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^{12}CO($J = 1-0$) MAPPING OF THE MERGING GALAXY NGC 3310

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Since molecular gas clouds in nuclear regions play important roles on both the intense star formation and fueling active galactic nuclei, a large number of molecular-line observations have been made for starburst, Seyfert, and merging galaxies. Recently, millimeter-wave arrays have been used to study circumnuclear molecular gas in merging galaxies. Most of them, however, have been devoted to the observations of more luminous objects such as ultra-luminous merging galaxies (ULMGs) discovered by IRAS (Sanders *et al.* 1988). In order to obtain a comprehensive understanding, it is necessary to study less-luminous merging galaxies . With this motivation, we present results of CO mapping of NGC 3310 which is one of less luminous merger candidates ($L_{\rm FIR} = 2.5 \times 10^{10} L_{\odot}$).

The central region (5.1 kpc in diameter) of NGC 3310 was observed in CO($J = 1 - 0$) using the Nobeyama Millimeter Array. The synthesized beam size was $6''.3 \times 6''.1$, which corresponds to 500 × 480 pc at the distance 16.3 Mpc. Our main results and conclusions are summarized as follows.

(1) The molecular gas shows clumpy distribution and is associated with the inner spiral arms. The positions of CO peaks are displaced from the local peaks of the HII regions. Further, the CO emission is stronger in the northern side than in the southern one while the Hα emission shows the opposite sense. This is due to that more active star formation tend to consume more gaseous content.

(2) We have identified four molecular clouds (component D is marginal). The masses of these clouds ($\alpha = 3.0 \times 10^{20}$) are (4-11)$\times 10^7 M_{\odot}$ which are comparable to those of molecular superclouds identified in M51 and NGC 1068. Our resolution is too large to study fine structures of these clouds. However, it is remarkable that the sizes of the clouds (500 - 1400 pc) are comparable to those of giant HII regions in the spiral arms and in the ring of NGC 3310.

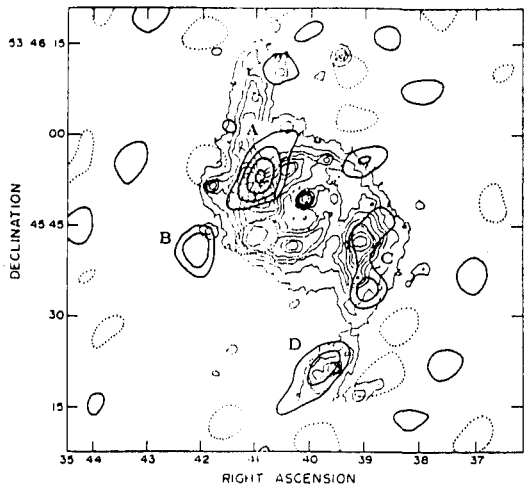

FIGURE I A map of CO integrated intensity (thick contours) which covers the velocity range ,889 - 1105, km s^{-1} is superposed on the intensity map of the Hα emission (thin contours; Duric *et al.* 1986). The contours of CO map are $\sigma\times$ (-1.5, 1.5, 2.5, 3.5, and 4.5), where σ is 6.6 mJy $beam^{-1}$.

(3) Based on the available data on NGC 3310, it has been proposed that NGC 3310 is a merger with a gas-rich dwarf galaxy (e.g., Balick and Heckman 1981). In this scenario, gas of the dwarf galaxy has been sinking into the inner region, resulting intense star formation events in the nuclear region. Recent numerical simulations of shell-forming merging galaxies by Hernquist and Weil (1992) show such a possibility. Thus, we consider that the merging hypothesis proposed by Balick and Heckman (1981) becomes to be more reliable now.

(4) The star formation properties of NGC 3310 are quite different from those of the ultra-luminous merging galaxies. The age of the star forming regions in NGC 3310 are young ($\simeq 10^7$ years) and thus there are many massive O stars while the dominant massive stars in ULMGs are B type stars. We suggest that this difference is due to the difference of merging partners: *i.e.*, a dwarf gas-rich galaxy for NGC 3310 while a roughly equal-mass galaxy for ULMGs.

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