Astrophysics Seminar

Wednesday, May 17

Molecular Gas and Star Formation at Low Metallicity in the Magellanic Clouds

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The Magellanic Clouds are two interacting, gas-rich, star-forming, low-mass, nearby satellite galaxies of the Milky Way that afford a unique view of low-metallicty star-forming regions, providing the nearest laboratories to study the processes relevant to star formation in the early universe. We use the dust emission from HERITAGE Herschel data (Meixner et al. 2013) to map the molecular gas in the Magellanic Clouds, avoiding the known biases of CO emission as a tracer of H2, and find that on large scales the molecular gas depletion time is not a strong function of metallicity. We compare galaxy-scale analytic star formation models to our observations and find that successfully predicting the trends in the low metallicity environment needs the inclusion of a diffuse neutral medium. The averaging of the scatter in the molecular gas depletion time as a function of scale size suggests that the drivers of the star formation process in these galaxies operate on large scales. On small (~ few pc) scales in the Small Magellanic Cloud (SMC), we study the effect of metallicity on the structure of photodissociation regions in the outskirts of molecular clouds using [CII] and [OI] spectroscopy combined with new ALMA 7-m array maps of 12CO and 13CO. We estimate the total amount of molecular gas using [CII] to trace H2 at low-Av and 12CO to trace H2 at high-Av. We find that most of the molecular gas is traced by [CII] emission and that metallicity only affects the relationship between CO emission and molecular gas through changes in Av. Using mid-infrared spectroscopy from Spitzer Space Telescope in the SMC (Sandstrom et al. 2012), we model the H2 rotational line emission to estimate temperatures, column densities, and fractions of warm H2 gas (T>100 K). The temperatures and column densities of warm H2 gas are similar to nearby galaxies, but the SMC shows somewhat high fractions of warm H2. The properties of the warm H2 gas indicate that it is located in photodissociation regions that are more extended in the low metallicity environment of the SMC. Finally, I will discuss our new ATCA survey of HI and OH absorption in the Magellanic Clouds.

3:30pm in CAS 502. *Refreshments served at 3:15pm in CAS 500.*

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End of Series

There are no more seminars for the Spring Semester. Good luck on finals and see you next fall!