Atomic and Molecular Gas in the LMC





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Molecular Cloud Lifetimes

Evidence for long molecular cloud lifetimes (>10 Myr):

- H_2 formation on grains
- Milky Way's star formation rate

Evidence for short molecular cloud lifetimes (<10 Myr):

- Association with young stellar content
- No turbulent driving required
- Molecular cloud chemistry
- Molecular cloud morphology

The HI-CO $(HI-H_2)$ Connection



Previous Work on HI envelopes

- "Do all molecular clouds have an HI lining?" (Wannier et al. 1983+)
- inner MW giant molecular clouds are associated with HI superclouds (Elmegreen & Elmegreen 1987)
- molecular cloud mass
 approximately equals the associated
 HI mass (Blitz et al. 1989+)



CO and HI in the LMC



~ 3.8 x $10^5 M_{\odot}$ (for Galactic X_{CO}) $M_{\rm mol}$

RA (J2000)

RA (J2000)





48





GMC 0517-6752

RA

GMC 0526-6932



 $M_{mol} \sim 1.6 \times 10^5 M_{\odot}$ (for Galactic X_{CO})

3DSlicer (fingers crossed...)

- GMC 0520-6901
- GMC 0526-6932
- GMC 0517-6752
- GMC 0528-6951

Pink:	CO
Purple:	80-90K HI
Blue:	70-80K HI
Green:	60-70K HI
Aqua:	40-60K HI
Grey:	10-40K HI





5^h20^m0* 45* 35* 15* 19^m0* 45* 35















CO and HI Intensity: 3D comparison

T_{b} (HI) = $\eta \times T_{s}(1-e^{-\tau})$



CO and HI Intensity: 2D comparisons



 $6^{h}0^{m}$ 45^{m} 30^{m} 15^{m} $5^{h}0^{m}$ 45^{m}

CO vs HI for Individual Clouds*



T_{b} (HI) = $\eta \times T_{s}(1-e^{-\tau})$

RA (J2000)

 $5^{h}18^{m}0^{s}\ 30^{s}17^{m}0^{s}\!30^{s}16^{m}0^{s}\!30^{s}15^{m}0^{s}\!30^{s}14^{m}0^{s}$





Possible Interpretations

- Rapid HI to H_2 conversion?
 - HI accretion?
 - Mechanical feedback?



CO and HI Velocity Dispersion



Average Properties of HI Envelopes

Average HI properties around ~20 GMCs in



Size of HI Envelopes



RA

Importance of stellar gravity?



Conclusions

- The LMC is a unique laboratory for this kind of analysis
- HI and CO peaks are offset (in space): efficient HI to H₂ conversion? Role of optical depth vs gas temperature?
- GMCs correlated with low HI velocity dispersion: gas getting colder, or losing turbulent support?
- HI envelopes: increasing HI brightness & decreasing HI velocity dispersion over ~ 2 x $R_{\rm GMC}$
- M_{HI} approaches M_{H2} over similar scales
- Coherent pattern in R_{env}: related to stellar bar? •

