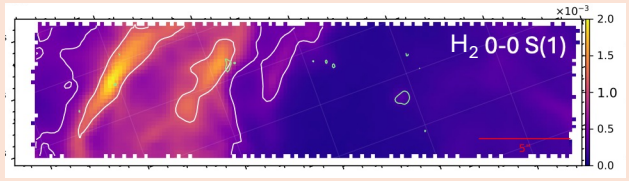
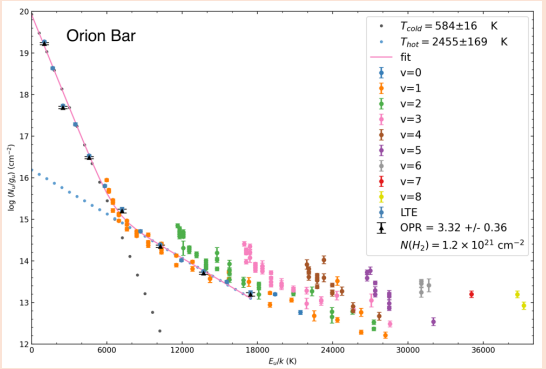
The fundamental structure and physical conditions of the Orion Bar as seen by JWST and ALMA

JWST

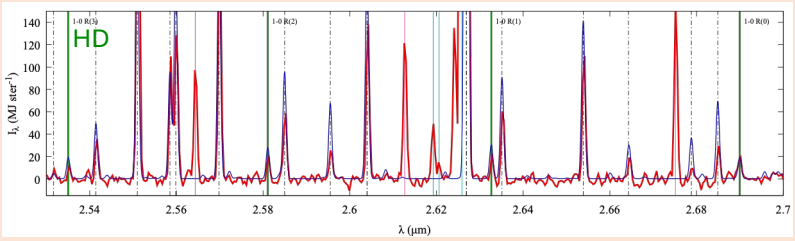
Zannese, Sidhu+in prep, Zannese+2026



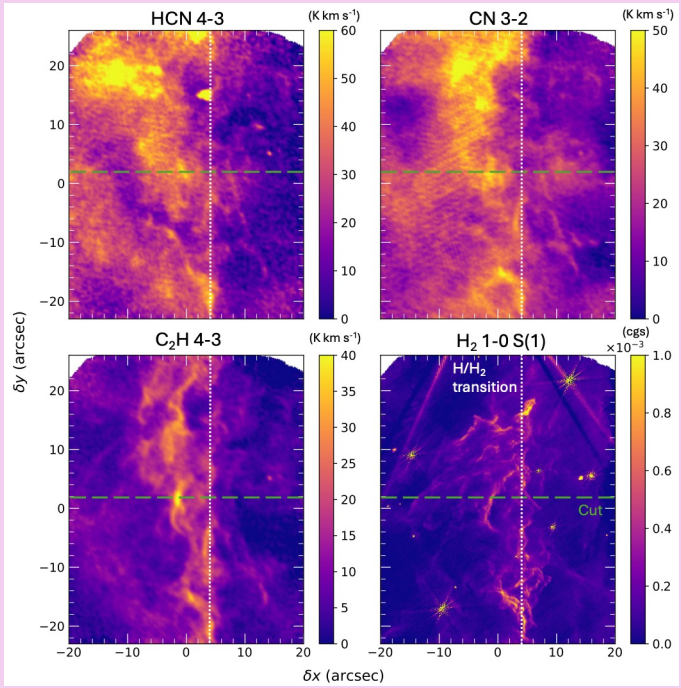


- Detection of hundreds of H_2 lines

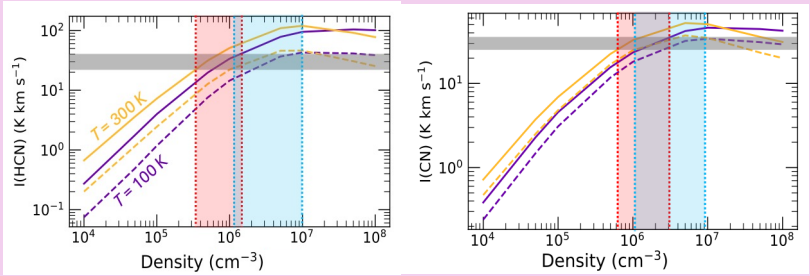
- Rotational lines thermalized
  → Tracer of temperature in the dissociation front : T_{gas}(DF) ~ 600 K
- Estimation of density from the size of the emission
  → n_H(DF) ~ 2 x 10^5 cm^{-3}



- Meudon PDR model : P_{gas} = 5 x 10^7 K cm^{-3}
  → n_H ~ 10^5 cm^{-3}



- No clear evidence of small high-density clumps
- HCN and CN peak very close the H/H_2 transition

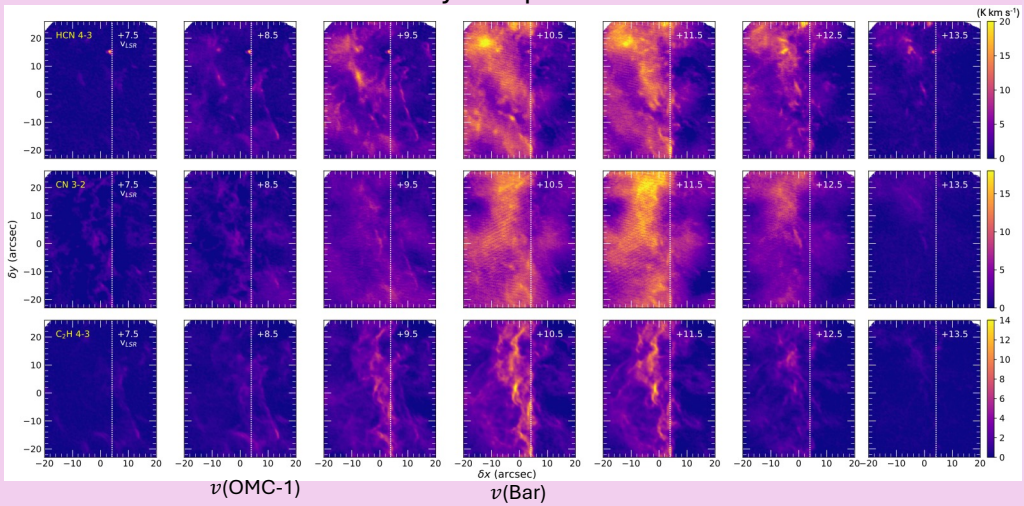


- Comparison with RADEX models
  → n_H ~ 5 x 10^5 – 2 x 10^6 cm^{-3}

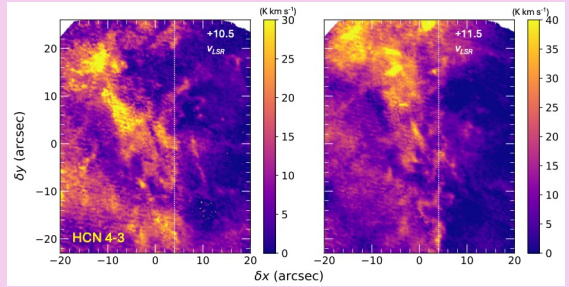
ALMA

Zannese, Goicoechea+subm

Velocity components



→ Two observed components in HCN emission : 10.5 km s^{-1} & 11.5 km s^{-1}



- 11.5 km s^{-1} component associated with:
  - Large clump in the top part of the FOV
  - Small-scales structures observed near the DF
- 1 km s^{-1} ~ estimation of shock velocity
  → Structure observed originated from the propagation of a UV-driven shock compressing the gas

CONCLUSIONS

→ Multi wavelength study (JWST/ALMA) reveals great density gradient (10^5 - 10^6 cm^{-3})
→ No small-scales high density clumps are observed
→ Filamentary structure / Origin: propagation of a UV-driven shock compressing the gas?