discovered quasars. The third sample tests the idea that the luminosity is important: with complete disregard for apparent magnitude we tried to observe (at least twice) as many quasars with Z > 3.00 as we could from ESO. The sources were taken from Osmer and Smith (1980): 6 including 4 radio sources from sample 1; Hoag and Smith (1977): 2; and from Parkes - Jauncey et al. (1978) and Wright et al. (1978). The total is 10 - all detected; 6 are radio sources. Seven were observed at 2 epochs and of these only 1 was detected only at 1 epoch. Examples of these objects may be seen in Sherwood (1981) and Sherwood et al. (1981a). This high luminosity sample is detected, on the average, at ∿8.5 sigma corresponding to an average flux density of 1.9 Jy.

Conclusions

1) Among optically selected ($m \leq 17^m.5$) QSOs (most of which are radio quiet) there are certainly some quasars with strong millimetre wave emission: S(300 GHz) ∿ 1-10 Jy.
2) They have inverted spectra with respect to the radio spectrum.
3) If synchrotron theory is applicable then they are compact sources 10^{-5} to 10^{-6} arc sec. in diameter with an absorbed spectrum below 300 GHz.
4) The probability of detecting an optically selected quasar at 1 mm increases with luminosity.
5) There is evidence for variability.
6) Where X-ray data is available (but not simultaneously observed) the millimetre to X-ray luminosity ratio is ≥ 1.

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