

HI and OH Absorption of the Nuclear Region of NGC 3079

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Abstract. We conducted an observation of weak HI and OH absorption features in the parsec-scale nuclear region of NGC 3079 using a global VLBI network; the VLBA, the VLA and the Green Bank 43-m telescope of NRAO. One mas corresponds to 0.076 pc in NGC 3079.

NGC 3079 shows HI and OH absorption in the nuclear region (Haschick & Baan 1985, Irwin & Seaquist 1991). Interferometric observations have shown that HI absorption towards the nucleus has a few velocity components around V_{sys} , suggesting an outflow or a rapid rotation in the nuclear region (Gallimore et al. 1994, Pedlar et al. 1996). Baan & Irwin (1995) showed similar doubly peaked HI and OH absorption profiles with the VLA. Our previous VLBI study of HI absorption reveals that a velocity gradient which seems different from the galactic rotation was found (Sawada-Satoh et al. 2000).

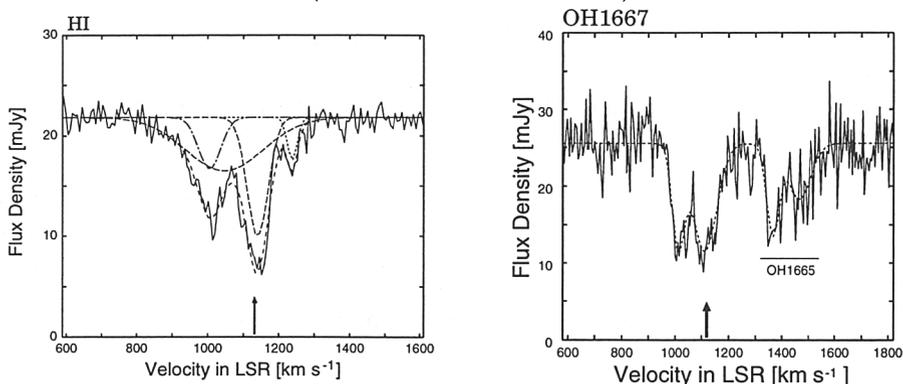


Figure 1. (*left*) HI absorption spectrum obtained from visibilities with spatial resolution of 15×11 mas and (*right*) OH 1667 MHz absorption spectrum with spatial resolution of 13×11 mas. The systemic velocity of the galaxy (V_{sys}) is indicated by the arrows.

Table 1. Parameters of HI and OH absorption

HI absorption			
Velocity	Δv	Optical Depth	$N_{\text{HI}}/T_{\text{spin}}^{\dagger}$
[km s ⁻¹]	[km s ⁻¹]		[10 ¹⁹ cm ⁻² K ⁻¹]
1005± 5	73±18	0.27±0.08	3.6±1.4
1047±12	257±28	0.28±0.10	13.1±4.8
1140± 2	71±7	0.78±0.11	10.6±1.7
1238± 3	32±6	0.21±0.04	1.3±0.3
OH absorption			
Velocity	Δv	Optical Depth	$N_{\text{OH}}/T_{\text{ex}}^{\ddagger}$
[km s ⁻¹]	[km s ⁻¹]		[10 ¹⁶ cm ⁻² K ⁻¹]
1013±5	53±12	0.73±0.17	9.2±2.9
1110±7	96±17	0.79±0.13	17.8±4.4

† A spin temperature

‡ An excitation temperature

We performed a four-component Gaussian fitting to the profile of HI absorption to get the minimum χ^2 . One absorption feature at 1047 km s⁻¹ has a broad profile of FWHM (>250 km s⁻¹), and the three other absorption features show a narrower profile (Figure 1). Assuming a spin temperature (T_{spin}) of 100 K, the broad velocity range, over 250 km s⁻¹, and high column density, over 10²² atoms cm⁻² of HI absorption feature in the nuclear region are consistent with the idea that the atomic gas is in rapid orbital motion close to the nucleus.

On the other hand, double absorption peaks are seen in the spectrum of OH absorption (Figure 1). The dominant one is for absorption at 1667 MHz, and the weaker one at 1665 MHz. This profile agrees well with the profile obtained from single-dish observation (Haschick & Baan 1985). We did not find a broader OH feature similar to that seen in the HI spectrum. OH absorption seems to be due to foreground OH gas outside of the nuclear region in NGC 3079.

References

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