Galaxies and Their Constituents at the Highest Angular Resolutions
IAU Symposium, Vol. 205, 2001
R.T. Schilizzi, S. Vogel, F. Paresce and M. Elvis

Megamaser Dics-Rings in Active Galactic Nuclei

Yu Zhi-yao

Shanghai Astronomical Observatory, National Astronomical Observatories,
The Chinese Academy of Science, 80 Nandan Road, Shanghai 200030, China

Abstract. We present results from fitting of water-vapor megamaser emission from NGC 4258 and NGC 1068. Using the radiative transfer, velocity, and coordinate equations, we derive parameters of the maser disc-rings.

1. Fitting the Spectra

Water vapour megamaser emission has been observed in NGC 4258 by Greenhill et al. (1995) and in NGC 1068 by Claussen & Lo (1986). We have found the following functions which fit these spectra (see Yu 1996 for details of the general procedure):

$$S(mJy) = exp[\frac{1}{a(V_{LSR} - V_p)^2 + b}], for NGC 4258. \quad (1)$$

$$S(mJy) = exp[\frac{1}{a(V_{helio} - V_p)^2 + b}], for NGC 1068. \quad (2)$$

where V_{LSR} and V_{helio} are in unit of km s^{-1} .
The values of a, V_p, and b for NGC 4258 and NGC 1069 are shown in Table (1) and (2), respectively.

Table 1. The values of a, V_p, and b for NGC 4258

peak	a	$V_p(kms^{-1})$	b
1	0.005909	466.2	0.1225
2	0.02424	472.0	0.1248
3	0.001299	485.0	0.1428
4	0.3586	492.0	0.1496
5	0.03438	496.0	0.1468
6	0.03438	499.2	0.1468
7	0.03586	502.0	0.1496
8	0.008966	506.2	0.1496
9	0.04162	512.0	0.1607
10	0.004356	520.0	0.1559

Table 2. The values of a, V_p, and b for NGC 1068

peak	a	V_p	b
1	0.0003556	1337	0.1580
2	0.0003665	1400	0.1604
3	0.0003569	1407	0.1585
4	0.001873	1430	0.1798

2. Model and Results

The model is described in Yu (1996). Because the megamaser galaxy must be edge-on, we take $\theta = 0$, and $\delta = -3$, $\alpha = 2.5$, for both galaxies, β= -0.5 for NGC 4258 and -2.5 for NGC 1068, r_0= 2 pc for NGC 4258 and 0.4 pc for NGC 1068, V_{r0}= 4096 kms^{-1} for NGC 4258 and 6400 kms^{-1} for NGC 1068, V_{t0}= 270 km^{-1} for NGC 4258 and 3200 kms^{-1} for NGC 1068. Comparing equation (3) in Yu (1996) with equation (1) and (2), we take $P = 1$. Using the Yu (1996) model, our computational results are shown in Table 3 for NGC 4258 and for NGC 1068.

Table 3. Computational Results for NGC 4258 (left) and NGC 1068 (right)

peak	r(pc)	y(pc)	peak	r(pc)	y(pc)
1	0.2028	-0.08600	1	0.1539	-0.03056
2	0.1987	-0.08422	2	0.1534	-0.03197
3	0.1991	-0.08680	3	0.1535	-0.03216
4	0.1985	-0.08766	4	0.1533	-0.03262
5	0.1986	-0.08844			
6	0.1986	-0.08843			
7	0.1986	-0.08951			
8	0.1986	-0.09022			
9	0.1986	-0.09129			
10	0.1987	-0.09279			

It is found from Table 3 and Table 4 that the peaks of H_2O megamaser spectra of NGC 4258 and NGC 1068 are formed by the megamaser spot radiation at the points on the thin-discs with different r and y, respectively. This model accounts for the profiles of the bright extragalactic water vapour megamaser emission.

This work was supported by the National Foundation of Natural Sciences of China and Union Lab of Radio Astronomy, the Chinese Academy of Science.

References

Greenhill, L. J. et al., 1995, ApJ, 440, 619

Claussen, M. J. & Lo, K.-Y., 1986, ApJ, 308, 592

Yu, Zhi-yao, 1996, APSS, 241,305