Contribution ID: **285** Type: **Poster Presentation**

Recent Results on Spatially Resolved Molecular Gas Star Formation Law from CARMA Survey Towards Infrared-bright Nearby Galaxies (STING)

Wednesday, 10 July 2013 17:40 (1 hour)

Abstract content
   (Max 300 words)

The STING is a CARMA 3mm survey of nearby galaxies. We will present a comprehensive analysis of the relationship between the star formation rate surface density and molecular gas surface density at sub-kpc level in the STING sample. To construct the tracers of molecular gas surface density and star formation rate, respectively, we have used high resolution (3-5") CO (J=1-0) data from CARMA and the mid-infrared 24-micron data of comparable resolution (6") from Spitzer Space Telescope.

Observational determinations of the functional relationship between star formation rate and molecular gas surface densities, commonly known as the star formation law, in galaxies require taking into account a number of factors. Extinction, contributions from non star-forming populations affect many measures of star formation, treatment of the diffuse emission, and statistical methodologies employed all have impacts on the precise relation between gas and star formation.

We find that precise observational constraint on the linear or non-linear functional form of the relationship requires an accurate estimate of the fraction of the diffuse emission. Our results show that the treatment of the diffuse emission has significant impact on the intrinsic scatter in the Schmidt-Kennicutt type canonical star formation law. The scatter varies substantially with the choice of the star formation tracer used. For example, the non-linear 24-micron star formation tracer shows the tightest correlation with the molecular gas content whereas (azimuthally averaged) extinction corrected Halpha, as a tracer, appears to be the noisiest. Measuring the relationship in the bright, high molecular gas surface density (Sigma H_2 => 20 Msun/pcˆ2) regions of the disks to minimize the contribution from diffuse extended emission. Using mid-infrared emission as a tracer of star formation, we find an approximately linear relation between molecular gas and star formation rate surface densities with a molecular gas depletion time ˜2.30 Gyr.

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Session Classification: Poster2

Track Classification: Track D1 - Astrophysics