HCN (J=1-0) Survey of Molecular Clouds in the Galactic Center Region

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We have observed molecular clouds in the Galactic Center Region of $-6^\circ \leq l \leq 6^\circ$ and $-0.7^\circ \leq b \leq 0.9^\circ$ with HCN (J=1-0) line (88.63 GHz),which is optically thin almost everywhere, on a 4′ grid using the 14 m telescope of the Daeduk Radio Astronomy Observatory. The integrated intensity maps binned to 100 km s^{-1} range show the existence of many clouds having highly forbidden velocity in the Galactic Center region. We have made l-v diagrams for each b as well as the averaged one over b, to describe the velocity structures of the clouds. Our l-v diagrams are similar to those of ^{13}CO, but there are some different features as the HCN line trace higher density regions ($\sim 3\times10^5$ cm^{-3}) than the ^{13}CO line. We also have observed some strong HCN emitting regions with optically thinner $H^{13}CN$ line to derive HCN column densities. Estimated HCN column densities range from $\sim$ 10^{15} cm^{-2} to $\sim$ 10^{17} cm^{-2}.

THERMAL AND NON-THERMAL RADIO CONTINUUM SOURCES IN THE W51 COMPLEX

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We have decomposed the 11-cm radio continuum emission of the W51 Complex into thermal and non-thermal components. The distribution of the thermal emission has been determined by analyzing H I, CO, and IRAS 60-μm data. We have found a good correlation between the 11-cm thermal continuum brightness temperature $T_{11,th}$ (K) and the 60-μm surface brightness of ionized region $I_{60,ion}$ (MJy sr^{-1}), $T_{11,th} = (7.9\ ^{+2.1}_{-1.6}) \times 10^{-3}\ I_{60,ion}$. Most of the thermal continuum is emanating from the compact H II region and the low-density ionized envelopes of W51A and W51B. All the H II regions, except G49.1-0.4 in W51B, have associated molecular clumps. The absence of a molecular clump in G49.1-0.4 may be related to the high-velocity H I gas discovered by Koo & Heiles (1991) in this region. The thermal radio continuum fluxes of the compact H II regions have a good correlation with the masses of molecular clumps. This may indicate that the masses of the newly formed stars are proportional to those of the parential clouds.

According to our result, there are three non-thermal continuum sources in W51: G49.5-0.4 in W51A, a point source near G49.1-0.4 in W51.B, and the shell-like source W51C. The non-thermal flux of G49.5-0.4 at 11-cm is 23 Jy, which is 30% of the 11-cm thermal flux. The existing data between 150 MHz and 300 GHz seems to indicate the coexistence of the thermal and non-thermal components in G49.5-0.4. The nature of the non-thermal source near G49.1-0.4 is unknown. The source has a flux of 9 Jy at 11-cm. The physical associations of this non-thermal source either with the nearby X-ray emission and/or the high-velocity H I gas needs to be studied.

The diameter of the non-thermal shell source W51C is 30′ (or 44 pc at a distance of 5 kpc), and its 11-cm flux is 120 Jy. In X-ray, W51C appears as a center-filled source. The X-ray luminosity is 7×10^{34} erg s^{-1}, and the mass of the X-ray emitting gas is 55 M⊙. The center-filled X-ray emission and the shell-brightened radio emission of W51C can be explained by the evaporation model of the supernova remnant (White & Long 1991).

Stellar Populations in the Faint Dwarf Galaxy LGS-3

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LGS-3 is a faint dwarf galaxy discovered by Kowal et al.(1978, IAU circular No.3305) in a search for new local group galaxy candidates. HI and CO gas have been detected, although very little, in this galaxy (Lo et al. 1993, AJ, 106, 507, Tacconi and Young 1987, ApJ, 322, 681), but no Hα emission has been observed (Hunter, Hawley and Gallagher 1993, AJ, 106, 1797). It is a very unique galaxy in that the ratio of HI gas mass to luminosity is the lowest among known dwarf irregular galaxies and that the mass to luminosity ratio of this galaxy is very high ($M/L_B = 26 \pm 16 M_\odot / L_{B,\odot}$ (Lo et al. 1993). The distance to this galaxy is not well-known (0.7 - 1.2 Mpc) (Christian and Tully 1983, AJ, 88, 934, Cook and Olszewski 1989, BAAS, 21, 775). AGB carbon stars are also discovered in this galaxy Cook and Olszewski 1989).

I present a study based on VRI CCD photometry of the LGS-3 dwarf galaxy. Color-magnitude diagrams show that the resolved bright stars are mostly red giant branch (RGB) stars and that there are a small number of asymptotic giant branch (AGB) stars above the tip of the RGB. The mean metallicity of the RGB stars has been estimated using the color of the RGB, and the distance to this galaxy has been measured using the tip of the RGB. LGS-3 has been considered as a red dwarf irregular galaxies (see Lo et al. 1993). However, it appears that it is not a dwarf irregular galaxy, but much closer to a typical dwarf spheroidal galaxy, considering the morphological structure and luminosity of the galaxy and the stellar populations in the galaxy.

Nature of the Blue Compact Dwarf Galaxy Mrk 49*

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We present optical and near-IR multicolor photometry, and high/low resolution spectroscopy for the blue compact dwarf galaxy Mrk 49(also known as VCC 324, UGC 7354) in Virgo Cluster. Our UBVRI and JK surface photometry confirms that the radial luminosity distribution is well described an exponential disk in all wavelength domain, except the central