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# Bolometric Luminosity Correction of $H_2O$ Maser AGNs

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**Abstract.** For the $H_2O$ maser host AGN sample, we derived their bolometric luminosity corrections, based on their X-ray data and [O III] emission line luminosities. Our results for maser AGNs is comparable to that of non-maser AGNs.

*Key words.* Masers—active galaxies nuclei—bolometric correction.

## 1. Introduction

As a special subsample of AGN, $H_2O$ maser AGNs are always heavily obscured (Zhang *et al.* 2006). So their AGN intrinsic bolometric luminosities $L_\mathrm{b}$ is difficult to be measured directly. It can generally be estimated with the bolometric correction, which is the ratio between the AGN intrinsic bolometric luminosity and a given band luminosity. Here the bolometric correction of maser host AGNs is estimated, using their X-ray and [O III] line luminosities.

## 2. Sample and analysis

For all $H_2O$ maser sources, we collected their extinction-correction [O III] line and the intrinsic X-ray luminosities (Table 1). Applying the luminosity-dependent relation, $\log[L_\mathrm{b}/L_X] = 1.54 + 0.24£ + 0.012£^2 - 0.0015£^3$, where $£ = (\log L_\mathrm{b} - 12)$ and $L_\mathrm{b}$ is in units of $L_\odot$ (Marconi *et al.* 2004), we calculated the X-ray bolometric correction $C_X$ ($C_X = L_\mathrm{b}/L_X$) for our maser host AGN sample. For AGN with luminosities of $10^8$, $10^9$, $10^{10}$, $10^{11}$ and $10^{12} L_\odot$, $C_X$ is 7.38, 9.3, 13.18, 20.58 and 34.67, respectively.

According to the bolometric luminosity $L_\mathrm{b}$ (derived from $C_X$), $C_{[\mathrm{O\,III}]}$ were estimated ($C_{[\mathrm{O\,III}]} = L_\mathrm{b}/L^c_{[\mathrm{O\,III}]}$). Figure 1 shows the $C_{[\mathrm{O\,III}]}$ distribution (left) and the relation between $L^c_{[\mathrm{O\,III}]}$ and $C_{[\mathrm{O\,III}]}$ (right) of our maser AGN sample. $C_{[\mathrm{O\,III}]}$ is mostly less than 200, and hence there is no obvious correlation between $L^c_{[\mathrm{O\,III}]}$ and $C_{[\mathrm{O\,III}]}$.

**Table 1.** The data of $H_2O$ maser host AGN.

| Source | Type | $L^c_{[O\,III]}$ | $L_X$ | $L_b$ | $C_{[O\,III]}$ | $L_{H_2O}$ |
|---|---|---|---|---|---|---|
| NGC 262 (Mrk 348) | Sy2 | 41.9 | 42.48∼43.98 | 44.5 | 440 | 36.18 |
| NGC 1052 | LINER | 39.7 | 41.08∼41.58 | 42.3 | 397 | 35.68 |
| NGC 1068 | Sy2 | 42.2 | >43.18 | 42.9 | 5 | 35.28 |
| Mrk 1066 | Sy2 | 42.2 | 42.58∼42.78 | 43.8 | 40 | 35.08 |
| NGC 1386 | Sy2 | 41.5 | 41.98∼42.58 | 43.4 | 79 | 35.68 |
| Mrk 3 | Sy2 | 43.2 | 43.18∼43.98 | 44.9 | 49 | 34.58 |
| NGC 2273 | Sy2 | 41.1 | 41.68∼42.88 | 43.4 | 199 | 34.43 |
| Mrk 1210 | Sy2 | 42.3 | 42.88∼43.88 | 44.7 | 247 | 35.48 |
| NGC 2639 | LINER | 40 | 40.58∼41.68 | 42.1 | 125 | 34.98 |
| NGC 2782 | SBG | 40.9 | 41.18∼42.68 | 42.9 | 100 | 34.68 |
| UGC 5101 | ULIRG | 42.8 | 42.38∼43.38 | 44 | 16 | 36.78 |
| NGC 3079 | Sy2/LINER | 40.4 | 41.98∼42.98 | 43.6 | 1585 | 36.08 |
| IC 2560 | Sy2 | 42.3 | 41.88∼42.78 | 43.5 | 14 | 35.58 |
| NGC 3393 | Sy2 | 42 | 42.08∼43.78 | 44.1 | 112 | 36.18 |
| ARP 299 (NGC 3690) | SBG | 40.9 | 41.78∼42.98 | 43.5 | 398 | 35.68 |
| NGC 4051 | Sy1.5 | 39.8 | 41.18∼42.08 | 42.6 | 629 | 33.88 |
| NGC 4151 | Sy1.5 | 41.6 | | 43.6 | 105 | 33.38 |
| NGC 4258 | Sy1.9 | 40.2 | 40.58∼41.28 | 41.8 | 40 | 35.48 |
| NGC 4388 | Sy2 | 41.7 | 42.28∼43.08 | 43.8 | 126 | 34.68 |
| NGC 4945 | Sy2 | 39 | 42.68∼43.18 | 44.1 | 112180 | 35.28 |
| M 51 (NGC 5194) | Sy2 | 40.4 | 41.28∼41.98 | 42.6 | 158 | 33.38 |
| Mrk 266 (NGC 5256) | Sy2 | 41.8 | 42.88∼43.88 | 44.7 | 782 | 35.08 |
| NGC 5347 | Sy2 | 41.1 | 41.68∼42.68 | 43.3 | 158 | 35.08 |
| *Circinus* | Sy2 | 41.1 | 41.08∼42.18 | 42.6 | 32 | 34.88 |
| NGC 5506 (Mrk 1376) | Sy1.9 | 41.4 | 42.48∼42.98 | 43.9 | 282 | 35.28 |
| NGC 5643 | Sy2 | 41.3 | 41.18∼42.58 | 42.9 | 35 | 34.88 |
| NGC 5728 | Sy2 | 42.1 | 42.28∼43.78 | 44.3 | 175 | 35.48 |
| NGC 6240 | ULIRG | 41.2 | 43.38∼44.38 | 45.4 | 16594 | 35.18 |
| NGC 6300 | Sy2 | 40.9 | 41.68∼42.08 | 42.9 | 89 | 33.92 |
| ESO 103-G035 | Sy2 | 41.6 | 42.68∼43.48 | 44.4 | 622 | 36.18 |
| 3C 403 | FRII | | 43.18∼43.88 | 44.8 | | 36.88 |
| NGC 7479 | | 40.3 | | 42.1 | 61 | 34.86 |

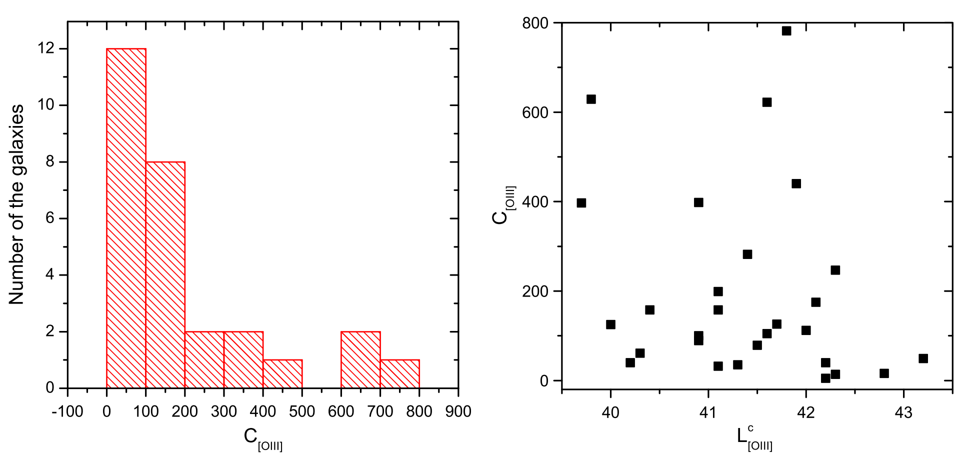


**Figure 1.** *Left*: The distribution of $C_{[O\,III]}$. *Right*: $L^c_{[O\,III]}$ vs. $C_{[O\,III]}$.

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## References

Zhang, J.S., Henkel, C., Kadler, C. *et al.* 2006, *Astron. & Astrophys.*, **450,** 933.
Marconi, A., Risaliti, G., Gilli, R. *et al.* 2004, *Mon. Not. R. Astron. Soc.*, **351**, 169.