

MOLECULAR GAS IN NGC 4736 : CO OBSERVATIONS AND NUMERICAL SIMULATIONS

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NGC 4736 is one of the nearest examples ($D \approx 6.3$ Mpc) of spiral galaxies with prominent rings : an inner ring of HII regions ($r \approx 50'' \approx 1.7$ kpc) and an outer stellar and HI ring ($r \approx 5' \approx 9$ kpc. Atomic gas is present in the inner ring, and throughout the main body of the galaxy, but neither in the nucleus nor in the gap between the main body and the outer ring.

We used the IRAM 30m telescope to map the inner region of the disk of NGC 4736 in the CO (1-0) and (2-1) lines (beam sizes = $22''$ and $14''$, map sampling = $10''$). The map of CO(1-0) integrated area (figure 1) shows that there is a strong gas concentration in the nucleus, of diameter $\approx 30''$, and another one associated with the inner ring of HII regions. Contrary to HI, the CO emission falls rapidly outside a radial distance of $60''$. The presence of molecular gas in the nucleus shows that if a starburst occurred, it did not consume all the available molecular gas : the total molecular mass is $3.9 \cdot 10^8 M_{\odot}$.

The formation of rings is well understood in strongly barred galaxies, but NGC 4736 has only a weak oval. In addition, the time scale necessary to form a ring scales as the orbital time at the ring radius, and is therefore very different for the inner and outer rings. We have simulated behavior of the molecular clouds of NGC 4736 in a weakly barred potential. These simulations show that it is indeed possible to form both rings with the weak oval potential present here, but with different time scales : $3.5 \cdot 10^8$ yr for the inner ring, $2 \cdot 10^9$ yr for the outer ring, while the inner rings disappears slowly after $3 \cdot 10^9$ yr.

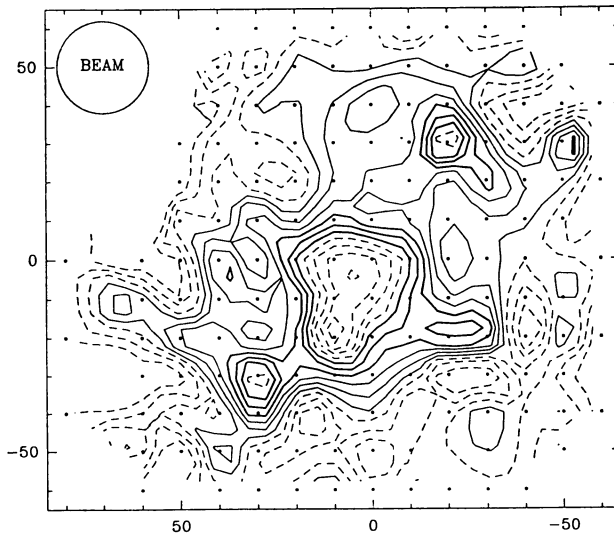


Figure 1 :
CO(1-0) line area
levels : 2.5 to 32.5 Kkm/s
by steps of 2.5 Kkm/s