VLA OBSERVATIONS OF THE PALOMAR BRIGHT QUASAR SURVEY

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Green and Schmidt (Green 1976, and in preparation) have optically surveyed some 10000 square degrees of the northern sky to search for bright quasars. Their final sample contains about 100 quasars. The B magnitudes of the sample range from 13.1 to 16.5, with most in the range 15.0-16.2. The redshifts range from 0.03 to over 2, considerably concentrated toward smaller values (median of 0.18).

We observed 94 of these quasars with the partially complete VLA in November/December 1979, and detected radio emission from 27 of them, or 29%, to a limit of 1-2 mJy. Our succes rate is considerably higher than in most previous surveys, which typically detected about 10% of the observed quasars (Smith and Wright 1980; Sramek and Weedman 1980). Our detection percentage is comparable to that in the smaller sample studied by Condon et al. (1981) and the brightest quasars in Smith and Wright's sample: about 35%. (there is some overlap between our sample and that of Condon et al.) We conclude that bright quasars are definitely more likely to be detectable radio sources.

Some 15 (or 16%) of the sample were already known to be radio sources, including five 3C sources and several 4C and Parkes sources. The number and strength of the previously known sources emphasizes one result from other quasar radio surveys: the detected sources are generally quite strong and the detection percentage goes up very slowly as the sensitivity is increased. Only 6 of our detections were weaker than 10 mJy.

The shape of our integral source count curve is essentially the same as that of Strittmatter et al.(1980): a steep rise (slope about -1.5) for the few strongest sources, with a knee around 500 mJy below which the slope is exceedingly flat, -0.2 or less. Such source counts are difficult

D. S. Heeschen and C. M. Wade (eds.), Extragalactic Radio Sources, 367–368.

to reconcile with the prediction of Scheuer and Readhead's (1979) beaming model for quasar radio emission, as discussed by Strittmatter et al. The extended structure of many of our sources also argues against the beaming hypothesis. We found at least 2/3 of the quasars to be discernibly resolved at 1" resolution. Many of them are classical double and triple sources, a few have a bright radio nucleus with one-sided extended emission ("class D2" quasars), and a few are only slightly resolved. All but one of the extended sources have a radio core coincident with the optical quasar. This high incidence of extended structure, which is most prominent in sources with the highest ratio of radio to optical luminosity, with prominent cores is very difficult to reconcile with beaming theories. Additionally, the source counts for the extended structures and radio cores have essentially the same shape as noted above for the total counts. This indicates similar over-all behaviour of radio luminosity for both cores and extended emission, contrary to core enhacement/reduction that depends on fortuitous alignment.

Although our sample and those of Condon et al. and Smith and Wright indicate a much higher (about three times) probability of detection of radio emission from bright quasars, we see little evidence of a strong correlation with apparent magnitude within our sample. We detect 3 of the 4 brightest quasars, but the next detection is for brightness rank #15. If we divide our sample into quarters, the detection rate in the first 3 quarters is essentially the same (32%), while the rate in the last quartile is rather lower (17%). The difference is about 2 sigma. Condon et al. and Smith and Wright find a similarly high detection rate down to B about 17.5, or about one magnitude fainter than our sample. There must, however, be a change in the ratio of radio to optical luminosity as one goes to still fainter quasars. Otherwise, there would be higher detection rates for fainter, optically selected samples since many of the bright quasars have radio luminosities such that they would be easily detectable if they were several magnitudes fainter.

Detectability and absolute optical luminosity are strongly correlated within our sample. In the most luminous quartile, the detection rate is 35%, in the second quartile the rate is almost 60% (13 of 23). The weakest half of the sample contains only 6 radio sources (out of 47 quasars, or 13%). The strong correlation between luminosity and detectability partially accounts for the enhanced probability of radio emission from bright sources.

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