MODELING CARBON CHAIN ANIONS IN L1527

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We have modeled the chemistry of the low-mass star-forming region L1527 with a model that includes negative ions. Sakai et al. had suggested that L1527 could be a unique source since they detected some unsaturated carbon-chain molecules that are unusual in star forming region such as C_nH, C_nH_2, cyanopolyynes[a], and also the negative ions C_4H^- and C_6H^-[b][c]. Their preferred explanation for these detections is that methane can evaporate from the grains and form carbon chains during the heat-up of the region. We modeled the chemistry that occurs following methane evaporation when some species are already abundant in the gas, such as CO and N_2. We used a gas-phase code that includes negative ions of the families C_n^-, and C_nH^-, as well as the newly detected C_3N^-. Negative ion chemistry can enhance the synthesis of some carbon chains and cyanopolyynes by two mechanisms: (i) by actively forming larger species through reactions with atomic carbon, which affects the chemistry at early time, and (ii) by interfering with the destruction of larger species through the formation of anions, which affects the chemistry at later times, around 10^5 yr. In L1527, we reproduce most of the observed abundances at a time of 10^4 yr. At later times, carbon chain anions become even more abundant than electrons, which has an impact on many organic species and ions. The anion-to-neutral ratio in our calculation is higher than observation for C_6H^- by factor of 4, and for C_4H^-, by more than three orders of magnitude. In order to explain this difference, more investigation is needed on rates of electron attachment and other reactions regarding anions.

[a] N. Sakai *et al. Astrophys. J.* **673**, L71 (2008)
[b] N. Sakai *et al. Astrophys. J.* **672**, 371 (2008)
[c] N. Sakai *et al. Astrophys. J.* **667**, L65 (2007)