# Polarization Limits in Compact Symmetric Objects

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We present results of multifrequency polarimetric VLBA observations of 34 compact radio sources. The observations are part of a large survey undertaken to identify CSOs Observed in the Northern Sky (COINS). Based on VLBI continuum surveys of ∼2000 compact radio sources, we have defined a sample of 52 CSOs and CSO candidates. Positive identification of CSOs is contingent upon acquiring multi-frequency observations in order to correctly identify the core of the source, which is expected to have a strongly inverted spectrum. We also expect CSOs to exhibit very little polarized flux. Despite the fact that synchrotron emission is intrinsically highly polarized, less than 0.5% fractional polarization is seen in low resolution studies of CSOs at frequencies up to 5 GHz. One possible explanation for the low observed linear polarization from CSOs is that their radiation is depolarized as it passes through a magnetized plasma associated with a circumnuclear torus. This interpretation is consistent with the unified scheme of AGN, and also with the recent detections of free-free and H I absorption in CSOs.

Here we present limits on the polarized flux density at 8.4 GHz and ∼1 mas resolution for 21 CSOs and candidates in the COINS sample.

## 1. Introduction

The 34 sources in this sample were initially selected from the VLBA Calibrator Survey. The total and polarized flux densities at 8 GHz of the 21 sources which are considered to be CSOs (or remain CSO candidates pending identification of the core) are shown in Table 1. None of these sources exhibit any significant polarization, with upper limits ranging from 0.3% to 1.6%.

The fluxes of the sources which were rejected from the CSO list based on morphology at 1.6, 5, 8 and/or 15 GHz and the spectral indices of the components, as well as continuum images of all sources, can be found in Peck & Taylor (2000). Five of the 13 rejected sources exhibit measurable polarized emission at 8.4 GHz.

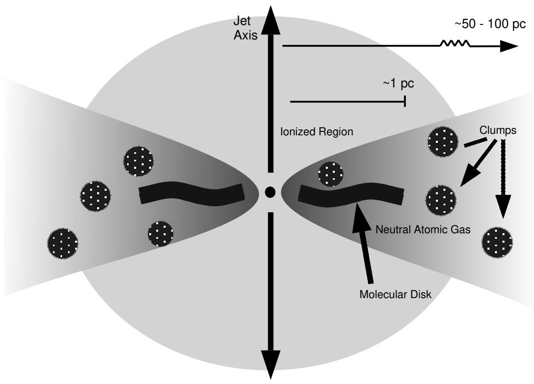


FIGURE 1. A cartoon model of the central parsecs of a CSO.

| Source Name | RA (J2000) | Dec (J2000) | Opt. ID | $S_{8.4}$ (mJy) | $P_{8.4}$ (mJy) |
|---|---|---|---|---|---|
| J0000+4054 | 00 00 53.0815 | 40 54 01.806 | G | 237.8 | <1.2 |
| J0003+4807 | 00 03 46.0413 | 48 07 04.134 | ... | 80.6 | <0.9 |
| J0132+5620 | 01 32 20.4503 | 56 20 40.372 | ... | 291.1 | <0.9 |
| J0204+0903 | 02 04 34.7589 | 09 03 49.248 | ... | 316.9 | <1.2 |
| J0332+6753 | 03 32 59.5241 | 67 53 03.860 | ... | ... | ... |
| J0427+4133 | 04 27 46.0455 | 41 33 01.091 | ... | 650.3 | <0.9 |
| J0518+4730 | 05 18 12.0899 | 47 30 55.536 | ... | 344.8 | <0.7 |
| J0620+2102 | 06 20 19.5286 | 21 02 29.501 | ... | 226.1 | <0.9 |
| J0754+5324 | 07 54 15.2177 | 53 24 56.450 | ... | 73.8 | <1.2 |
| J1111+1955 | 11 11 20.0694 | 19 55 35.950 | G | 224.7 | <0.9 |
| J1143+1834 | 11 43 26.0706 | 18 34 38.375 | ... | 233.9 | <0.6 |
| J1311+1417 | 13 11 07.8250 | 14 17 46.659 | QSO | 250.9 | <0.9 |
| J1311+1658 | 13 11 23.8204 | 16 58 44.213 | ... | 244.3 | <1.2 |
| J1414+4554 | 14 14 14.8526 | 45 54 48.730 | G | 76.1 | <1.2 |
| J1415+1320 | 14 15 58.8188 | 13 20 23.714 | QSO | 1426.4 | <4.5 |
| J1546+0026 | 15 46 09.5312 | 00 26 24.615 | G | 536.0 | <0.9 |
| J1734+0926 | 17 34 58.3773 | 09 26 58.274 | G | 401.2 | <1.2 |
| J1816+3457 | 18 16 23.8987 | 34 57 45.729 | G | 272.7 | <1.2 |
| J1826+1831 | 18 26 17.7118 | 18 31 52.915 | ... | 146.5 | <1.5 |
| J2203+1007 | 22 03 30.9534 | 10 07 42.584 | ... | 172.7 | <1.2 |
| J2245+0324 | 22 45 28.2846 | 03 24 08.863 | QSO | 390.3 | <1.2 |

TABLE 1. CSOs and CSO candidates in the COINS sample

## 2. Discussion

Figure 1 depicts a cartoon of the possible environment in the central parsecs of a CSO or other compact AGN. This model is based on the unified scheme, and on recent H I and free-free absorption studies (*e.g.* Peck, Taylor & Conway 1999). Some notable simplifications have been made for this figure. For example, it is not necessary for the toroidal structure to be perpendicular to the jet axis, the "clumps" of denser gas are unlikely to be uniform in size, and it is believed that the degree of warp in the disk can vary greatly. One possible explanation for the low observed levels of linear polarization from CSOs is that our line of sight to the jet components in these sources passes through a magnetized plasma associated with this torus. In order to depolarize the radio emission within our 8 MHz IF at 8.4 GHz the Faraday rotation measures could be larger than $5\times10^5$ radians m$^{-2}$, or alternatively the magnetic fields in the torus could be tangled on scales smaller than the telescope beam of $\sim$1 mas to produce gradients of 1000 radians m$^{-2}$ mas$^{-1}$ or more.

REFERENCES

PECK, A. B. & TAYLOR, G. B. 2000, ApJ **534**, 90.

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