MOLECULAR GAS IN THE CENTER OF THE ELLIPTICAL GALAXY NGC759

T. WIKLIND
Onsala Space Observatory, S-43992, Onsala, Sweden

F. COMBES
Observatoire de Paris, 61 Av. de l'Observatoire, F-75014 Paris, France

C. HENKEL
Max-Planck-Institute für Radioastronomie, Auf dem Hügel 69, D-53121 Bonn, Germany

AND

F. WYROWSKI
Physikalisches Institut der Universität zu Köln, Zulpicher Strasse 77, D-50937 Köln, Germany

Elliptical galaxies are traditionally defined as gas-free, inert stellar systems. Observations of continuum emission in the far-infrared (FIR) and sub-mm wavelength bands have, however, shown that a large fraction of all ellipticals, ~50% (Jura et al. 1987), contain a dust component. The infrared emission is due to warm dust, in many cases associated with star formation and/or weak AGN activity, while cold dust dominates the long wavelength continuum emission (e.g. Wiklind & Henkel 1995). Some elliptical galaxies also contain a molecular gas component, as seen through CO emission (Lees et al. 1991; Wiklind et al. 1995; Knapp & Rupen 1996). The dust and molecular gas are believed to be associated with each other, but it is not clear what powers the emission: star formation activity and/or AGN activity. Both the molecular gas mass and the FIR luminosity are on average lower in ellipticals than in spiral galaxies of similar luminosities. However, the $L_{\rm FIR}/M_{\rm H_2}$ ratio is larger for the elliptical galaxies. If this ratio is a measure of the star formation efficiency, this suggests that gas is being used up more efficiently in elliptical galaxies than in normal spirals (e.g. Wiklind et al. 1995). Other possibilities is that the FIR dust emission is

Y. Sofue (ed.), The Central Regions of the Galaxy and Galaxies, 253-254.

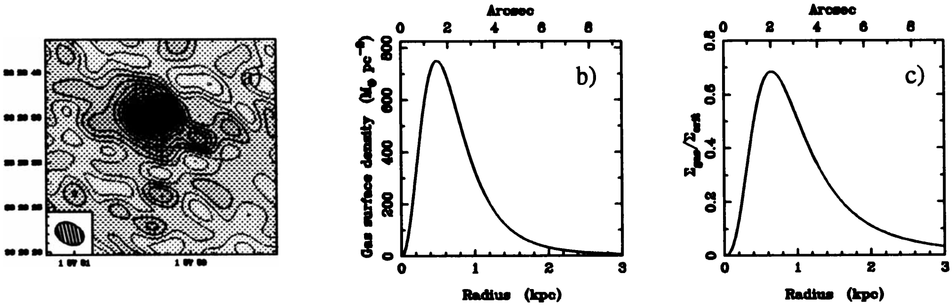

Figure 1. **a)** The integrated CO(1–0) intensity. **b)** The best fit model of the molecular gas distribution. **c)** The ratio of the total gas surface density to the critical gas surface density.

not only powered by UV–light from young stars, but from other sources as well, or that some dust is not spatially associated with the molecular gas.

In order to study the detailed distribution and kinematics of molecular gas in a typical elliptical galaxy, we observed the ordinary E0 galaxy NGC759 with the Plateu de Bure interferometer in the CO(1–0) line, with a resolution 3.1"×2.3" (990×735 pc). NGC759 is situated in the cluster A262 at a distance of 66 Mpc and contains $2 \times 10^9\,M_\odot$ of molecular hydrogen, derived from CO(1–0) and (2–1) single dish observations (Wiklind et al. 1995); its FIR luminosity is $3.5 \times 10^{10}\,L_\odot$. The filled aperture CO emission profile suggested that the the gas was distributed in a differentially rotating disk. However, the interferometer data shows that all of the $2 \times 10^9\,M_\odot$ of molecular gas is confined to the very center (Fig. 1a) (Wiklind et al. 1997). Modeling the molecular gas distribution with an extended ring (Fig. 1b) gives good agreement with the observed distribution as well as the emission profiles. The ring peaks at a galactocentric distance of ~650 pc. The ratio of the total gas surface density and the critical gas surface density for large scale gravitational instabilities is always much less than one, except for a small region outside the peak of the gas ring, where it reaches unity. Hence, NGC759 is not likely to be undergoing star formation on a large scale, despite its rather large molecular gas mass and high FIR luminosity.

References

Jura M., Kim D.W., Knapp, G.R., Guhathakurta P. 1987, ApJ 312, L11
Knapp G.R., Rupen M.P. 1996, ApJ 460, 271
Lees J.F., Knapp G.R., Rupen M.P., Phillips T.G. 1991, ApJ 379, 177
Wiklind T., Combes F., Henkel C., Wyrowski F. 1997, A&A 323, 727
Wiklind T., Combes F., Henkel C. 1995, A&A 297, 643
Wiklind T., Henkel C. 1995, A&A 297, L71