N-BEARING MOLECULES IN THE PROTOSTELLAR ENVELOPE OF AFGL 2591

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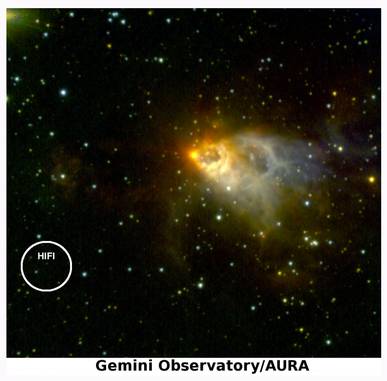
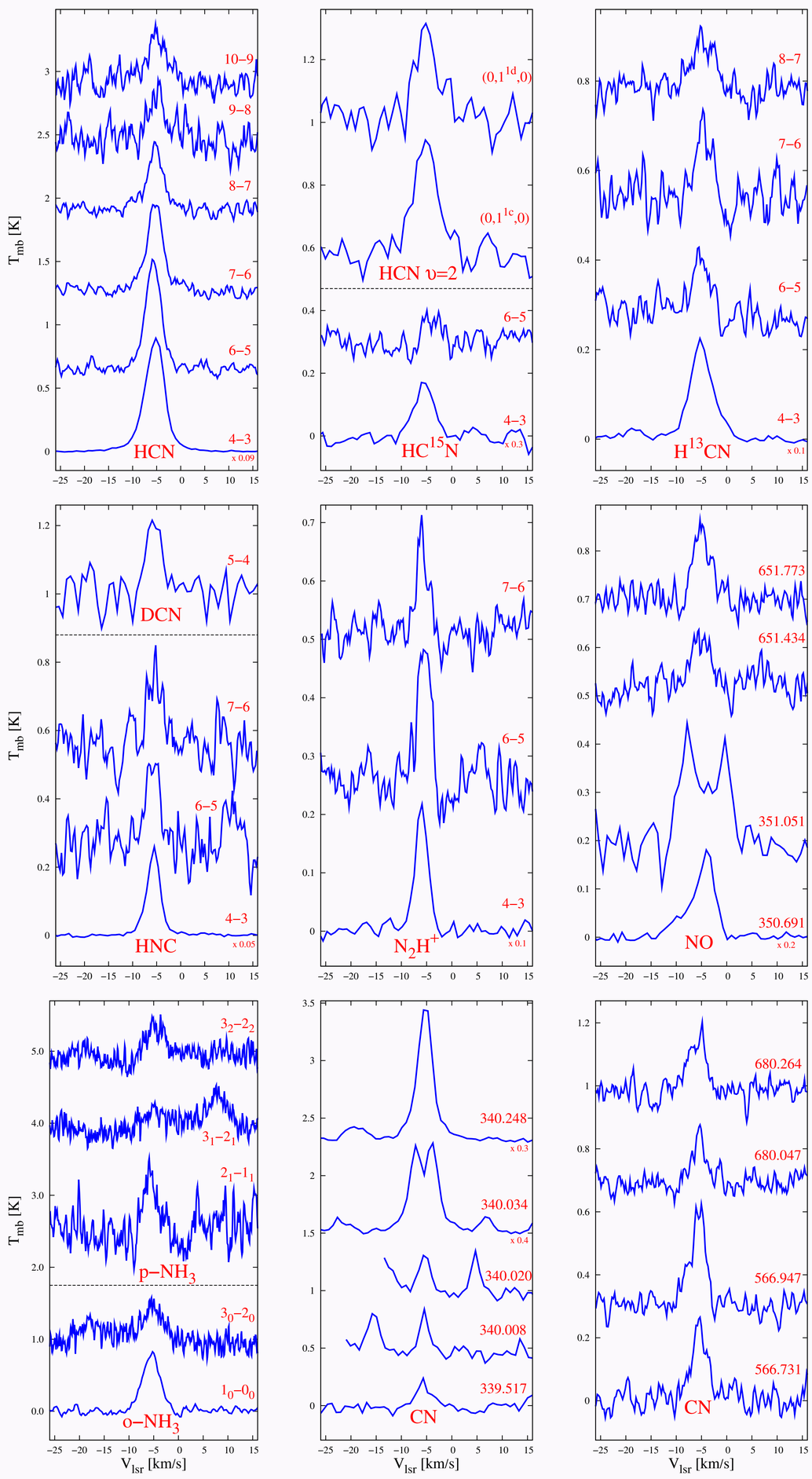
1. AFGL 2591



- AFGL 2591 – high mass protostellar object with a bipolar outflow (Van der Tak et al. 1999)
- located in the Cygnus X region (l, b)=78.°9, 0.°71
- relatively isolated massive star-forming region
- one of the targets of the CHESS project (Ceccarelli et al. 2010)
- luminosity = 2×10^5 $L_\odot$ (Sanna et al. 2012)
- distance = 3 kpc (Rygl et al. 2012)

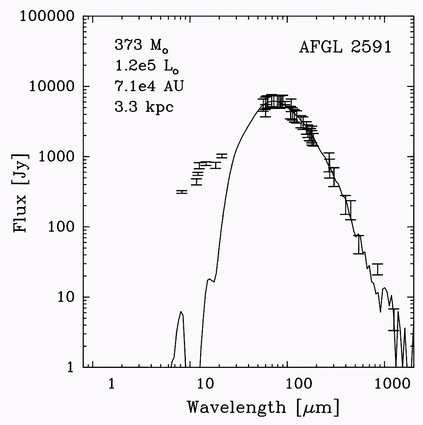
2. Line profiles (HIFI & JCMT data)



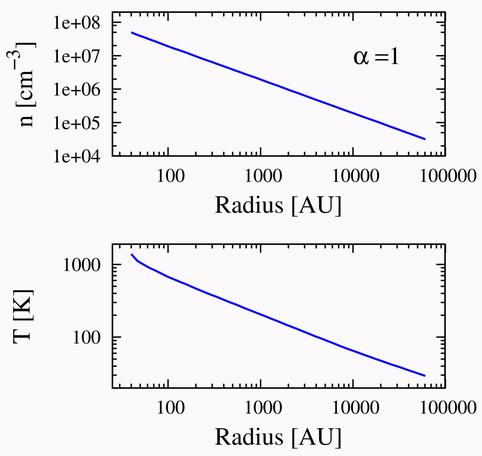
3. Excitation analysis

- Based on population diagrams method (Goldsmith & Langer 1999), N-bearing molecules represent cold species, with the excitation temperatures below 50 K.
- In contrast several warm species were found (e.g. CH_3OH, SO, SO_2) with temperatures above 100 K.

4. Physical model



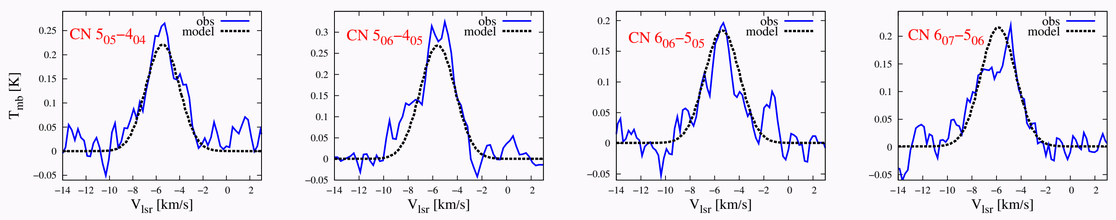
For more details see (Van der Tak et al. 2013).



5. Radiative transfer analysis

Abundances were estimated using Ratran code (Hogerheijde & van der Tak 2000).

- Some molecules are evenly distributed through the envelope: $[N_2H^+] = 5 \times 10^{-10}$, $[NO] = 2 \times 10^{-8}$ and $[CN] = 8 \times 10^{-11}$.



- HNC, HCN and its isotopologues are more abundant in the inner envelope, when T > 230 K ($[HCN] = 1 \times 10^{-5}$, $[HNC] = 3 \times 10^{-7}$), than in the outer part of the envelope (when T < 230 K, $[HCN] = 1 \times 10^{-7}$, $[HNC] = 3 \times 10^{-7}$). This temperature was predicted by the chemical models in which most of the atomic oxygen is driven into water. As a result atomic C and N abundances are higher, thus HCN abundance is increased as well at T > 230 K.

(For more info about jump model at 230 K, see e.g. Boonman et al. 2001.)

- NH_3 is concentrated in the inner part of the envelope, when T > 100 K, i.e., where water ice evaporates, with an abundance of 6×10^{-7}.

(For more info about jump model at 100 K, see e.g. Van der Tak et al. 2006).

6. Conclusions

The envelope of AFGL 2591 consists of 3 chemical zones, separated by the onset of water ice evaporation (T∼100 K) and high temperature gas phase oxygen chemistry (T∼230 K).

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