HIGH RESOLUTION APERTURE SYNTHESIS OBSERVATIONS OF MOLECULAR GAS IN NGC1068

P. PLANESAS
Centro Astronómico de Yebes, and California Institute of Technology
N. Z. SCOVILLE, S. T. MYERS
California Institute of Technology

We have obtained high resolution ($2.9''\sim260$ pc) aperture synthesis imaging of NGC 1068 in the CO J=1→0 line made with the Owens Valley mm Interferometer. The major features seen in CO are: (1) the inner spiral arms of molecular gas at $\sim15''$ radius (1.5 kpc) which originate from the ends of the central stellar bar, and (2) a compact source ($\sim3''$) coincident with the Seyfert 2 nucleus. The components within 2 kpc of the galactic nucleus account for approximately 30% of the total molecular gas content in NGC 1068. The spiral arm CO emission is resolved into 38 discrete complexes which closely correlate with regions of strong Hα and 10 μm emission. The sizes of these structures range up to 500 pc and their masses derived from the CO line flux are $2\times10^7-7\times10^8$ $M_\odot$. Somewhat smaller mass estimates are obtained from the virial theorem using the observed CO linewidths and sizes, suggesting that these complexes may be self-gravitating.

Radio continuum emission from the nucleus was detected at both 112 and 115 GHz. The flux density measured in the upper sideband (centered on the CO line) is significantly larger than the non-thermal radio continuum measured in the lower sideband. Assuming that this excess is CO line emission, then the derived H_2 mass for the central source is 8×10^7 $M_\odot$ (within 130 pc radius). The inferred column densities of neutral gas and dust are consistent with those inferred for the dusty torus hypothesized to obscure a Seyfert 1 nucleus. We suggest that the stellar bar in the inner disk provides a common link between the spiral arm starbursts, the cm-wave radio jets, and the active nucleus phenomena through dynamical effects on the dense molecular gas.

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