Study of molecular clouds and star formation in the Magellanic Clouds by NANTEN
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~ Introduction ~
In the decades, considerable efforts were devoted to reveal various aspects of star formation processes. Current knowledge on our star formation processes is, however, quite limited to low-mass, isolated star formation. Recent observations have just started to make it possible for us to study the properties of the molecular clouds in the intermediate to massive star forming regions, which are tend to be distant from us. In this study, we present the results from the surveys of the molecular clouds in the Magellanic System to study their distribution and properties. Comparisons with the indicators of the star formation bring us deeper knowledge on star formation processes.

~ The Large Magellanic Cloud ~
One of the nearest galaxies (distance ~ 50 kpc) & face-on to make it possible for us to study the properties of the molecular clouds with much less contamination along the line compared with the Galaxy. Different environment from that of Our Galaxy.
- Low metallicity: 1/4 - 1/3 (e.g., Rollenstone et al.)
- High gas to dust ratio (e.g., Koorneef 1982)
- Active star formation
- Large filaments, and shells visible in H 
- 10⁴ stars (e.g. Hodge 1961)) and associations.
- 30 Doradus ~ 39 O3 stars (Massey & Hunter 1999)

~ Massive star/cluster formation in the LMC ~
(Wakamura et al. 2008, submitted)

~ Star formation indicators ~
- Clusters
  - Bica et al. examined the colors (UBV bands) of 624 clusters. 137 are found to be younger than 10²/4yr (SWB 0), while 130 are as young as 10² - 3x10².
- GMC with HII regions
- GMC with HII regions and SWB 0 clusters

~ Molecular clouds in the LMC ~
(Fukui et al. 2008) 4m telescope @ Las Campanas
2.6 resolution@115GHz ~40 pc @LMC velocity res=0.6 km/s bandwidth 100 or 500 km/s
272 clouds were identified using the cprops method (Rosolowsky & Leroy 2006). 230 of which were detected at more than 3 observed positions.
The mass spectrum of the 230 clouds above 5x10⁴ Mo is N(M) = 6.6 x 10⁵ M^(-0.75 +- 0.06)-3.4. The slope of the mass spectrum becomes steeper if we fit only the massive clouds.

~ The Small Magellanic Cloud ~
We have made a CO survey in the Small Magellanic Cloud (SMC) by NANTEN at a linear resolution ~ 50 pc. About 30 molecular clouds with ~10⁴ - 10⁵ Mo, were identified. The preliminary results are found in Mizuno et al. (2001).

CO clouds observed by NANTEN (yellow contours) superposed on an optical image. Contours are from 1.2 Km/s with 2.4 Km/s intervals.
Luminosity and the virial mass of the molecular clouds show an almost linear correlation. A conversion factor, Xco, from a CO intensity to a column density is derived to be 7x10²⁰ cm⁻² Kkm/s.

~ Evolution of GMCs ~
Out of 272 clouds, 57 are associated with young clusters and 145 with HII regions, while 70 of them do not show any signs of massive star or cluster formation. The "starless GMCs" are very rare in our Solar vicinity. We also found that 60 % of the young clusters (<10Myrs) are associated with GMCs. This suggests that once clusters are formed, GMCs are dissipated in ~6 Myrs. The timescale of the evolution of the GMCs with M>10⁵Mo is estimated as shown in the figure by assuming constant star formation rate.