MODELING THE MOLECULAR COMPOSITION OF THE TRANSITIONAL PROTOSTAR L1527

GEORGE HASSEL, *Department of Physics, The Ohio State University, Columbus, OH 43210*; ERIC HERBST, *Departments of Physics, Astronomy & Chemistry, The Ohio State University, Columbus, OH 43210*; ROBIN GARROD, *Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany*.

Long-chain unsaturated hydrocarbons and cyanopolyynes have recently been observed in the low-mass star-forming region L1527.[a] Their unexpected presence was attributed to a gas-phase ion-molecule chemistry, which occurs during and after the evaporation of methane from warming grains.[b] The source L1527 is an envelope surrounding a Class 0/I low mass protostar with regions that possess a slightly elevated temperature of $\approx$ 30 K. The newly reported molecules are typically associated only with dark molecular clouds, and not with the more evolved hot corino phase. In order to determine if L1527 is chemically distinct from a dark cloud, we compute models including various degrees of heating. These newly observed abundances as well as those of a previous survey[c] are compared with computed models to determine the quality of agreement. The results indicate that the composition of L1527 is somewhat more likely to be due to "Warm Carbon Chain Chemistry" than to be a remnant of a colder phase. If so, the molecular products provide a signature of a previously uncharacterized early phase of low mass star formation, which can be characterized as a "lukewarm" corino. Although our calculations show that unsaturated hydrocarbons and cyanopolyynes can be produced in the gas phase as the grains warm up to 30 K, they also show that such species do not disappear rapidly from the gas as the temperature reaches 200 K, implying that such species might be detected in hot corinos and hot cores unless their spectral lines cannot be distinguished from the dense spectra of weeds.

[a] N. Sakai et al. *ApJ* **672**, 371, 2008.
[b] A. J. Markwick et al. *ApJ* **535**, 256, 2000.
[c] J. K. Jørgensen et al. *A&A* **416**, 603, 2004.