An 8″ resolution CO (J=3–2) map of IC342

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Introduction

IC342 (Distance 4 Mpc) is one of the most suitable sources for extragalactic molecular line studies. Toward its nucleus, a great number of molecular species have been found (see Henkel and Mauersberger, 1990); it is also one of the few galaxies investigated in molecular multi-level studies (Mauersberger and Henkel, 1989). In particular, CO shows strong emission: A 7″ resolution interferometric map of the central parts of this galaxy in the $^{12}CO(1-0)$ transition by Lo et al. (1984) reveals that the circumnuclear molecular gas is distributed in a bar (size $15'' \times 70''$) (330×1500 pc) extending from the nucleus towards the spiral arms. An interferometric map of the 1—0 line of CO by Ishizuki et al. (1990) shows that the inner part of the bar forms a molecular ring of diameter 110 pc. This inner ring also emits 2 and 6 cm continuum radiation (Turner and Ho, 1983). The kinetic temperature of the denser molecular gas is > 50 K (Martin and Ho, 1986). The H_2 density of the gas component seen in CO (Eckart et al., 1990) and CS (Mauersberger and Henkel, 1989) is $\sim 10^4$ cm^{-3}.

Instrumentation, observations and results

The observations are the result of first measurements using a 345 GHz Schottky receiver at the IRAM 30-m telescope. The CO (J=3-2) spectra are shown in Figure 1. These measurements have demonstrated that the 30-m telescope is suitable for 0.87 mm wavelength observations with respect to a) atmospheric conditions, b) surface accuracy and c) pointing stability. Averaged over a year, for more than 10% of the observing time, the amount of precipitable water vapour in the atmosphere is expected to be <2 mm. The beam width nearly gets down to that of conventional millimeter range synthesis telescopes. With the availability of broader spectrometers, the usable instantaneous bandwidth could be 1 GHz and, hence, extragalactic objects with broader line emission could be observed.

Interpretation

In Fig. 2, the features observed toward IC 342 are sketched. The shaded area marks the molecular bar seen in the CO (1—0) emission. The thick lines show where we have seen the CO (J=3—2) hotspots. The thin lines denote the cm radio emission (Turner and Ho) and the cross the 2μm IR source.

The radio emission traces regions of newly formed young stars. They are concentrated in a ring of $\sim$ 100 pc diameter located in the center of a bar-like structure seen in the J=1—0 line of CO. It could be inferred that the CO bar supplies the molecular gas needed for ongoing star

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formation. At the junction of the molecular bar and the 100 pc-ring, the molecular gas could be heated to the high temperatures derived from ammonia and compressed to high densities. Possible interpretations include the dissipation of flow motion of the molecular gas through the bar, the interaction between the molecular gas and the young stellar population or the fission of a nuclear molecular cloud (Fujimoto, these proceedings)

Presumably, the gas seen in our high resolution CO (3—2) map is being compressed to densities critical for star formation, and the next generation of stars will form in the two molecular hotspots.

References

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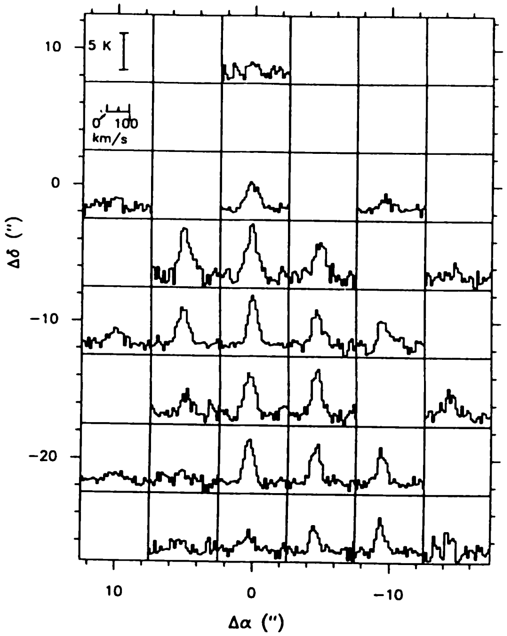

Fig. 1.:CO (3–2) profiles toward IC 342.

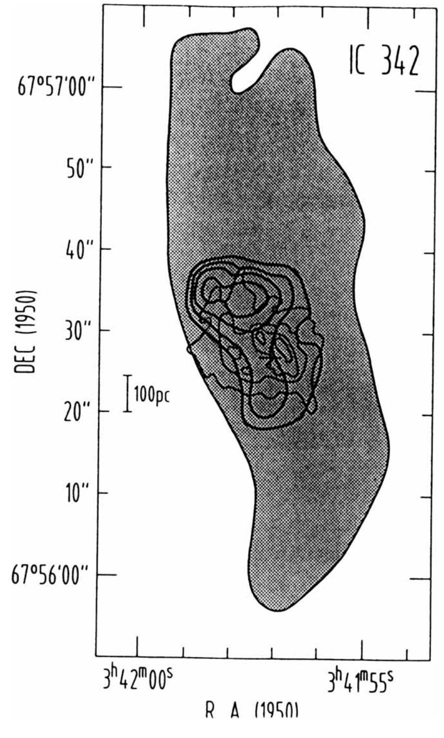

Fig. 2.: The nuclear region of IC 342 (see text).