Circumstellar chemistry at low metallicity

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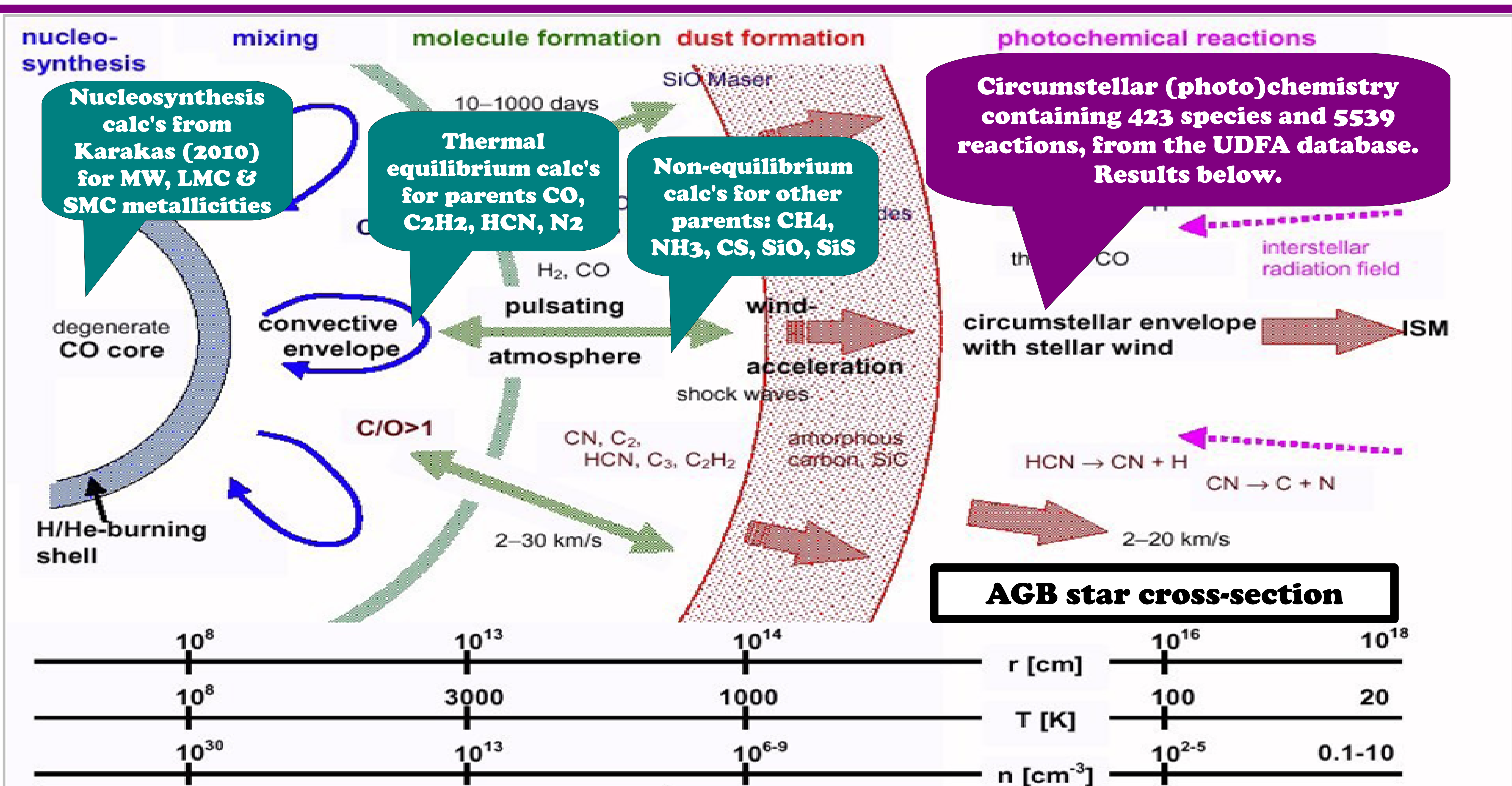
SAGE-Spec Spitzer observations of (extreme) carbon stars in the Large Magellanic Cloud, along with similar spectra from ISO, show deep absorptions due to acetylene; these appear deeper than those seen in comparable Galactic objects. This indicates that the acetylene abundance in the emitting region -- the atmosphere of the star -- is much higher. Since acetylene is an important parent molecule in carbon-rich circumstellar chemistry, this would imply that the chemistry of the stellar wind is also different. The question is, how different? Motivated by this, and the fact that the ALMA telescope will potentially be able to observe these low metallicity stars at the end of 2011, we aim to find out through the construction of a chemical model of the envelope.



MLR = 3×10^{-5} M_{sol}/yr; g2d = 100 (MW) 200 (LMC) 400 (SMC); G = 1 (MW) 2 (LMC) 4 (SMC) $\times G_0$

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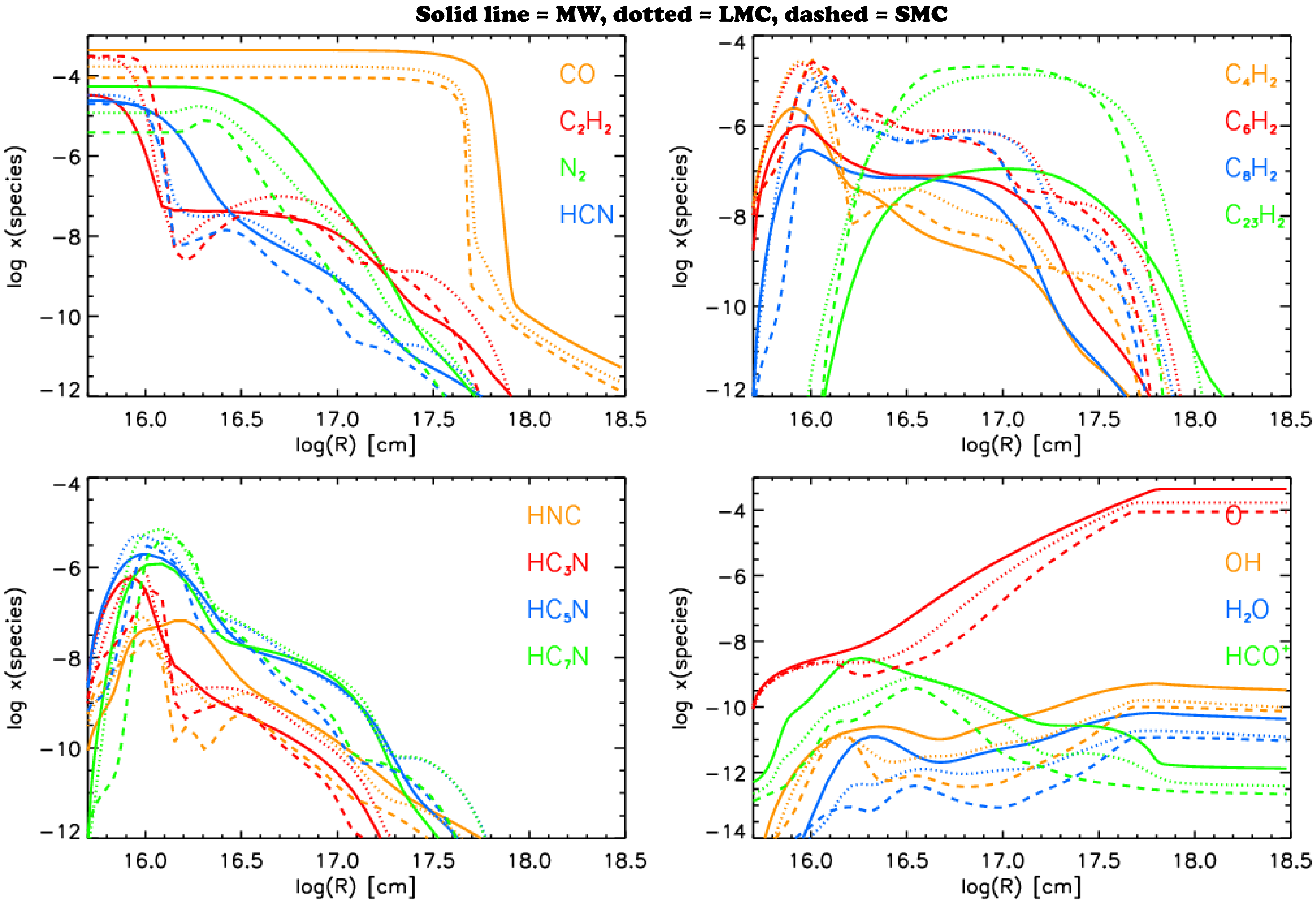
Solid line = MW, dotted = LMC, dashed = SMC



- **At low metallicities, hydrocarbon chemistry is significantly enhanced**
- **At small radii, C2H2 is more abundant than CO**
- **Longer carbon chains are as abundant as small members of same family**
- **N-based chemistry becomes more photon-dominated**
- **O-based chemistry is suppressed**

ALMA will be able to detect the CO envelopes of Magellanic carbon stars reasonably quickly, even in Early Science. Detecting other molecules will be beyond its scope.