

## Seyfert 2 Galaxies with Spectropolarimetric Observations

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**Abstract.** We compare Seyfert 2 galaxies (Sy2s) with detected polarized broad emission lines (PBL) with Sy2s without detected PBL and find that the majority of Sy2s without PBL are those sources with less powerful AGN activity, most likely caused by low accretion rates. This implies that the detectability of polarized broad emission lines in Sy2s mainly depends on their central AGN activity in most cases. We also find that Sy2s without PBL follow the exactly same FIR-radio relation as normal and starburst galaxies.

### 1. Introduction

In the scheme of the standard unification model, Seyfert 1 and 2 galaxies (Sy1s and Sy2s hereafter) are intrinsically the same objects and the absence of broad emission lines in Sy2s is ascribed to the obscuration by a pc-scale dusty torus oriented along the line of sight (see the review by Antonucci 1993). However, recent investigations suggest that this strictest version of unification model needs modifications. Among these are, for example, the outflowing wind model (Elvis 2000), and the existence of two intrinsically different populations of Sy2s – the hidden Sy1 and the “real” Sy2 with a weak or absent Sy1 nucleus – based on a spectropolarimetric survey of the CfA and  $12\mu\text{m}$  samples of Seyfert 2 galaxies (Tran 2001). Here we present our preliminary results of the study of Seyfert 2 galaxies with spectropolarimetric observations.

### 2. Results

We collect the multiwavelength data (radio, infrared, optical and X-ray) for a large sample of Seyfert 2 galaxies with available spectropolarimetric observation (including 41 Sy2s with detected PBL and 49 without detected PBL). As we know that  $[\text{O III}]\lambda 5007$ , infrared and hard X-ray (2-10keV) continua are good indicators of the intrinsic nuclear luminosity for Seyfert galaxies. We find that the mean absorption-corrected X-ray luminosity in the 2-10keV energy band for Sy2s with PBL,  $L_{2-10\text{keV}}^c \sim 10^{43} \text{ erg s}^{-1}$ , is the typical X-ray luminosity for Seyfert 1 galaxies, the mean  $L_{2-10\text{keV}}^c$  for Sy2s without PBL, on the contrary, is nearly 2 orders of magnitude smaller, as illustrated in Fig. 1a.

It is well known that a tight correlation exists between radio and far-infrared emission for normal, starburst and Seyfert galaxies (the latter with larger scatter) (Helou et al., 1985). In Fig. 1b, we plot such correlation for our Sy2s sample,

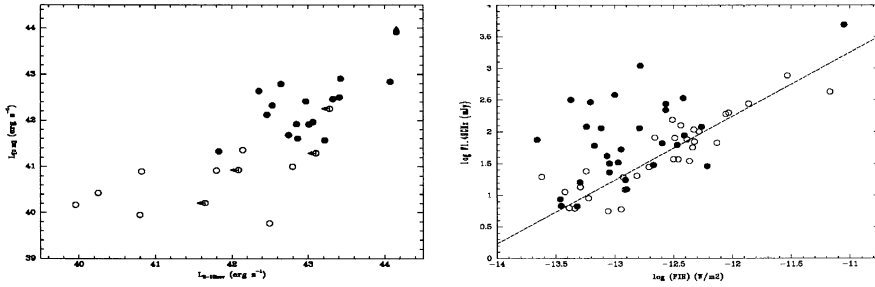


Figure 1. **Left:** Distribution of absorption-corrected 2-10keV luminosities against extinction-corrected [O III] luminosities for Compton-thin Seyfert 2 galaxies, where Sy2s with PBL are shown with filled circles and Sy2s without PBL as open circles. **Right:** Correlation between far infrared and radio 1.49 GHz fluxes for Seyfert 2 galaxies. The dashed lines the best fit to Seyfert 2 galaxies without detection of PBL, which is also the fit to the normal galaxies from Helou et al. (1985).

and we also plot the fit (dashed line) for normal galaxies (from Helou et al. 1985). It is very interesting to note that Sy2s without PBL following the exact same correlation as the normal ones, which is  $F_{1.49\text{GHz}} = (1.006 \pm 0.107) * \text{FIR} + 14.323 \pm 1.339$ , where  $\text{FIR} = 1.26 \times 10^{-14} (2.58 \times f_{60\mu\text{m}} + f_{100\mu\text{m}})$ , while most of Sy2s with PBL show radio excess.

### 3. Conclusions

We collect the multiwavelength data for 90 Seyfert 2 galaxies with spectropolarimetric observation. Compared to Sy2s without PBL, Sy2s with PBL show warmer mid-infrared colors and significant excess of emission (including the hard X-ray(2-10keV), [O III] $\lambda$ 5007, infrared (25  $\mu\text{m}$ ) and radio 1.49GHz). Our analyses indicate that the majority of Sy2s without PBL are those sources with less powerful AGN activity, most likely caused by low accretion rates. This implies that the detectability of polarized broad emission lines in Sy2s mainly depends on their central AGN activity in most cases. Due to the limitation of our sample selection (heterogeneous with different spectropolarimetric sensitivities), it is impossible to interpret our statistical results in the context of testing the unified model for AGN.

### References

- Antonucci, R. 1993, ARA&A, 31, 473
- Elvis, M. 2000, ApJ, 545, 63
- Helou, G., Soifer B. T. & Rowan-Robinson M. 1985, ApJ, 298, L7
- Tran, H. D. 2001, ApJ, 554, L19