

Photo: Alberto Seveso

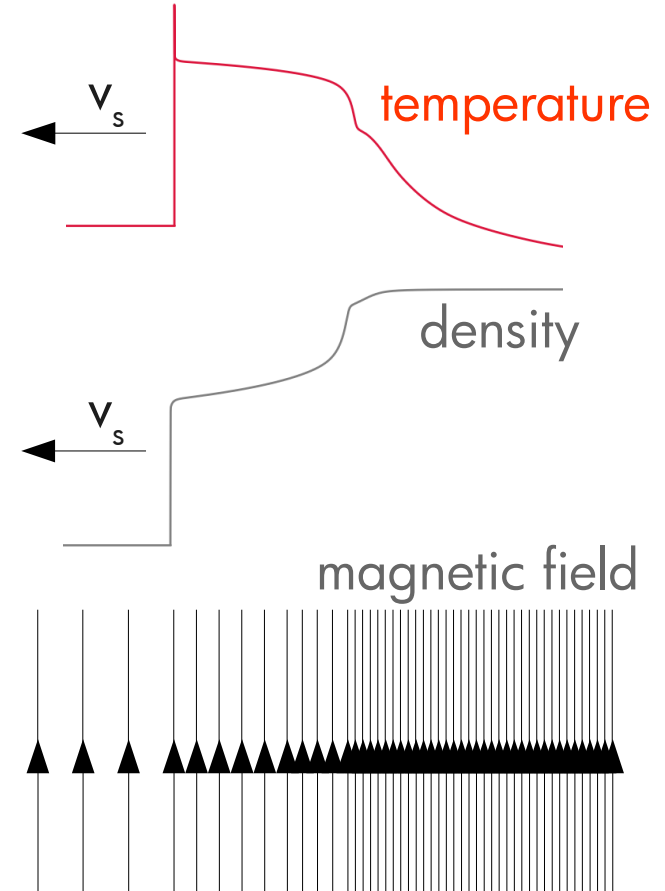
Irradiated and self-irradiated magnetised molecular shocks

Andrew Lehmann (École Normale Supérieure, Paris)

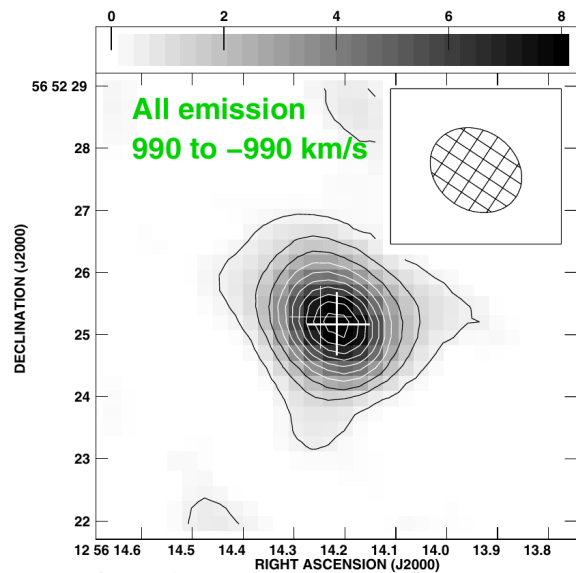


Paris-Durham shock code (Flower, Pineau des Forêts +)

- two-fluid (ion/neut) magnetohydrodynamics
- one-dimensional
- extensive molecular chemistry
- focus on H_2 (rovib levels, dissociation)
- public: ism.obspm.fr

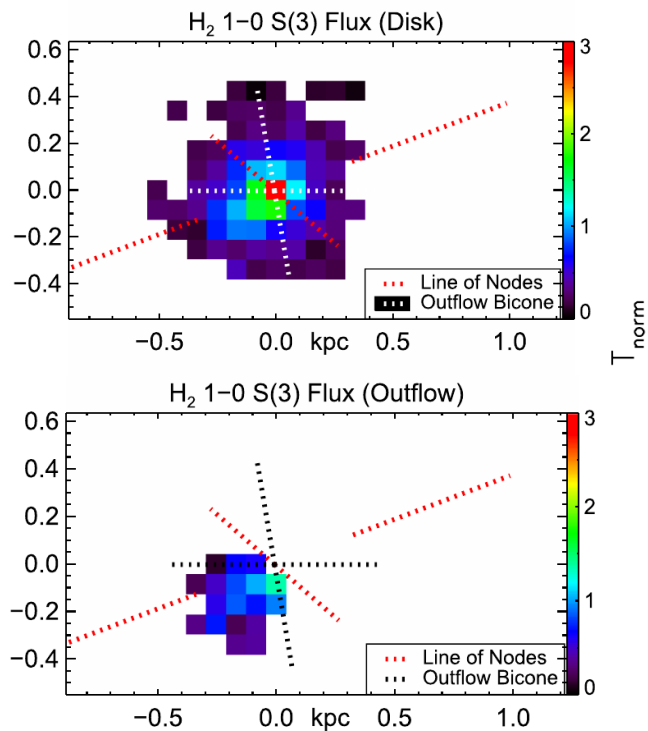


HCN, HNC, HCO⁺



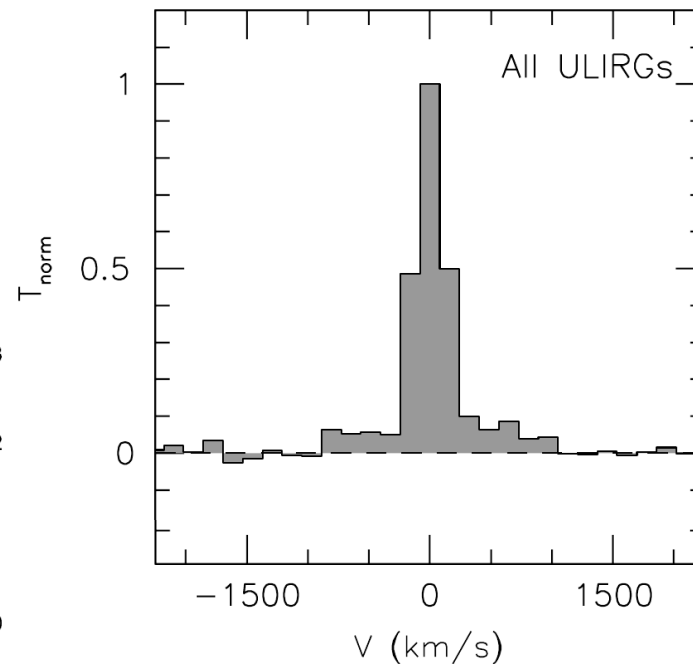
Aalto+12

H₂



Rupke+13

CO

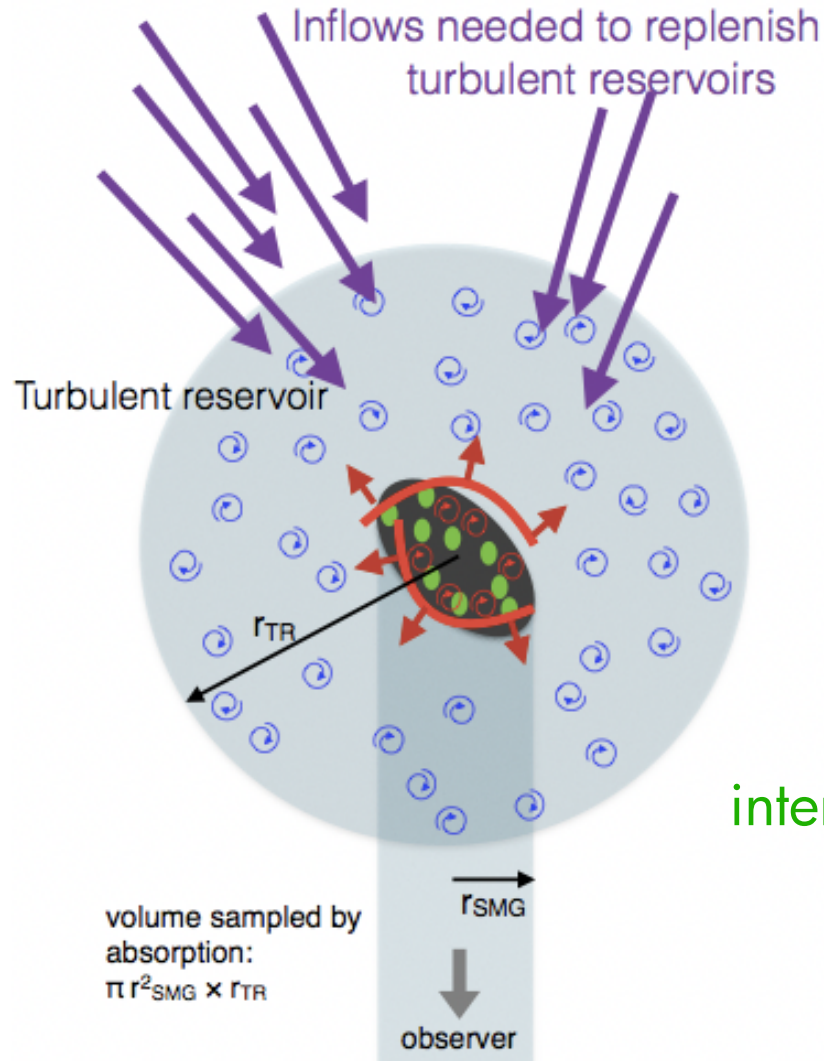


Chung+11

- large Δv
- molecular gas



myriad low velocity
molecular shocks

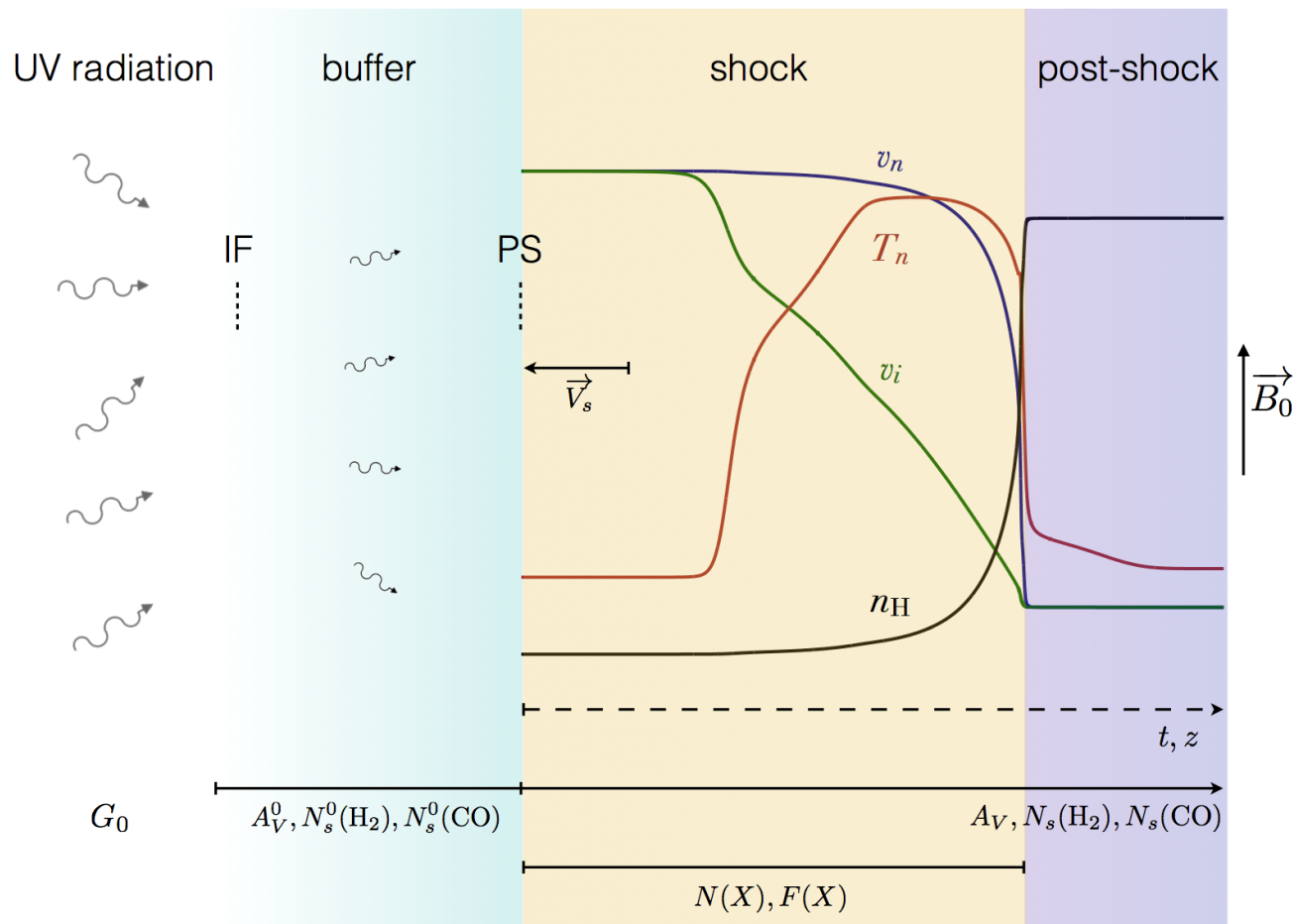


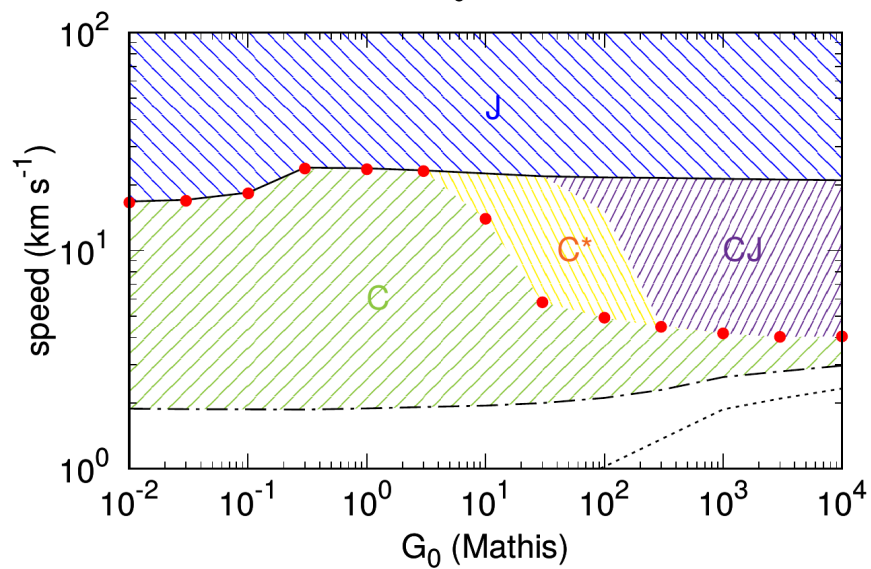
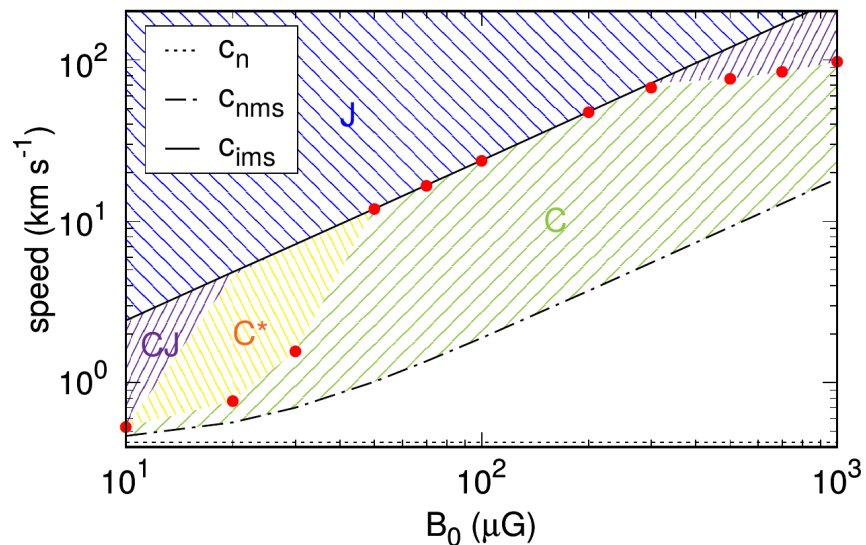
- $L \sim 1 \text{ kpc}$
- $SFR \sim 10^3 M_{\odot}/\text{yr}$



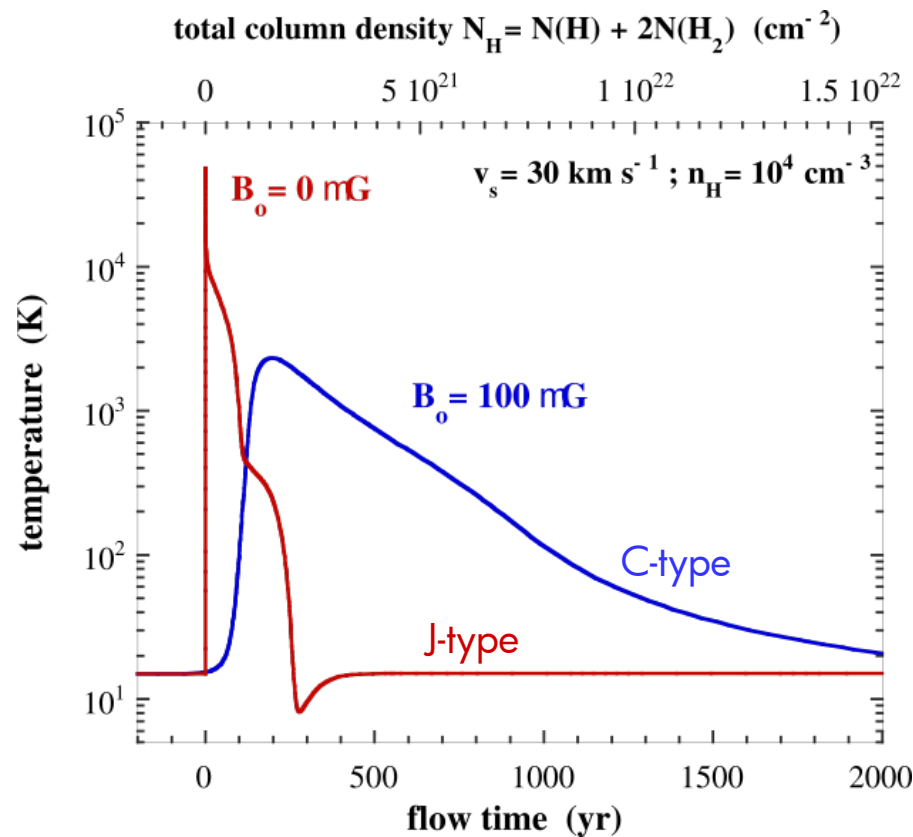
hot and dense
intense UV radiation fields

Externally irradiated shocks (Godard et al. 2019)

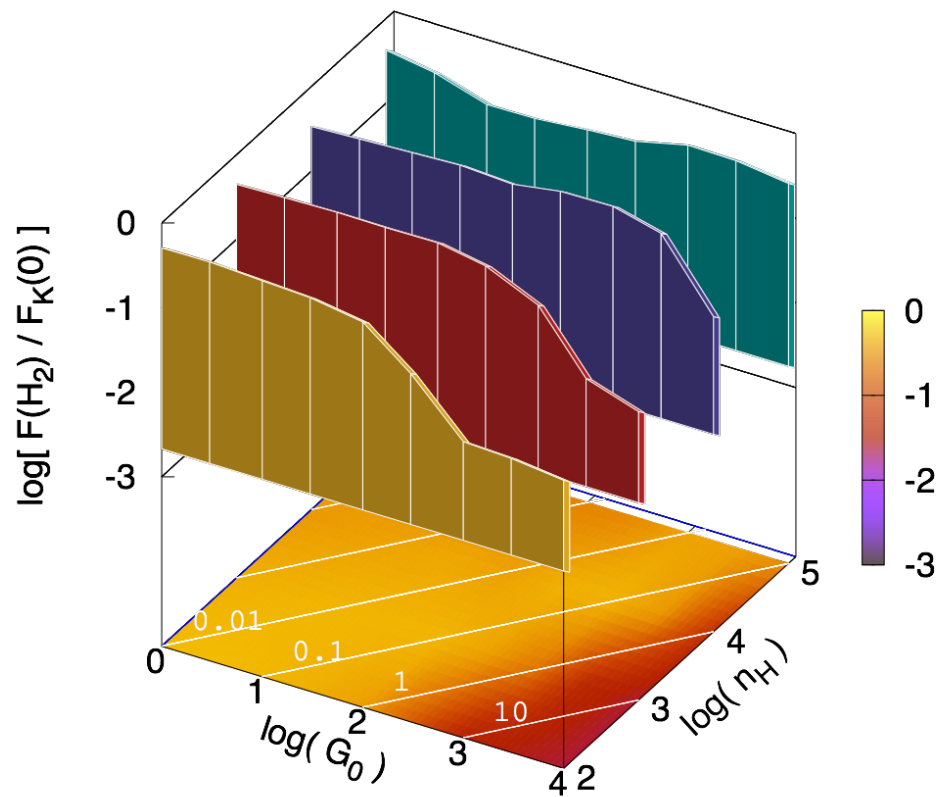




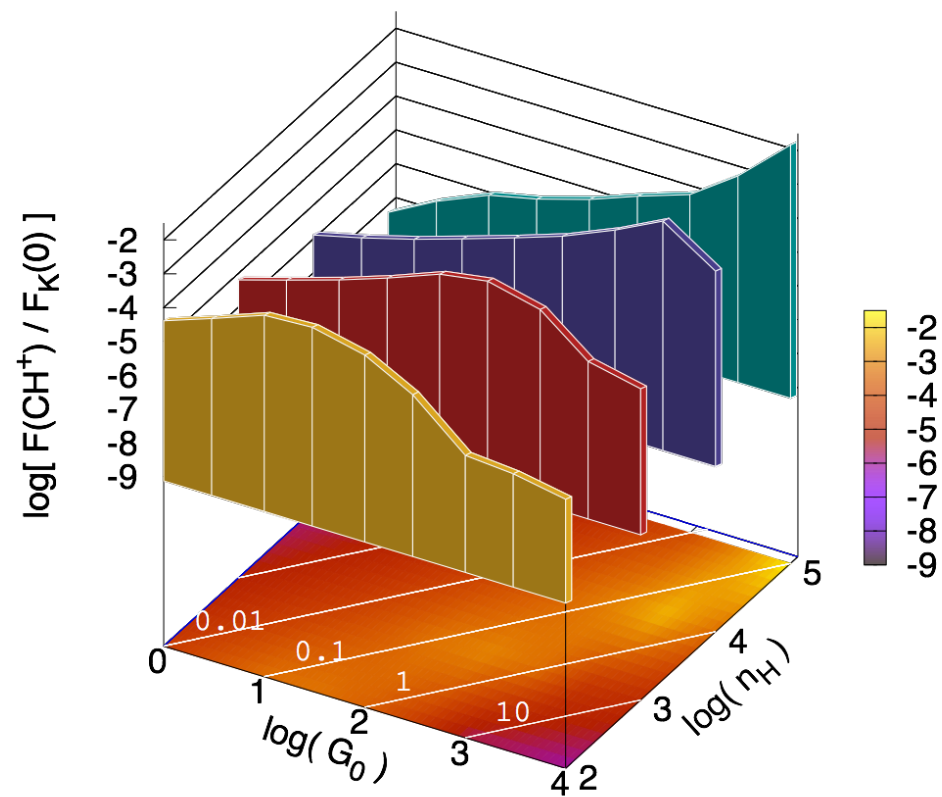
C-type (Continuous)
J-type (Jump)

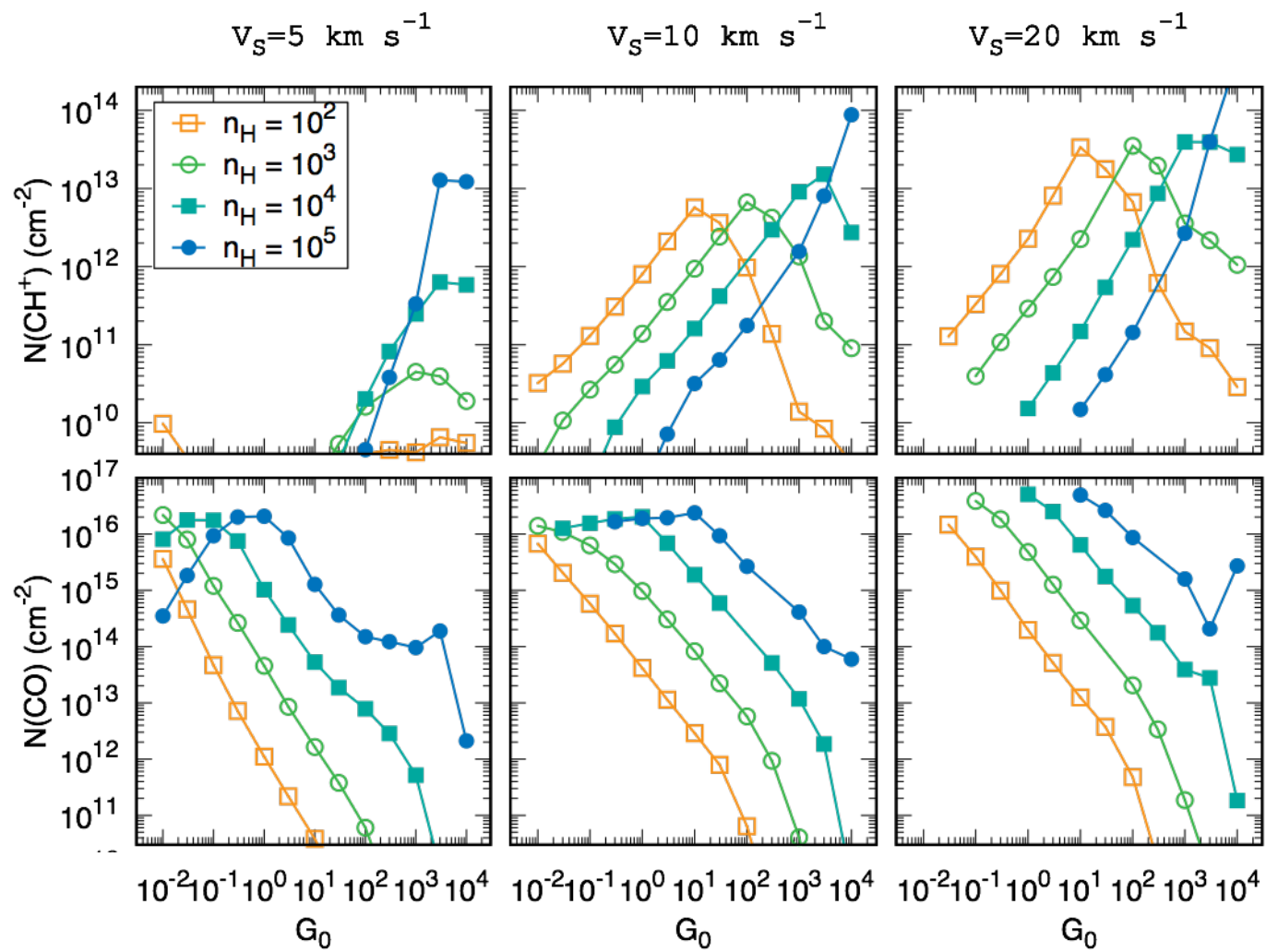


$V_S = 10 \text{ km s}^{-1}$



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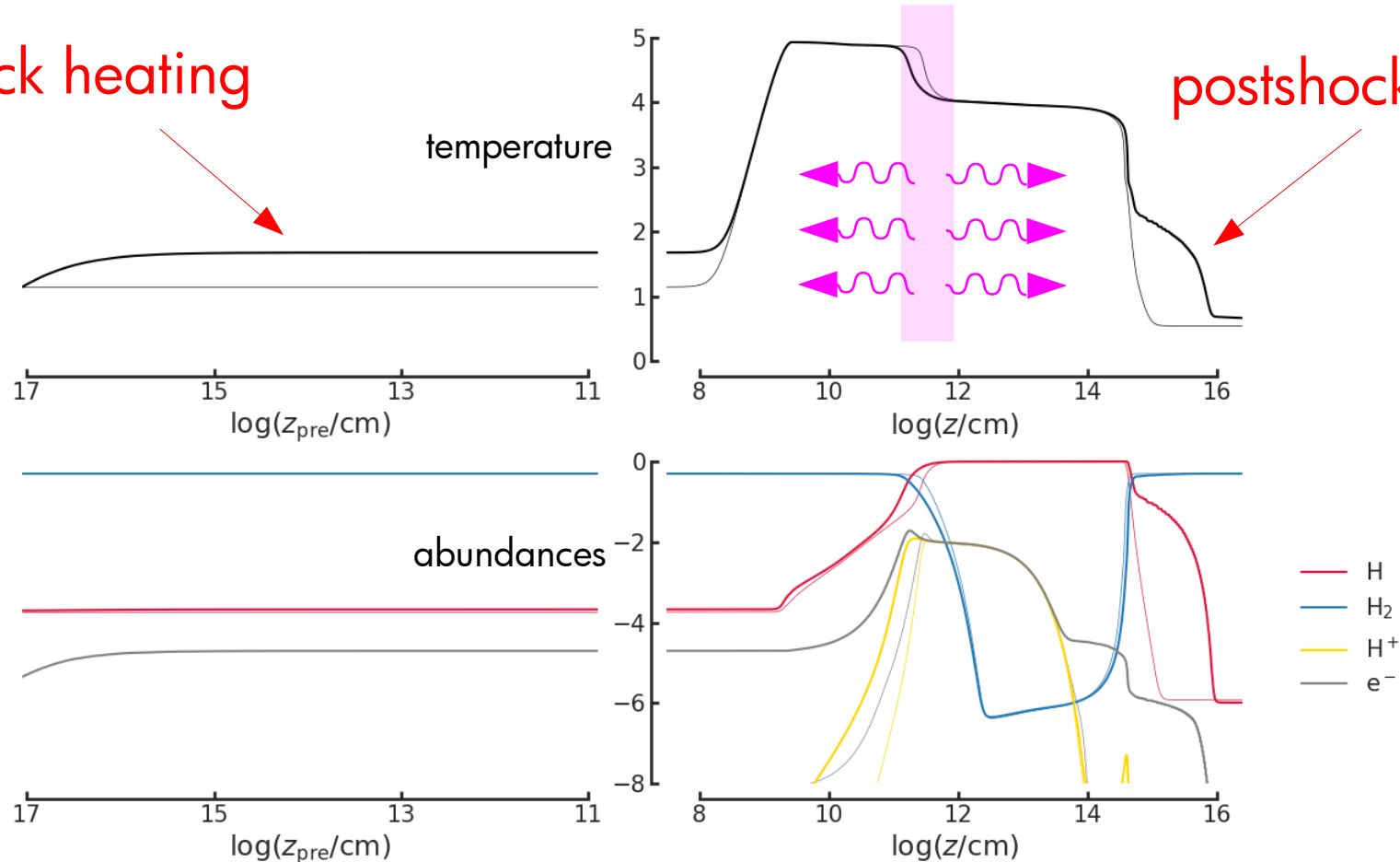


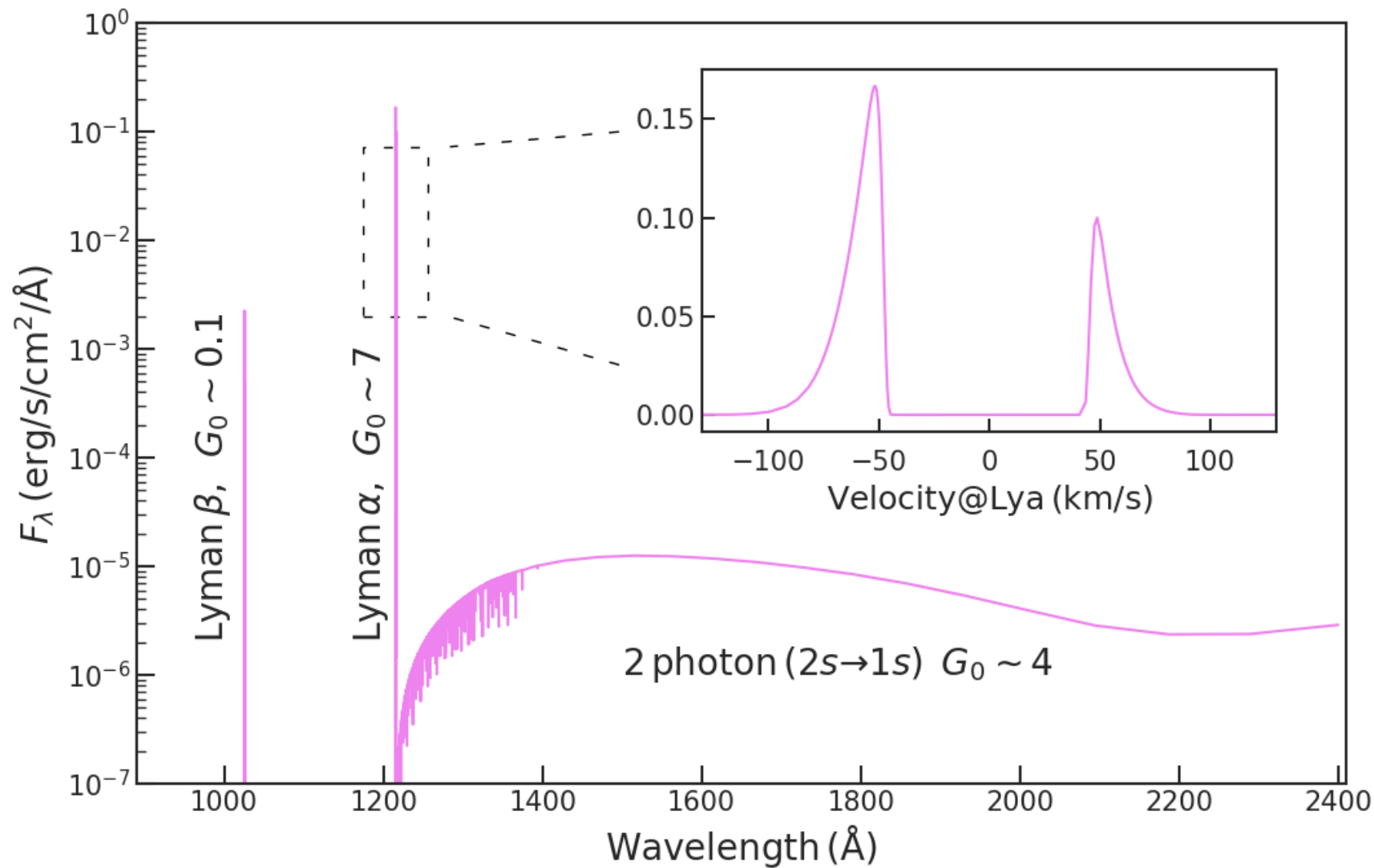


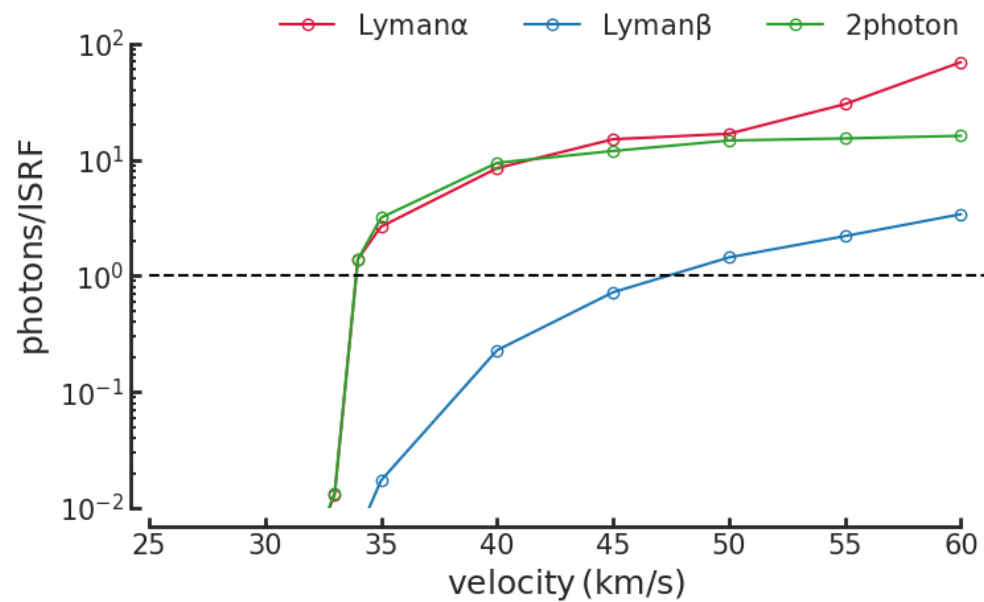
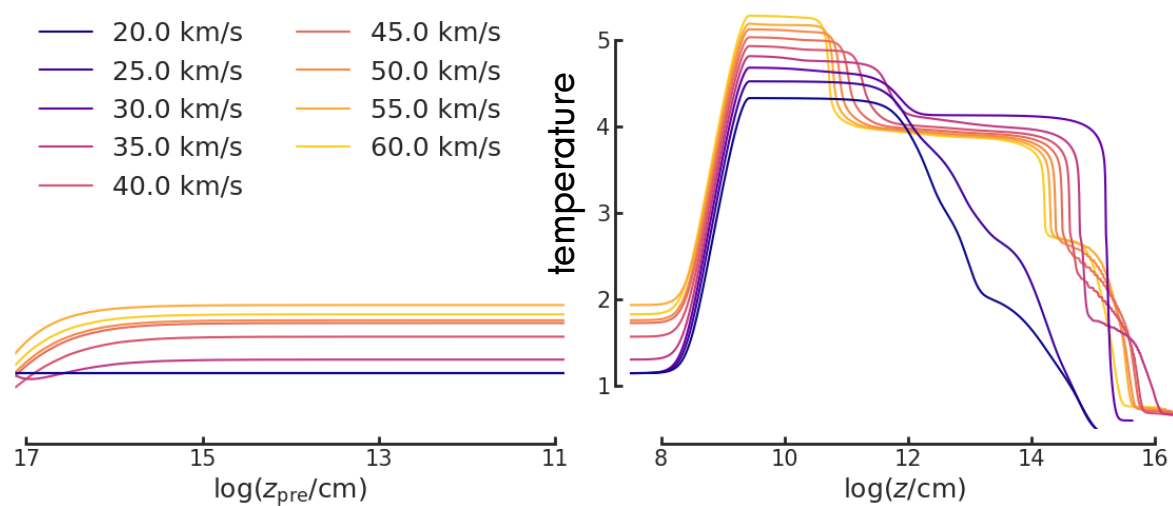
Self-irradiated shocks (Lehmann et al. in prep)

pres shock heating

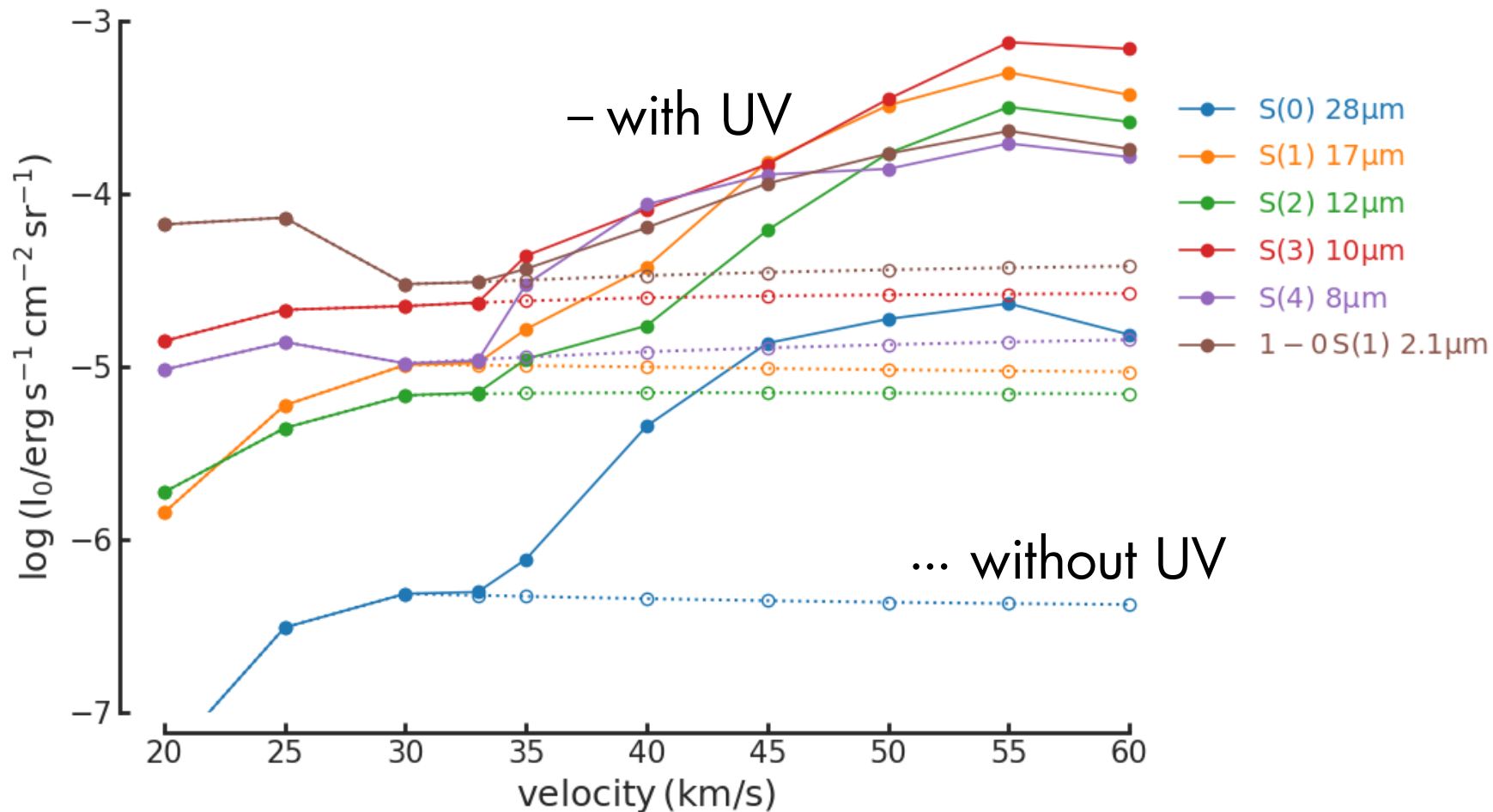
post shock heating







H₂ ro-vibrational lines (150 levels included)



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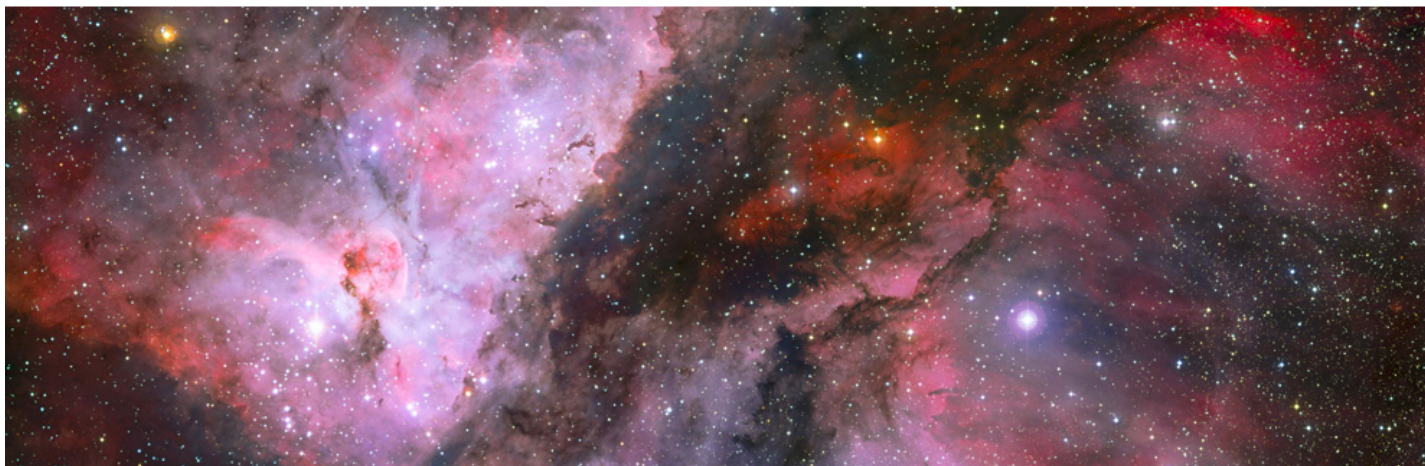
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standards

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REGISTRATION



PDR Code

The Meudon PDR code

DustEM

Dust Emission

Shock

Paris-Durham Shock model

Starformat

MHD simulations data base

Summary

- Magnetic field strength critical in modeling C-shocks
- H_2 is a dominant coolant over wide range of radiation fields and densities
- Molecular shocks must include self-generated UV for velocities $v \geq 35$ km/s
- UV strongly affects pre and postshock heating
- Ro-vibrational lines of H_2 are very different with this treatment

shock speed=40 km/s
density= 10^4 cm^{-3}
magnetic field=10 μG

