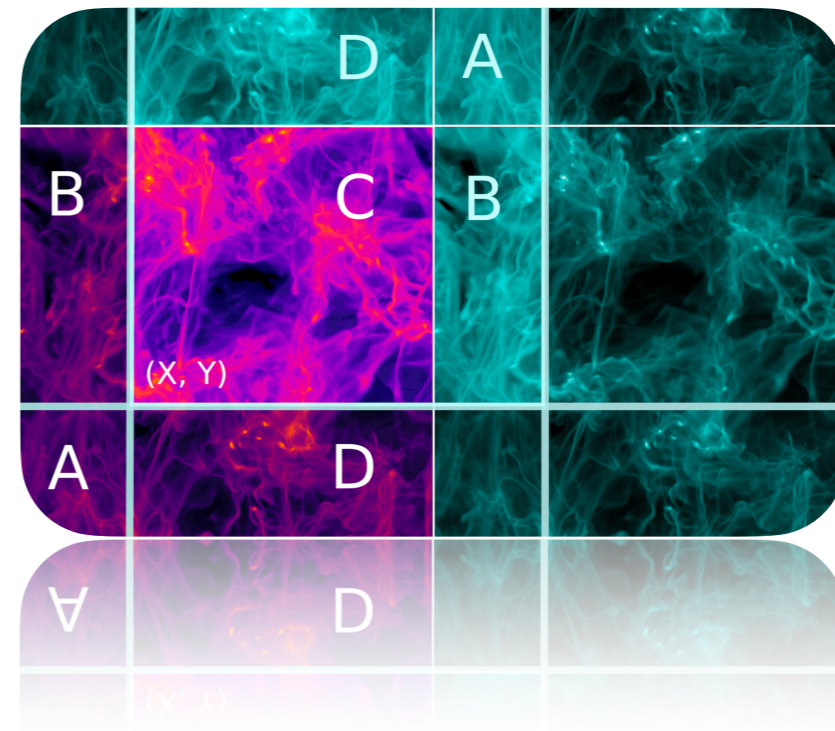
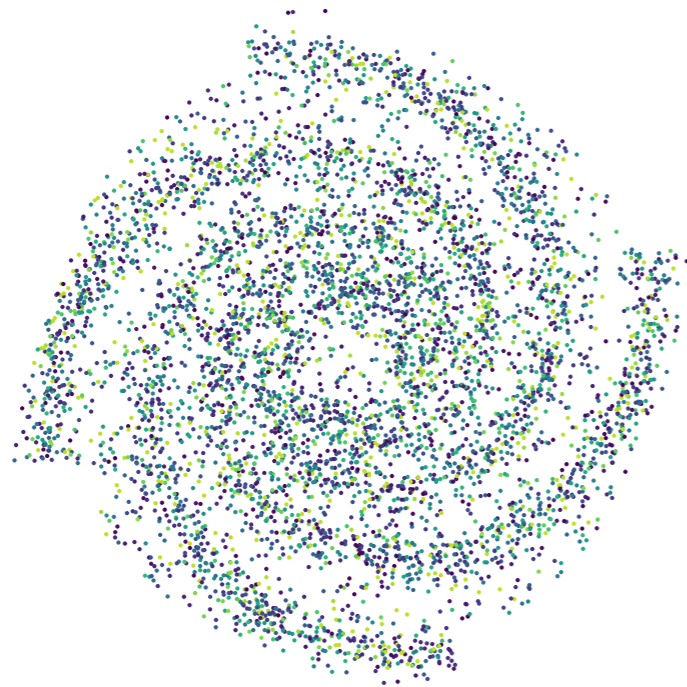
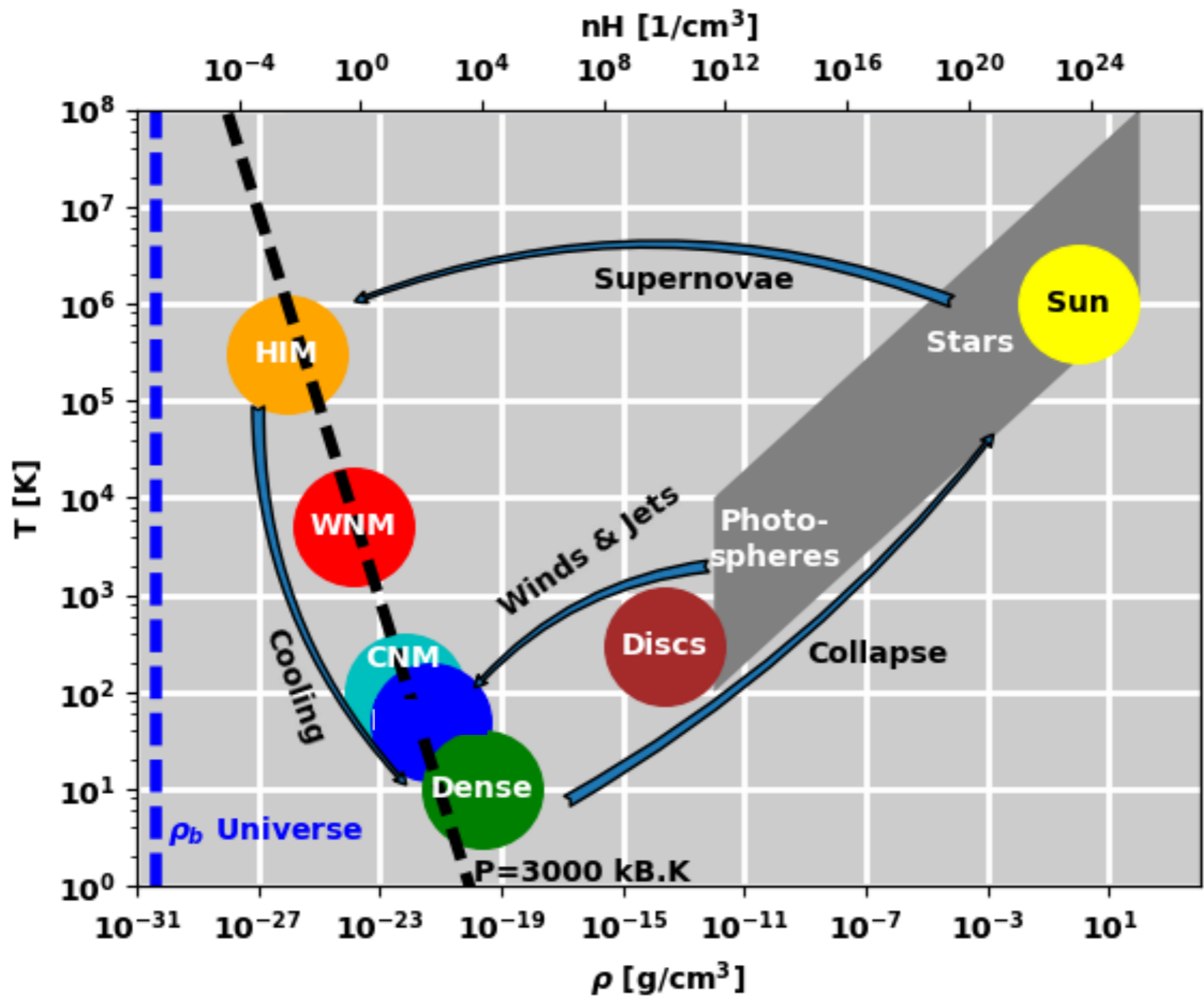


Phase transition shocks in the WNM***

B. Godard, G. Pineau des Forêts, S. Bialy

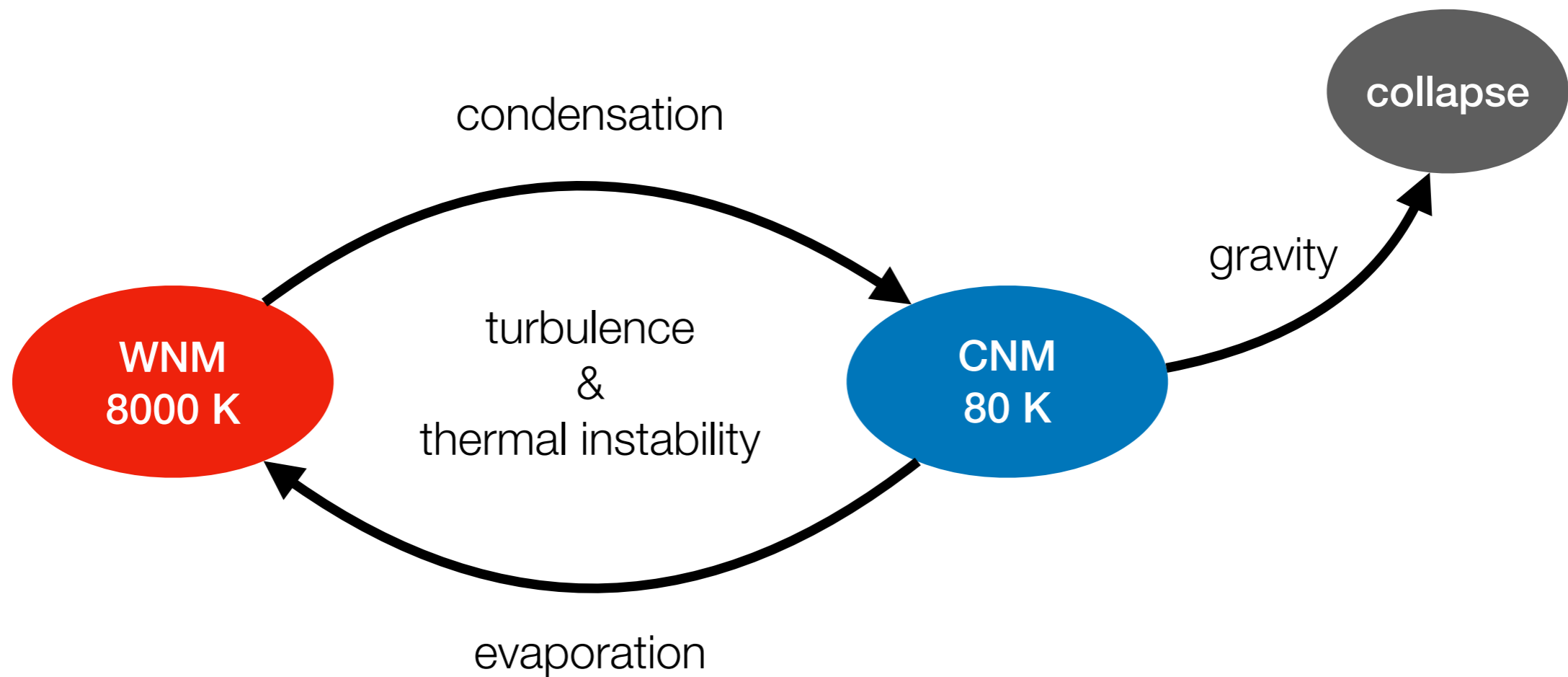


*** Origin of neutral carbon at high pressure

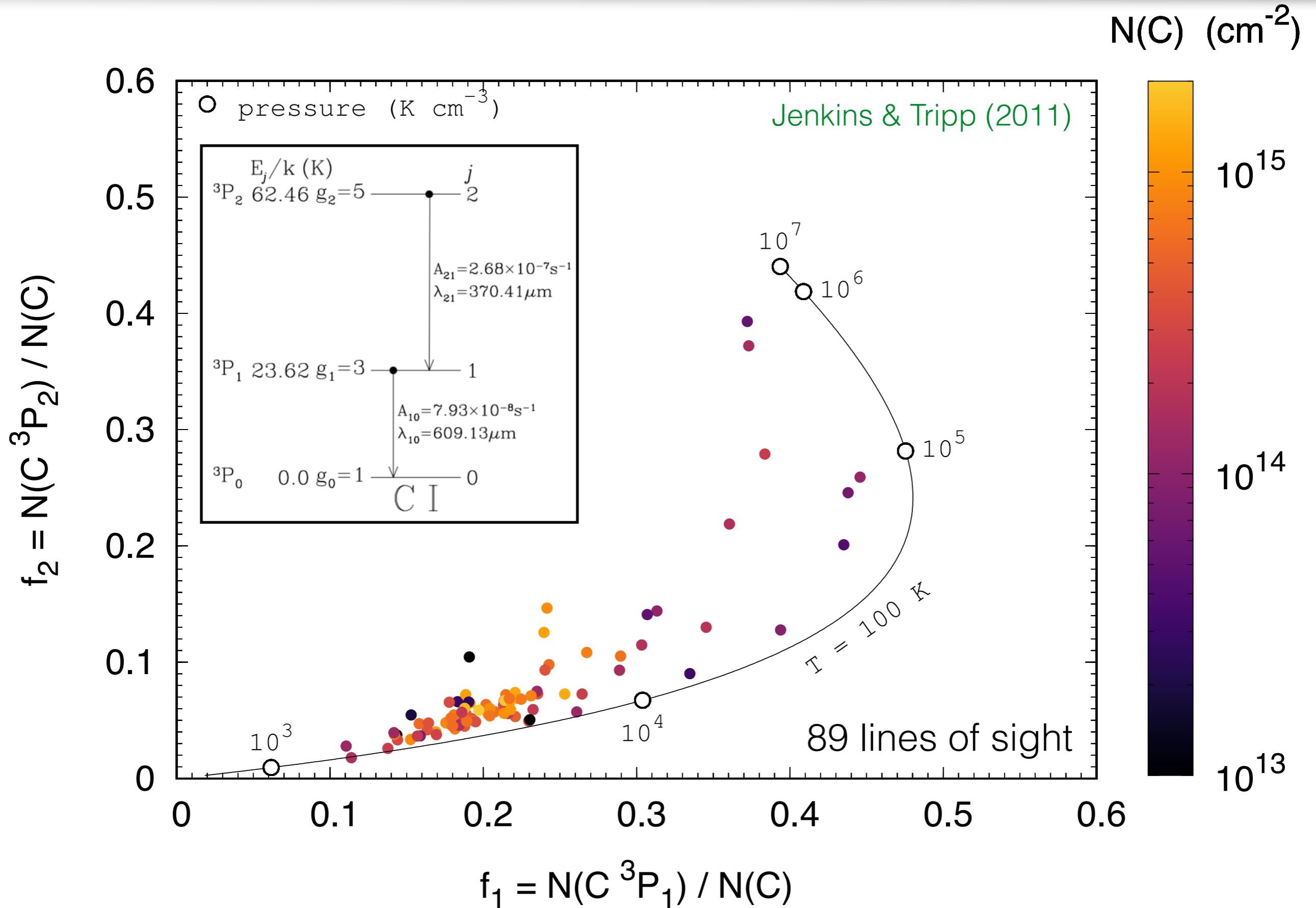


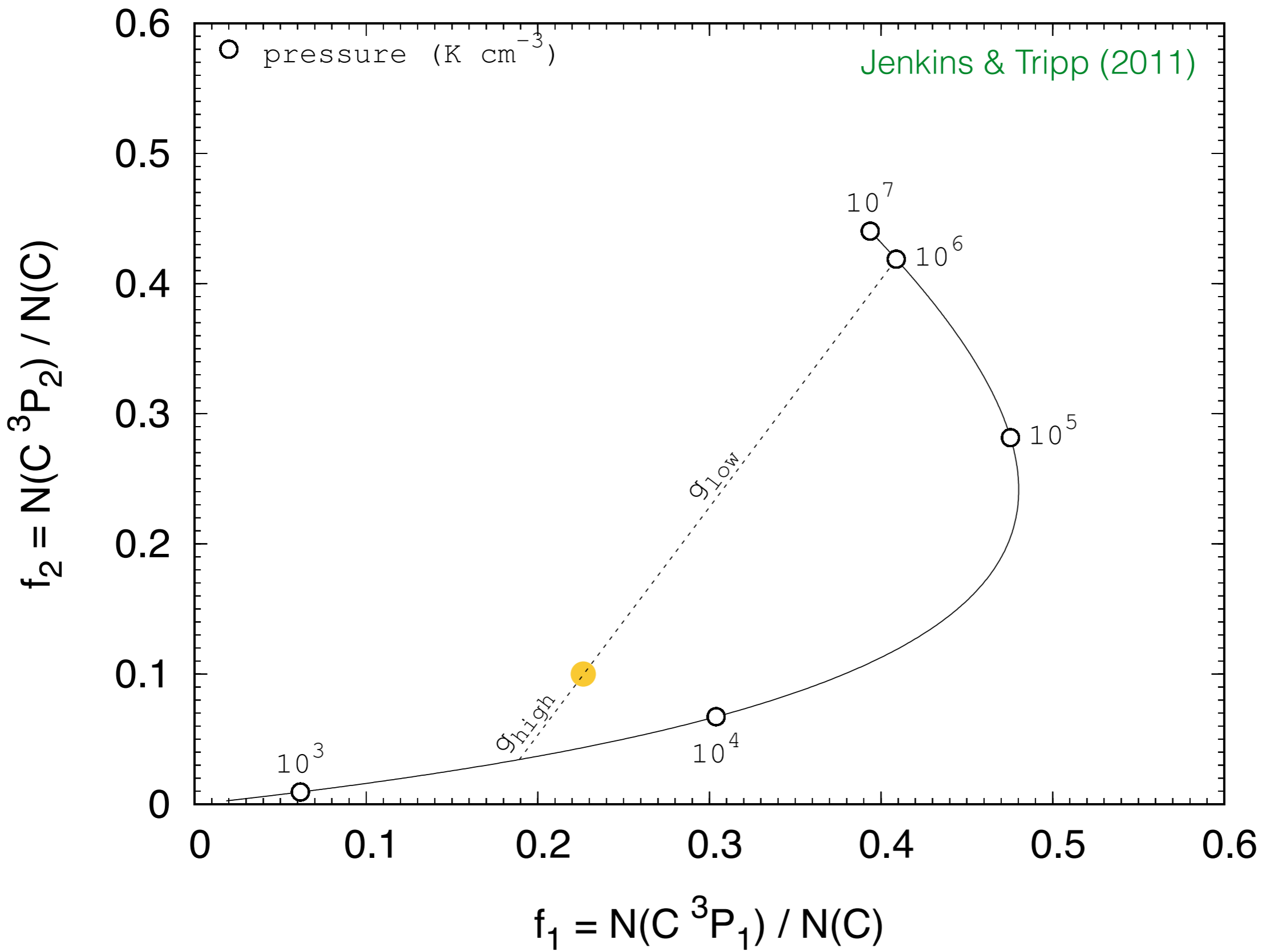
courtesy of P. Lesaffre

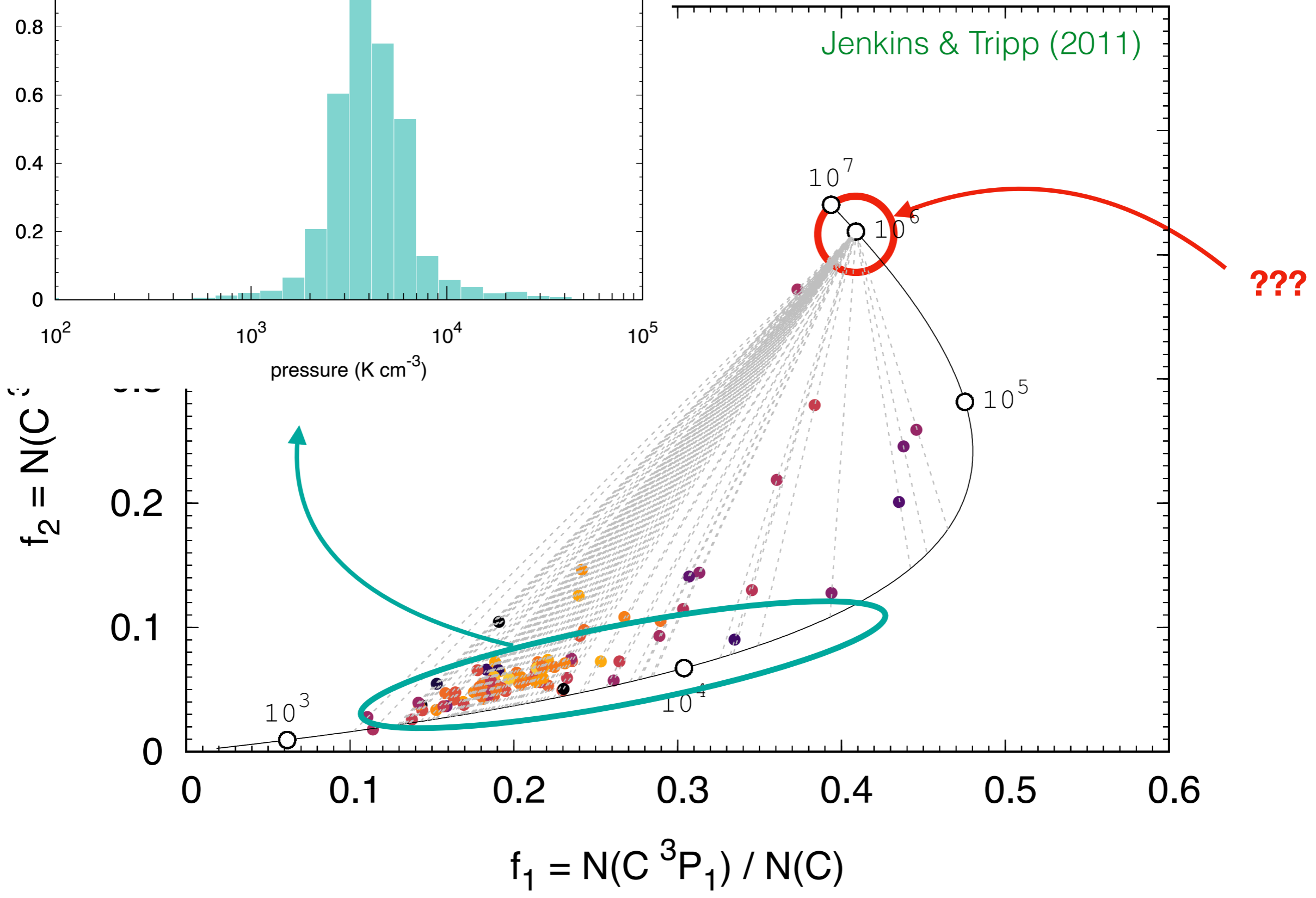
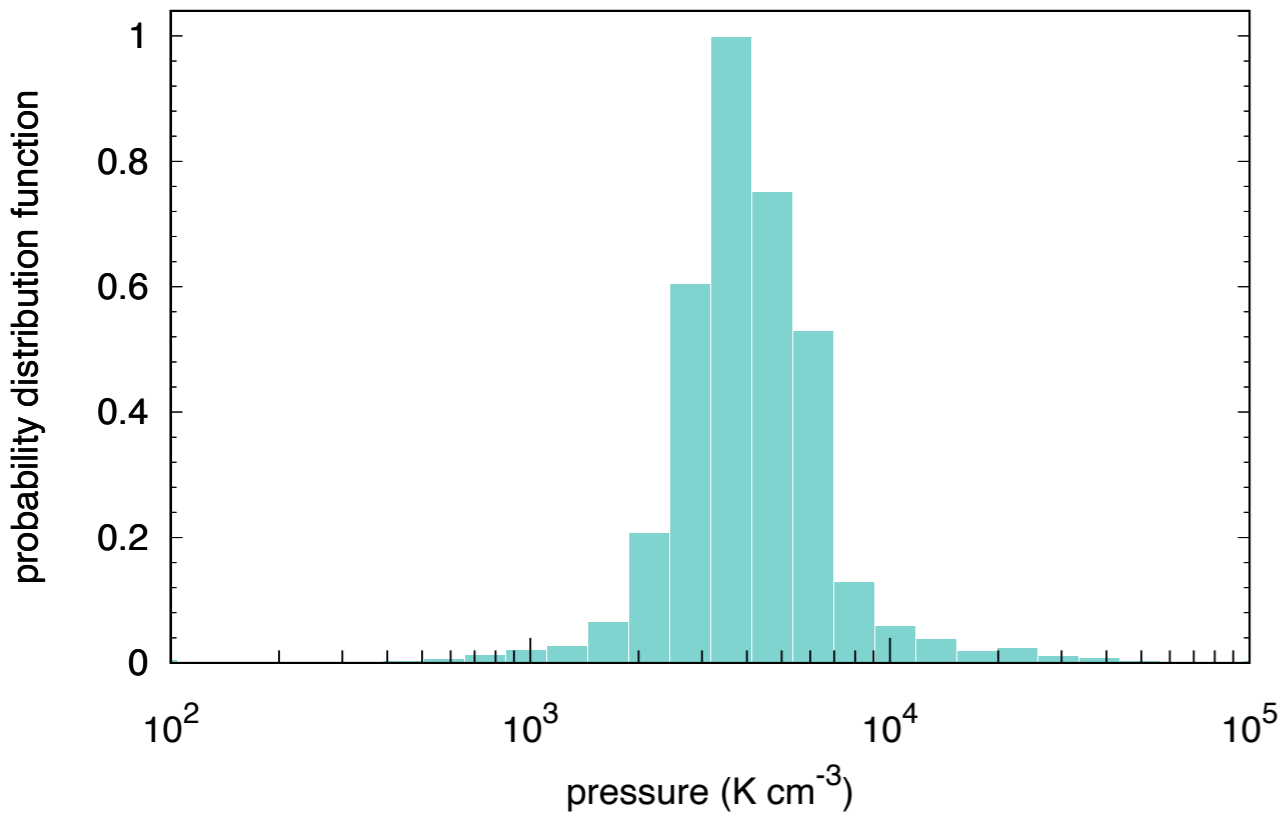
probabilistic evolution



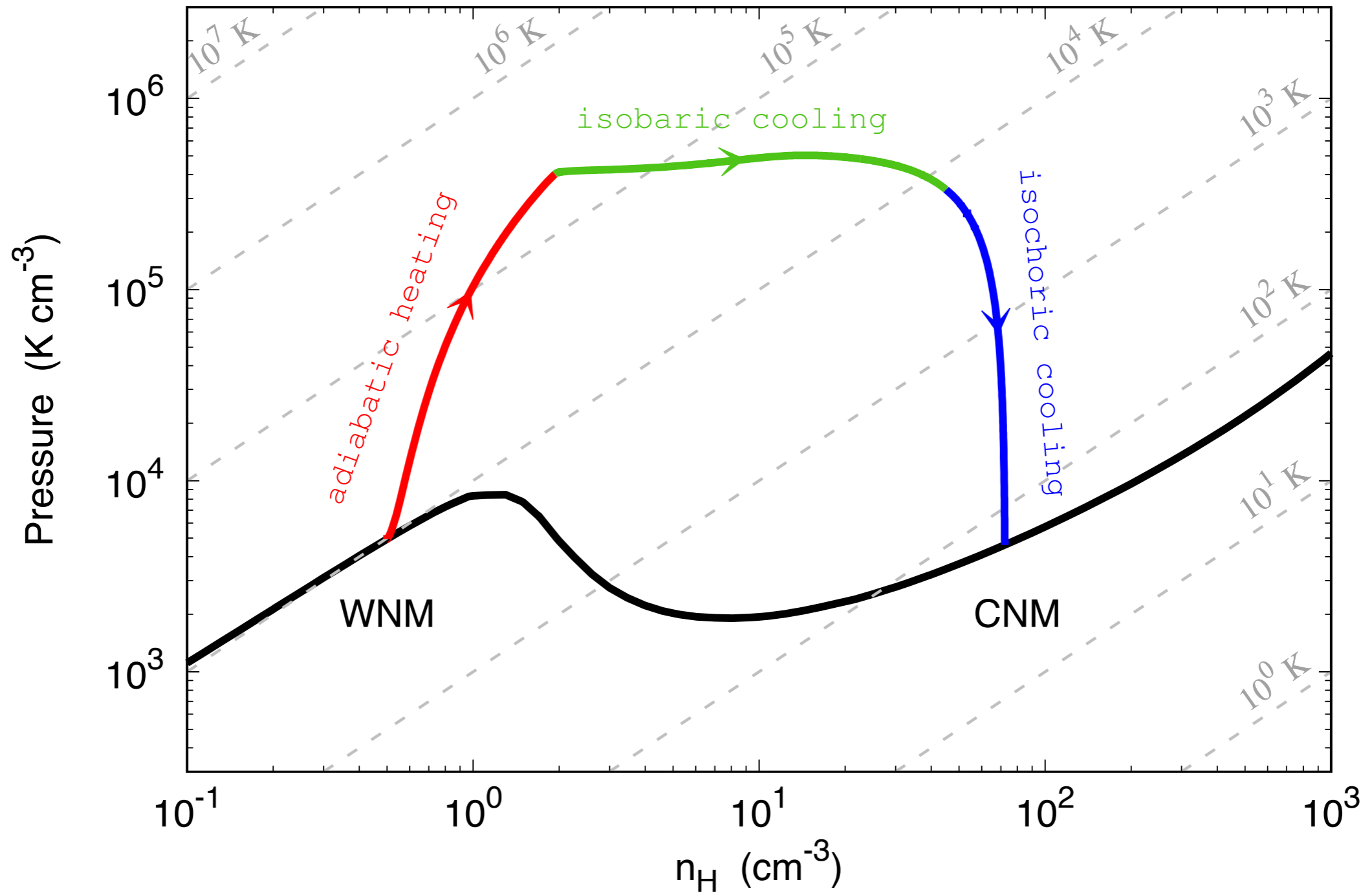
- turbulent cascade in multiphase environment ?
- transfer / dissipation of mechanical energy ?

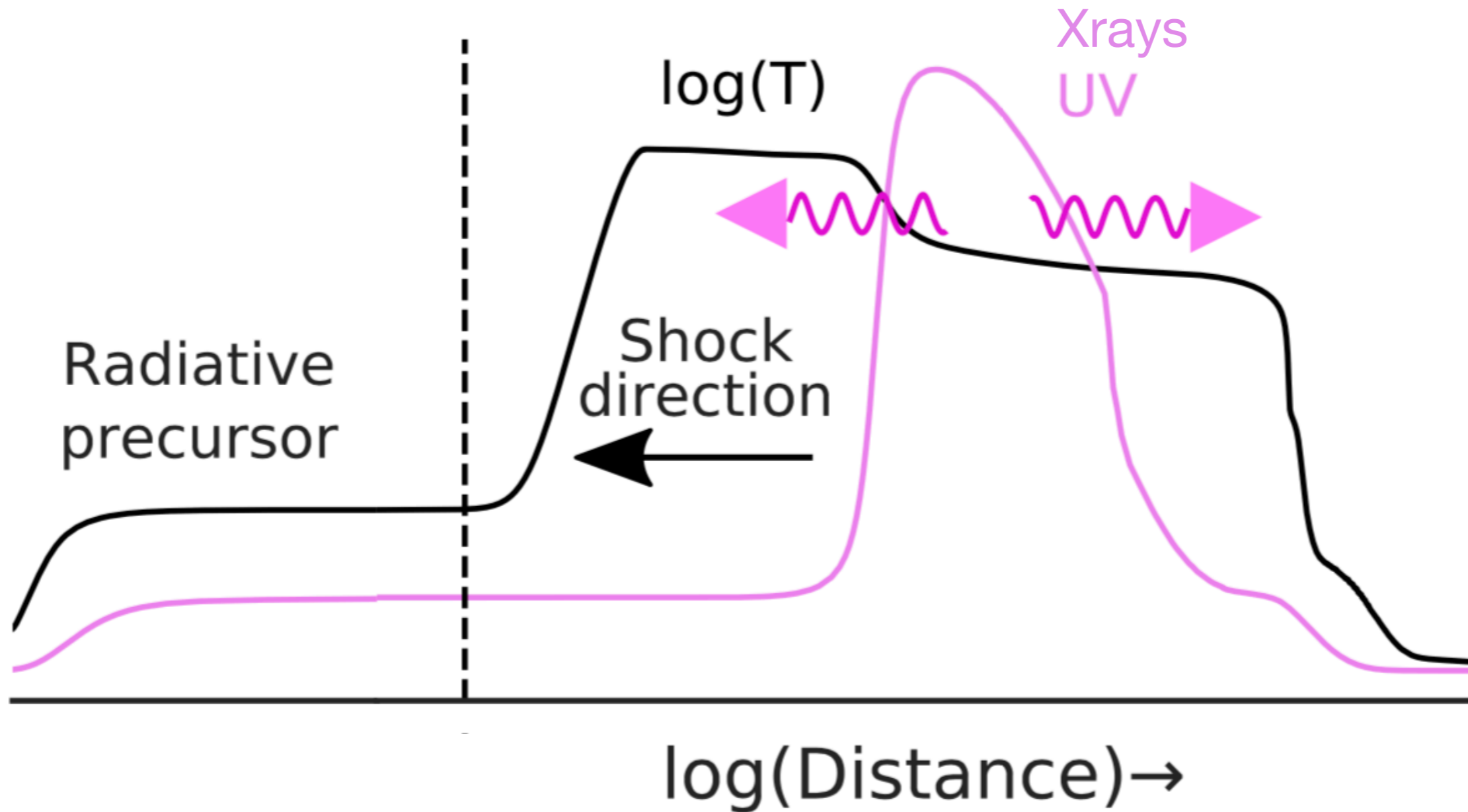






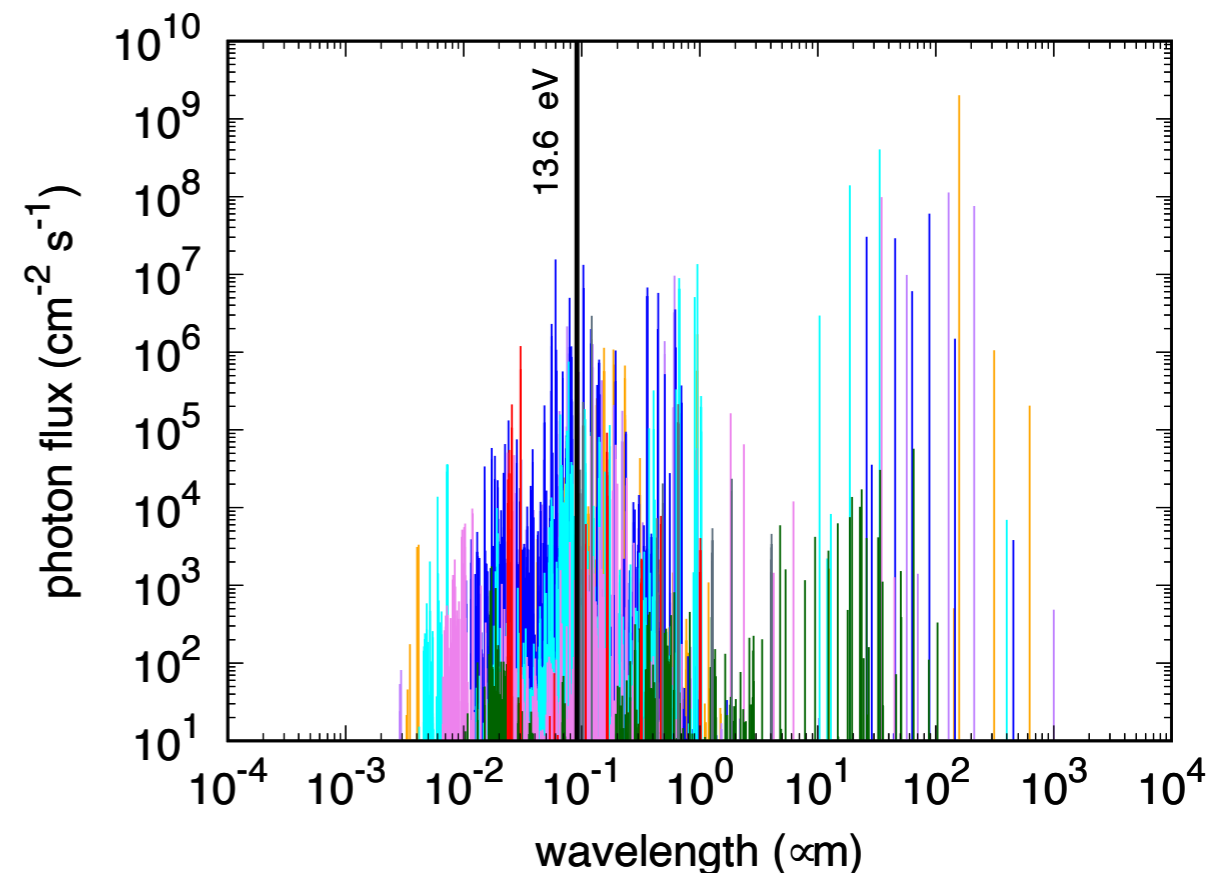
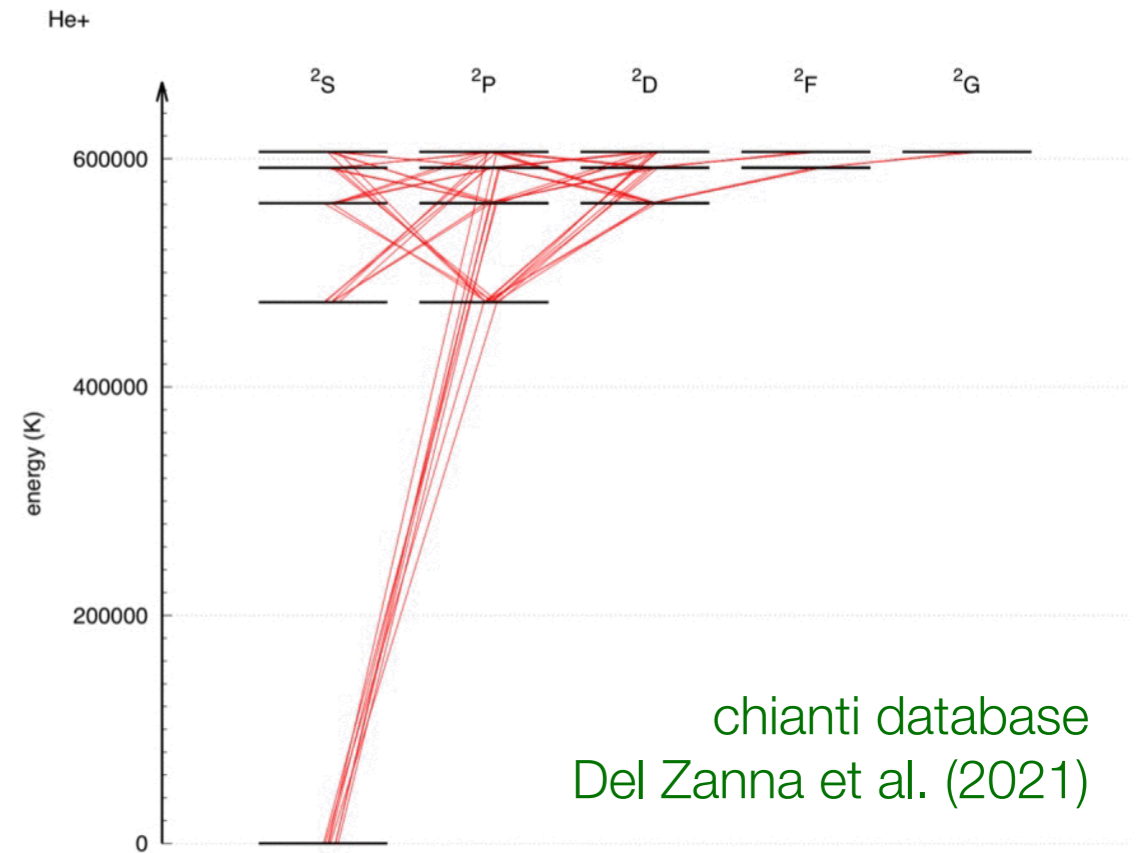
high velocity shocks in the WNM

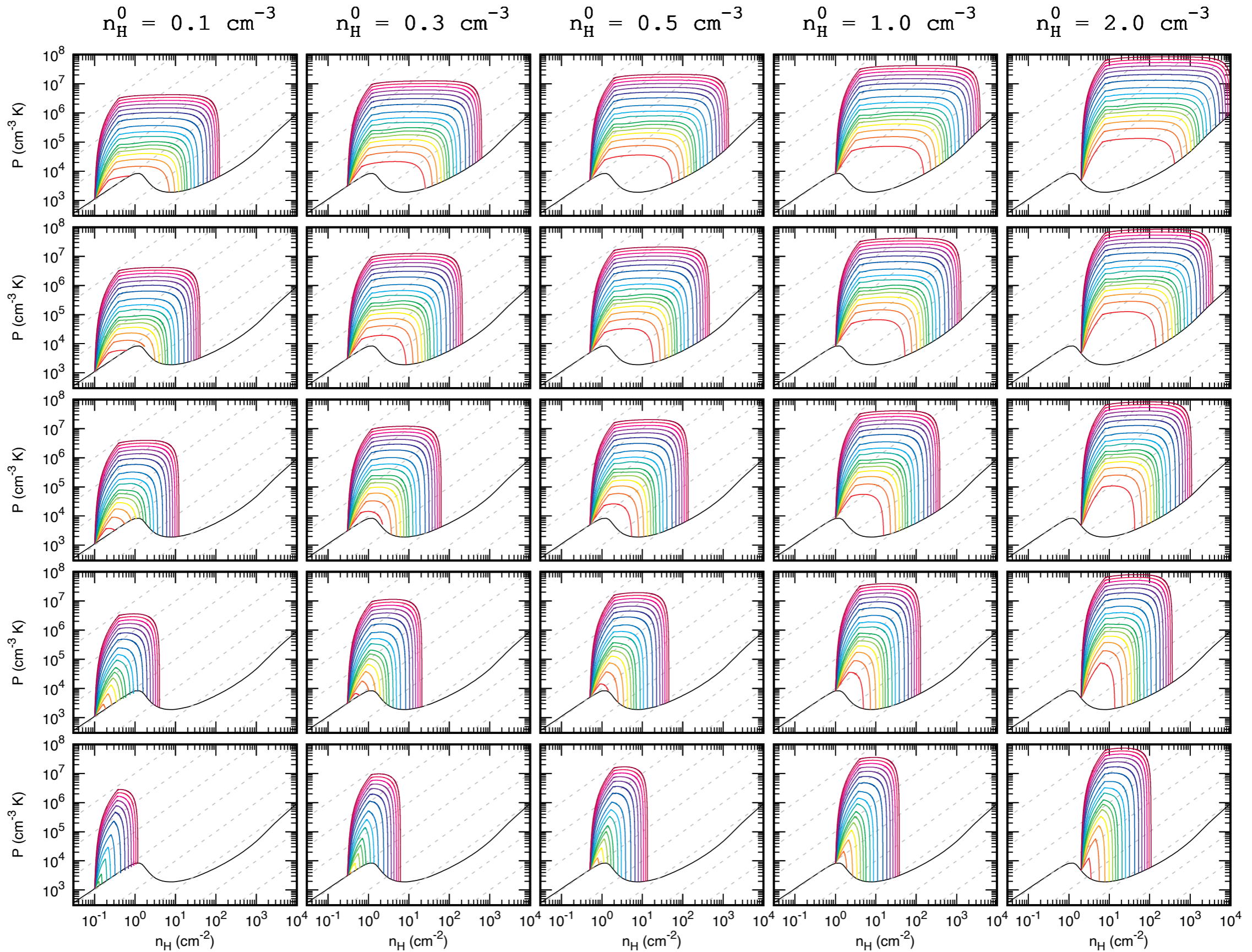


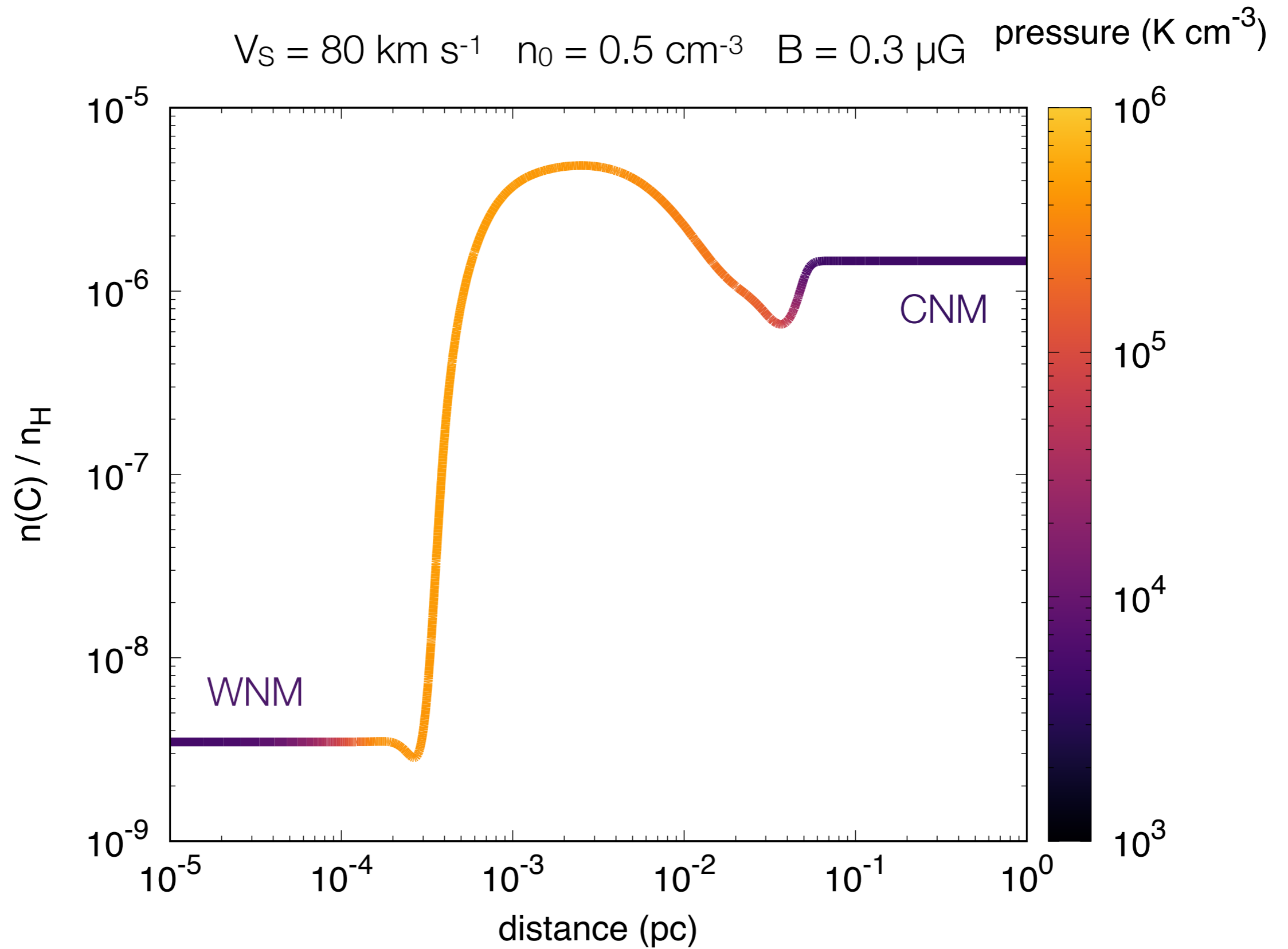


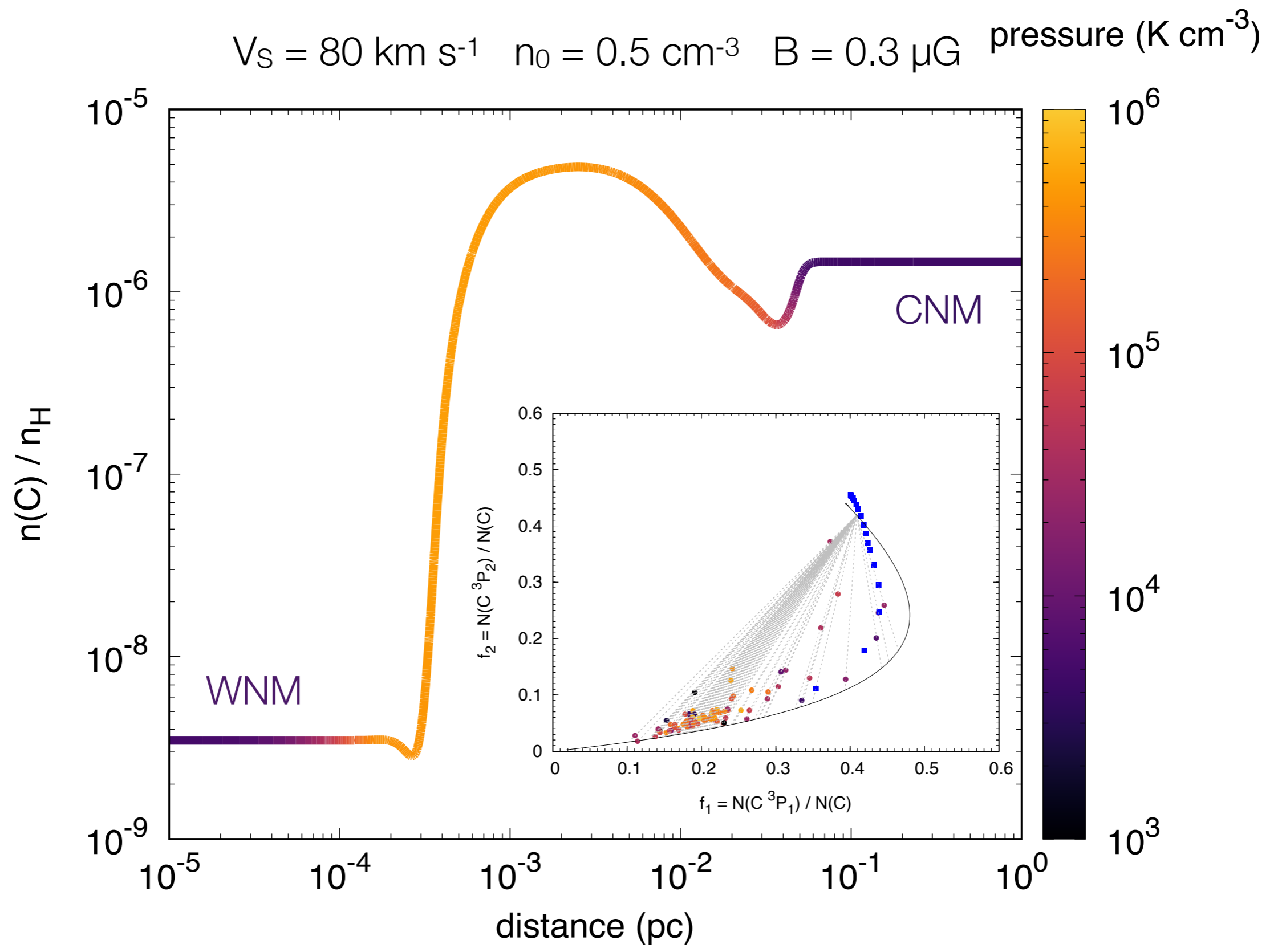
Paris-Durham shock code

- multi-ionized species
 - chemistry (coll / photo ion, recomb)
 - cooling (thousands levels / lines)
 - feedback on shock chemistry
-
- exact radiative transfer
 - iterative scheme
- ↓
- shock velocity up to 500 km s^{-1}



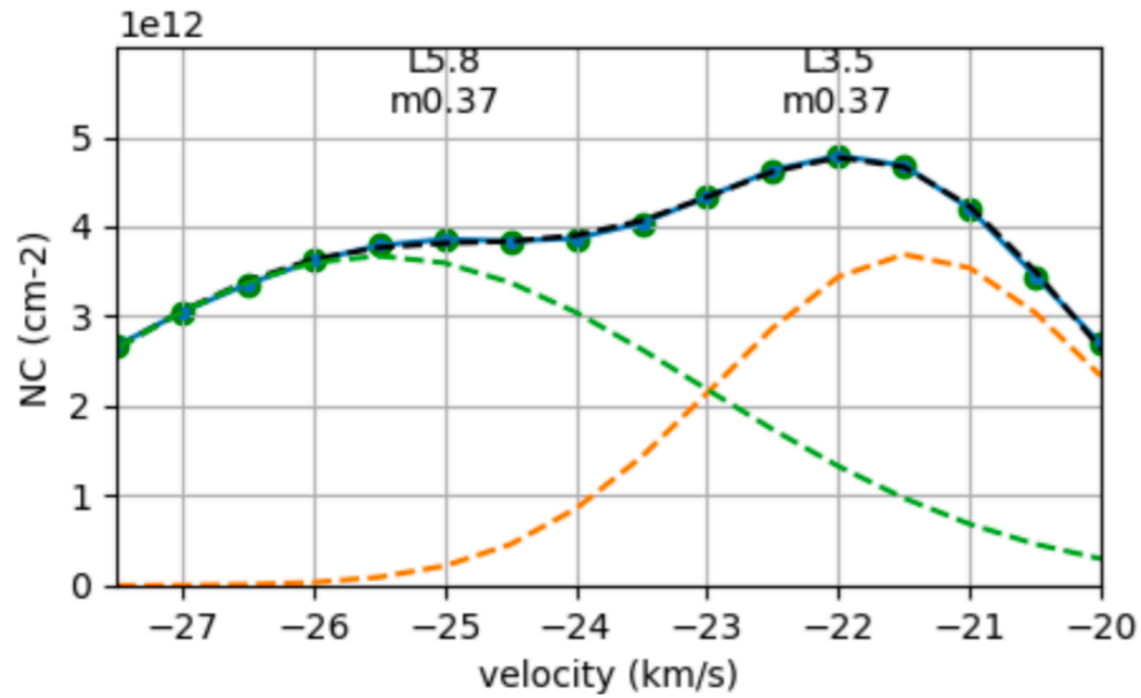






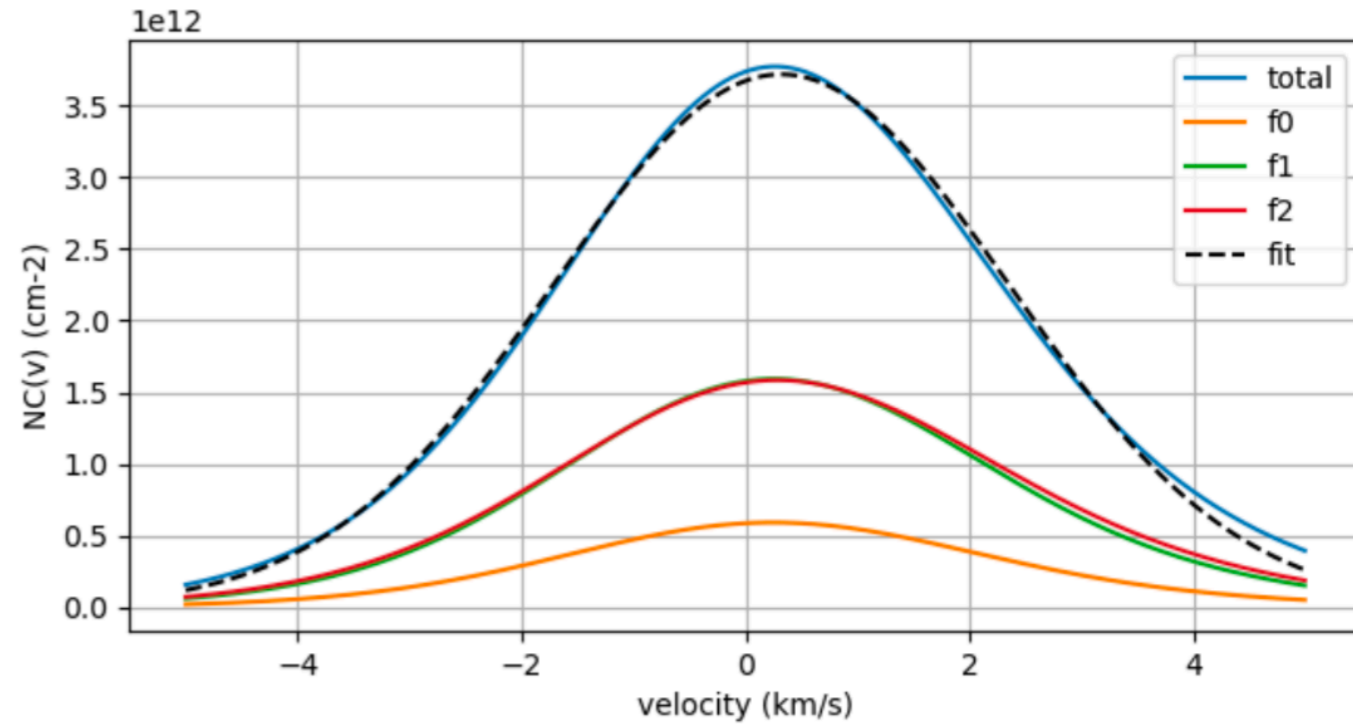
Observations

HD 93222

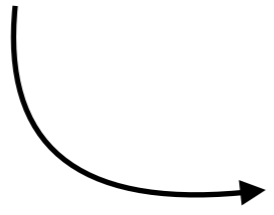
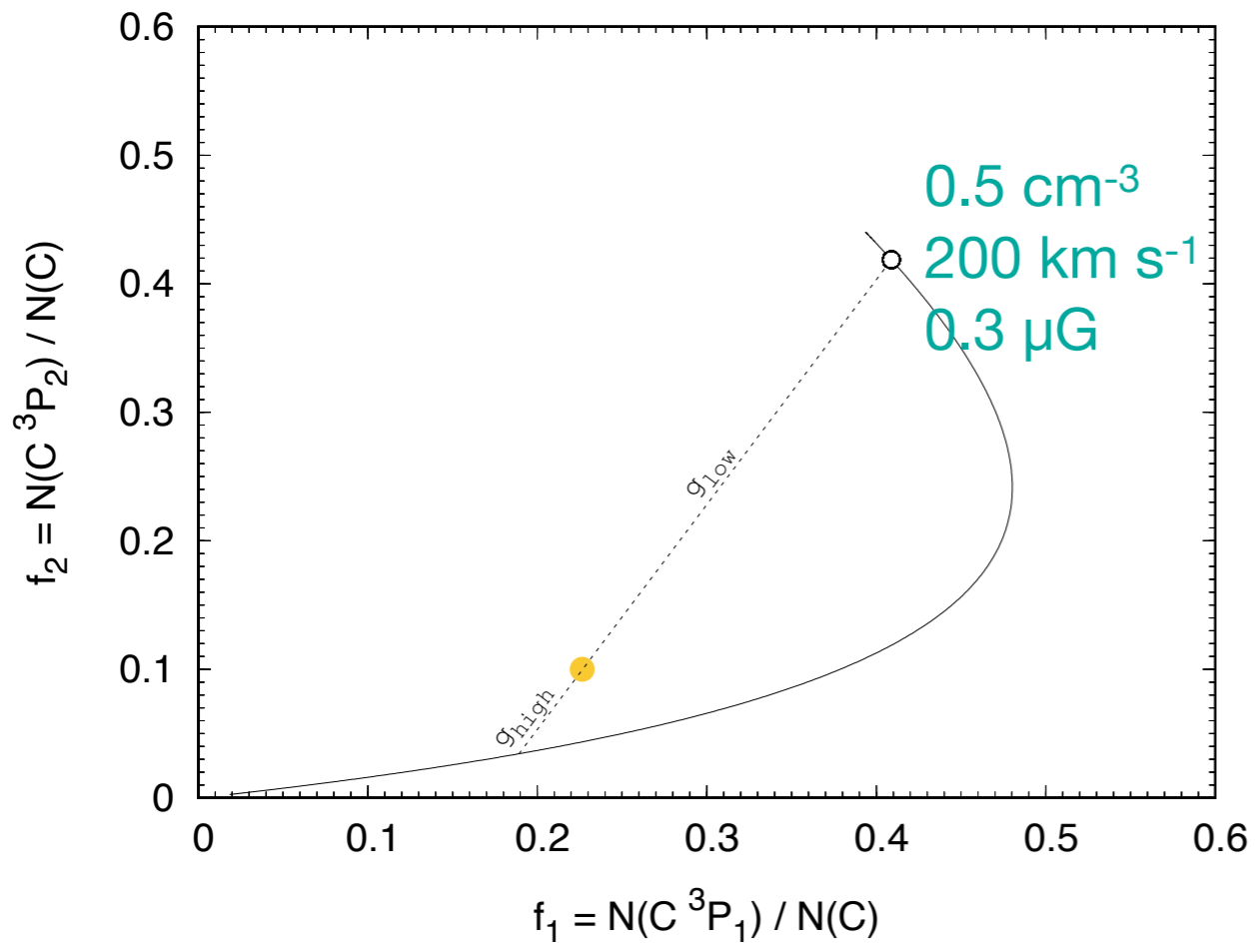


$$4 \leq \Delta V \leq 6 \text{ km s}^{-1}$$

Shock models



Vs(km/s) \ B(uG)	Largeur à mi-hauteur (km/s)		
	0.1	0.2	0.3
90	4.81	5.08	5.22
80	4.79	5.08	5.21
60	4.84	5.13	5.28
45	4.89	5.30	5.46



N(C) at high pressure



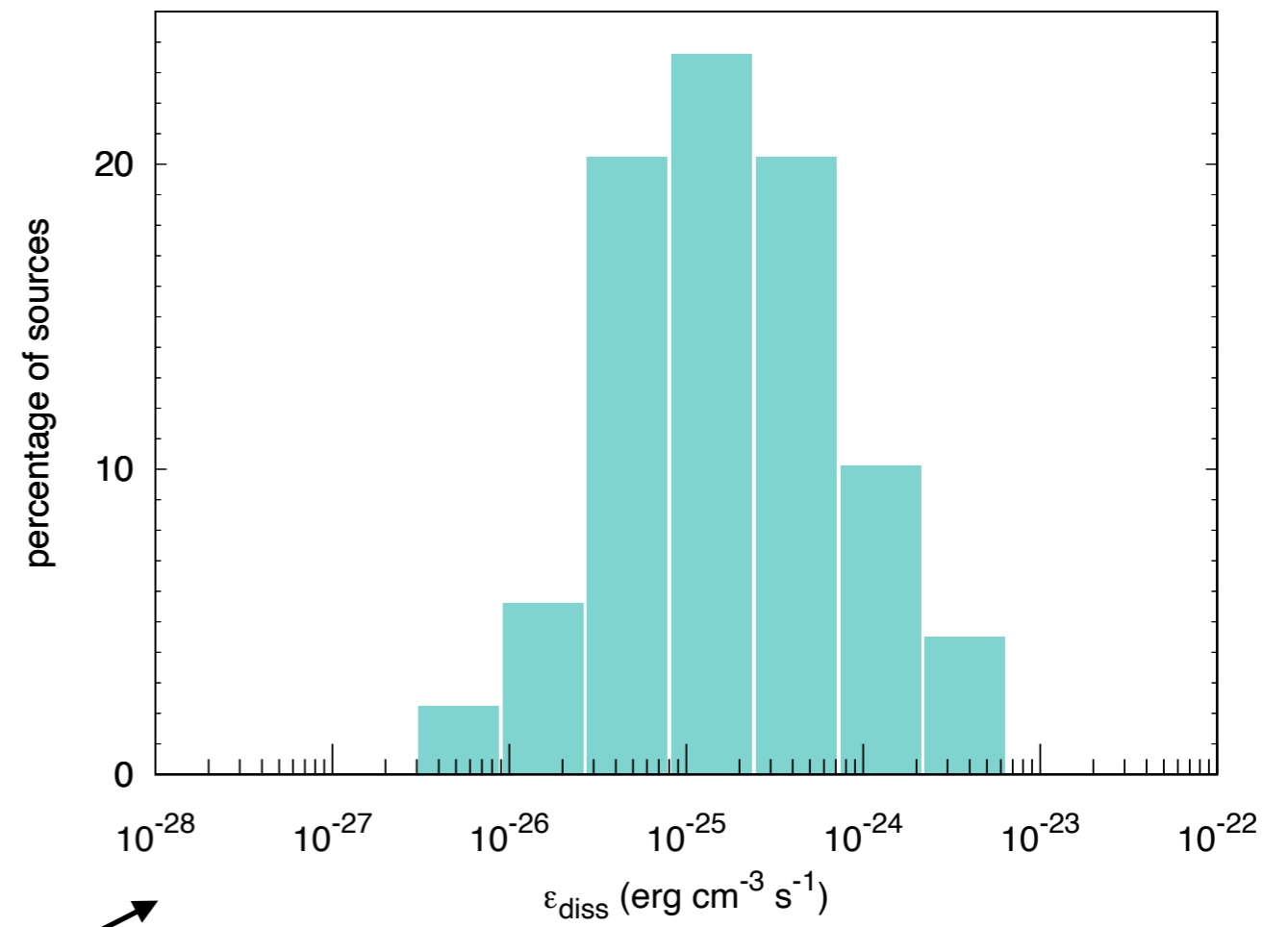
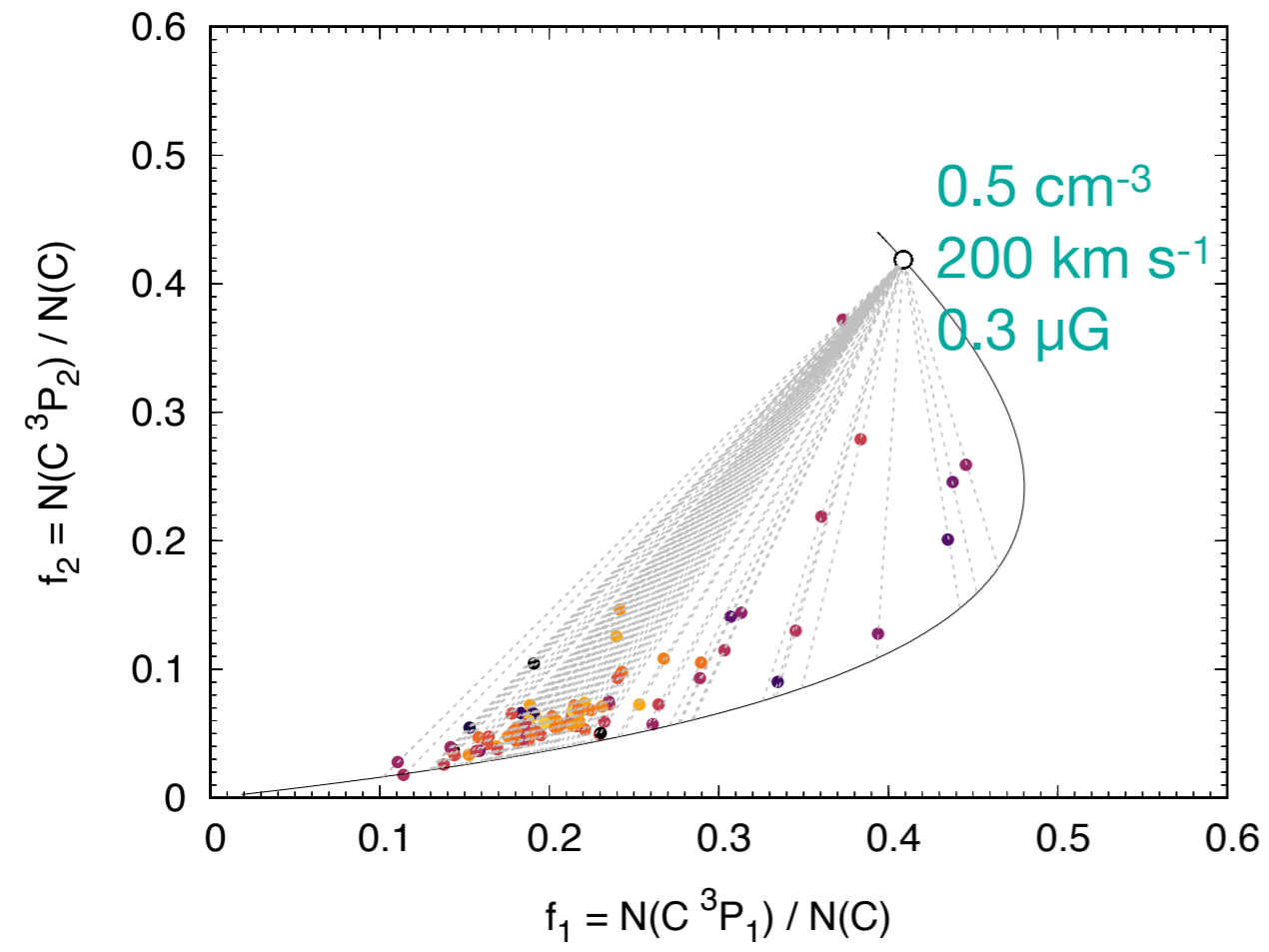
number of shocks

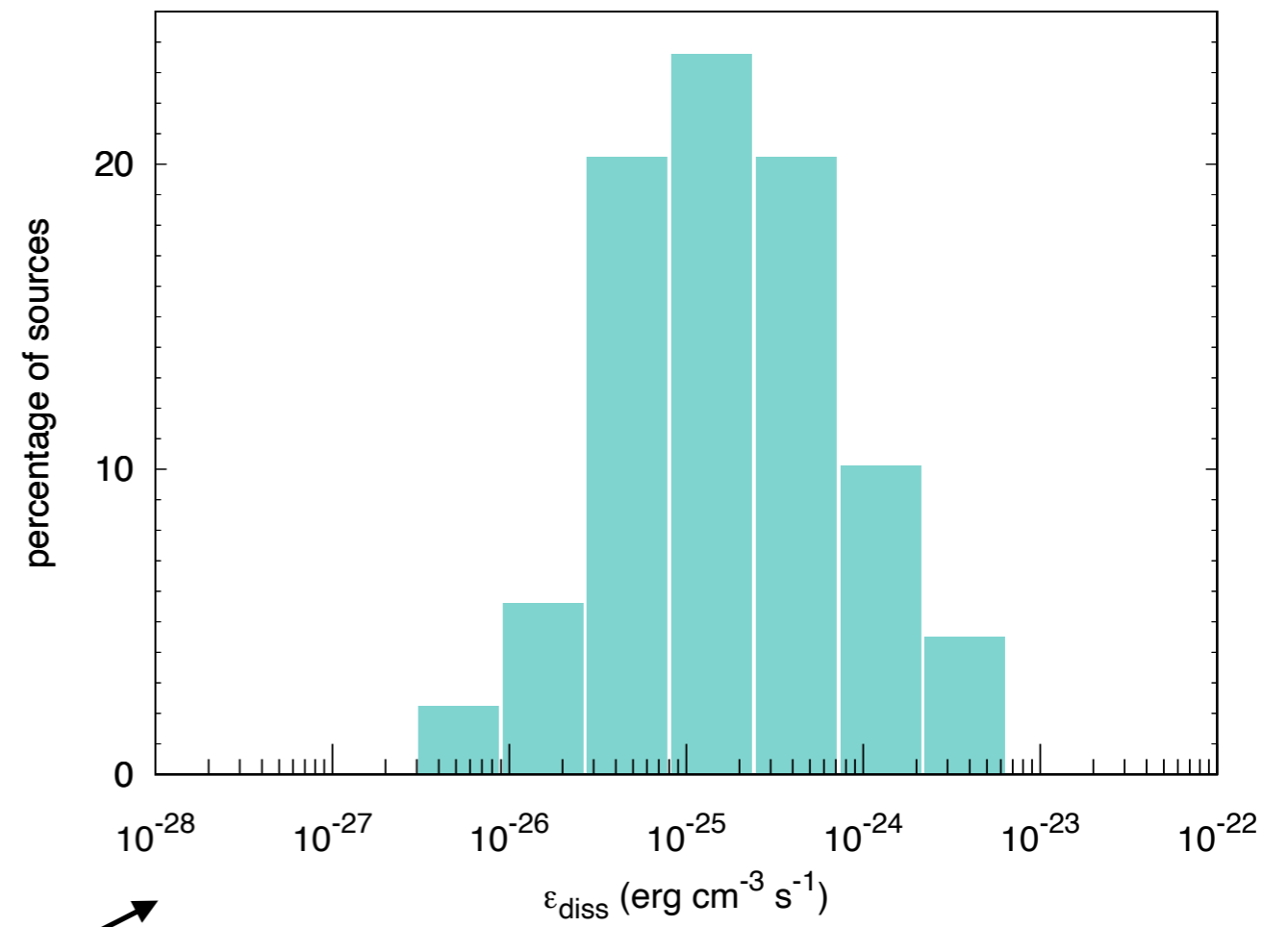
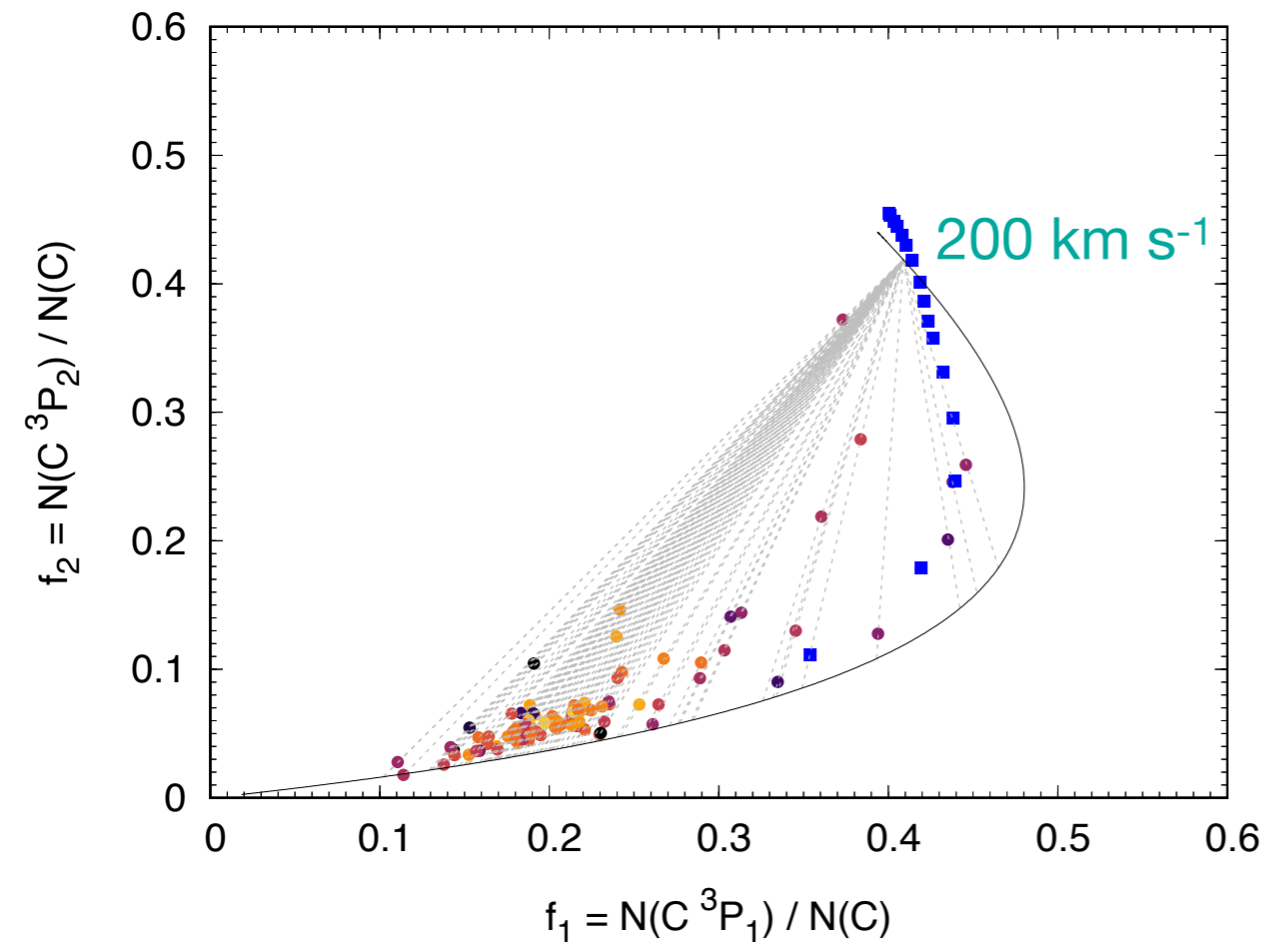
$$\mathcal{N}_{\text{sck}}$$



dissipation rate in WNM

$$\frac{1}{2} \rho V_S^3 \frac{\mathcal{N}_{\text{sck}}}{L\phi}$$





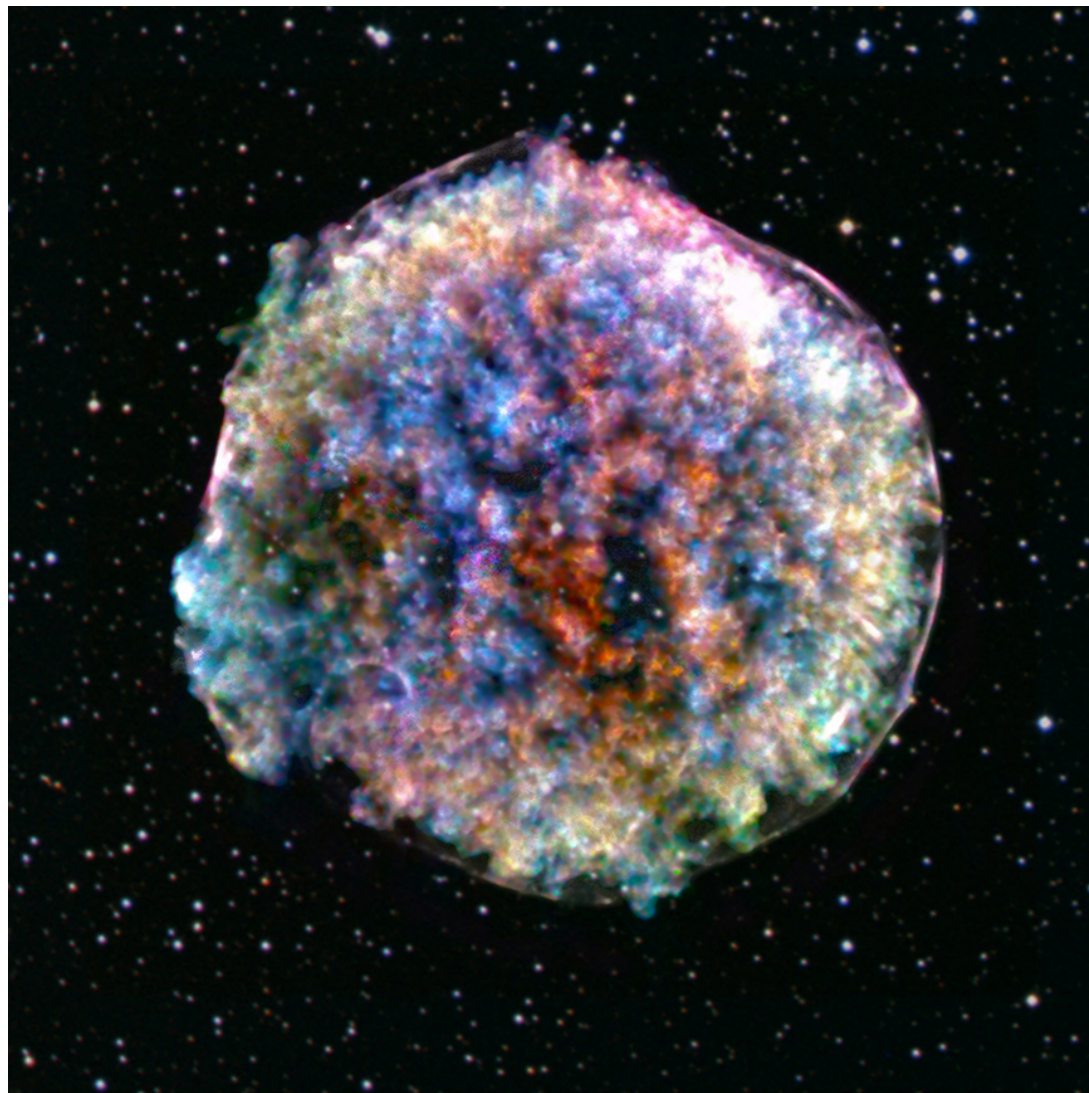
independent of shock parameters if

$$40 \text{ km s}^{-1} \leq V_s \leq 200 \text{ km s}^{-1}$$

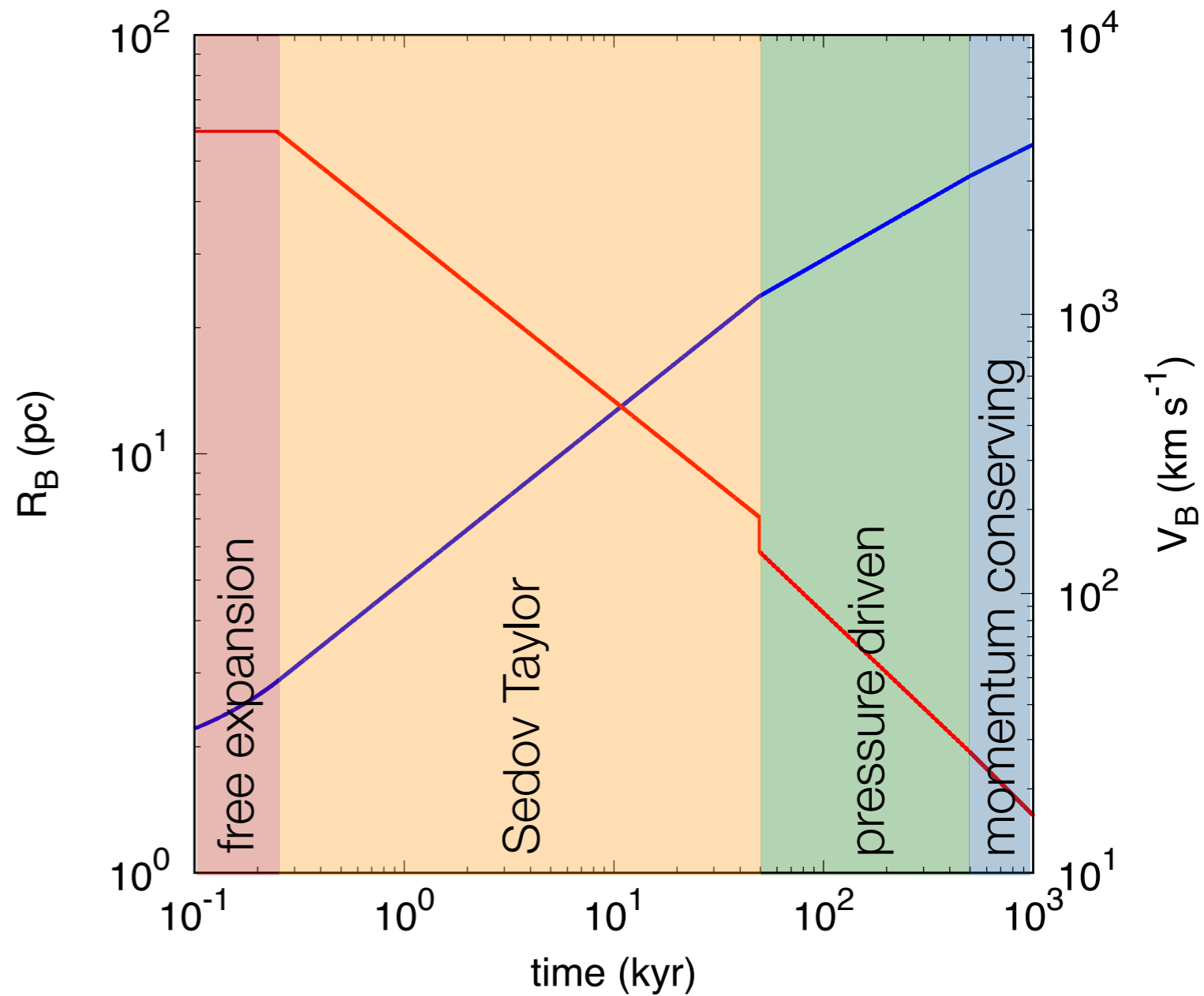
$$B \leq 3 \mu\text{G}$$

$$0.5 \text{ cm}^{-3} \leq n_H$$

can these shocks be terminal shocks of SNR ?

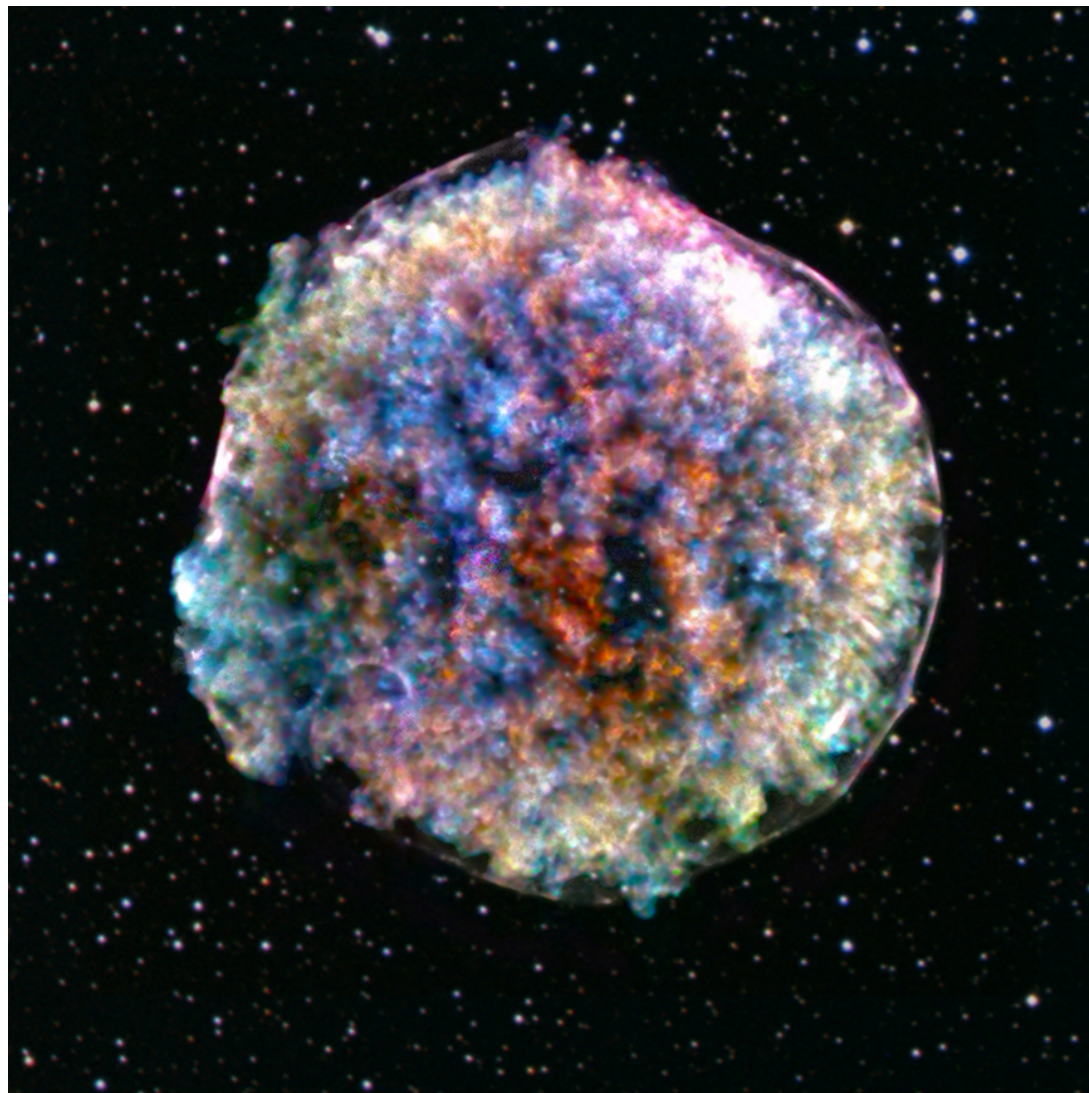


SN 1572, Tycho's SNR
J.Warren & J.Hughes et al.

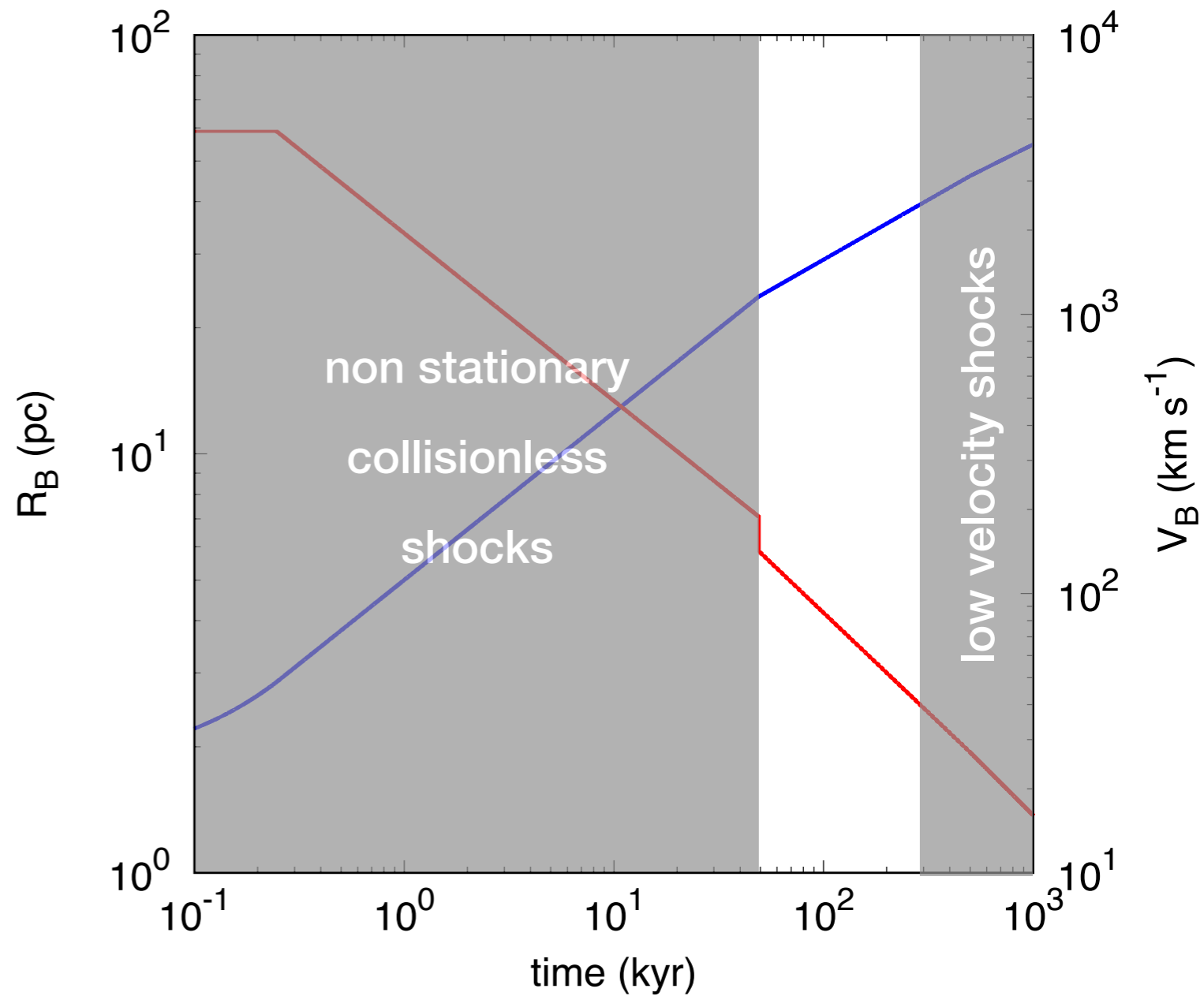


Draine (2011)
Cioffi et al.(1988)
Truelove & Mckee (1999)
Vink (2021)

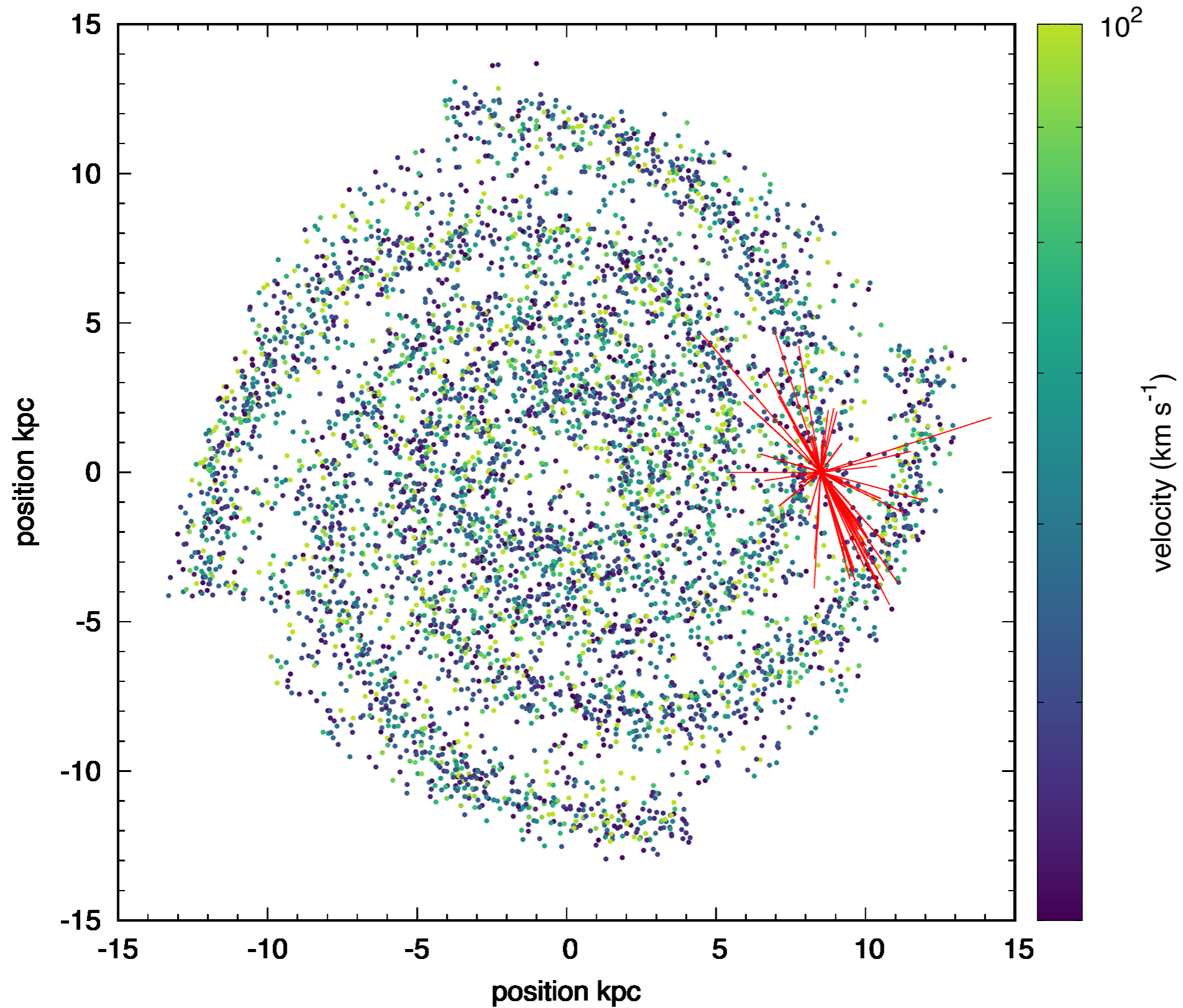
can these shocks be terminal shocks of SNR ?

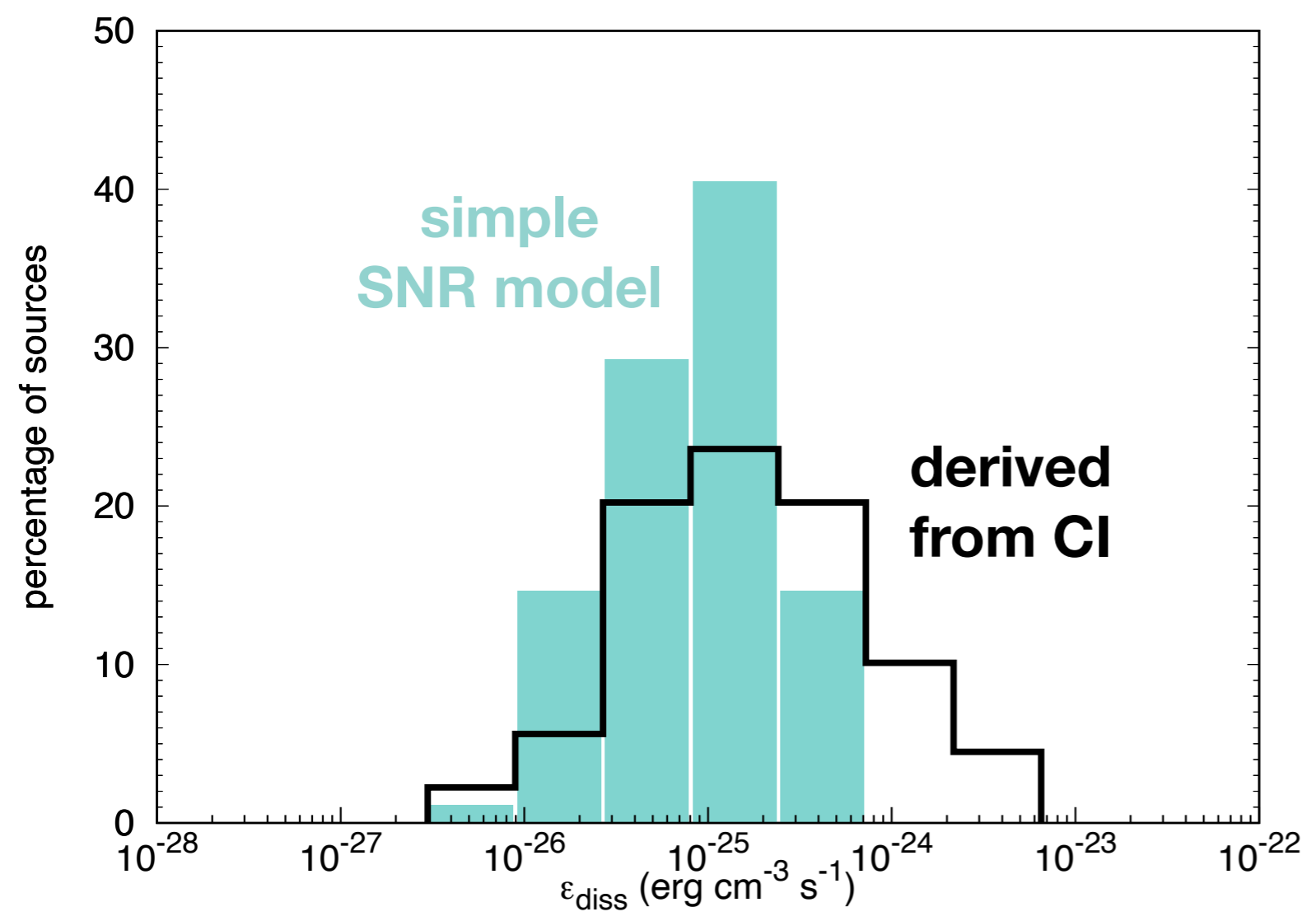


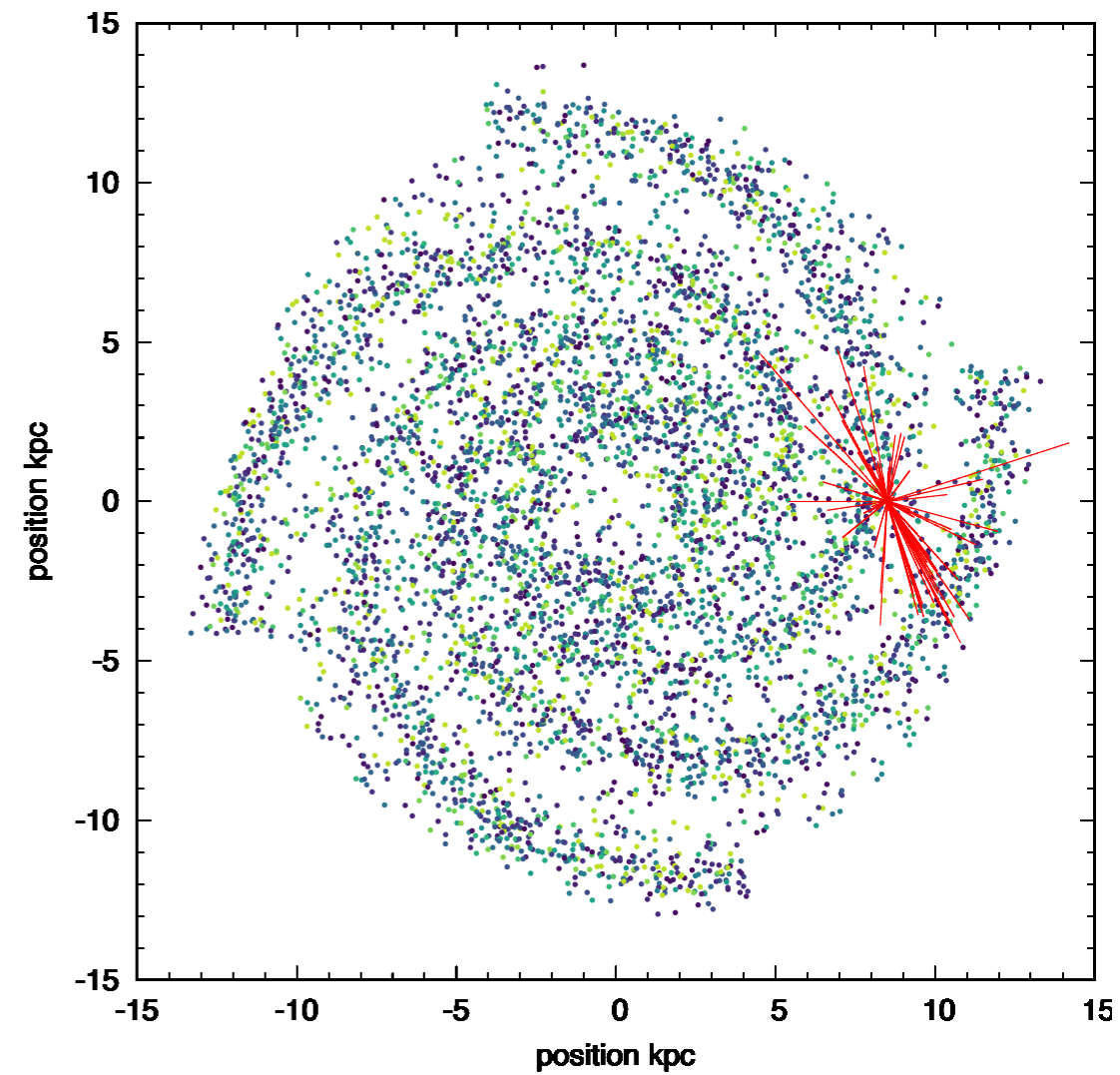
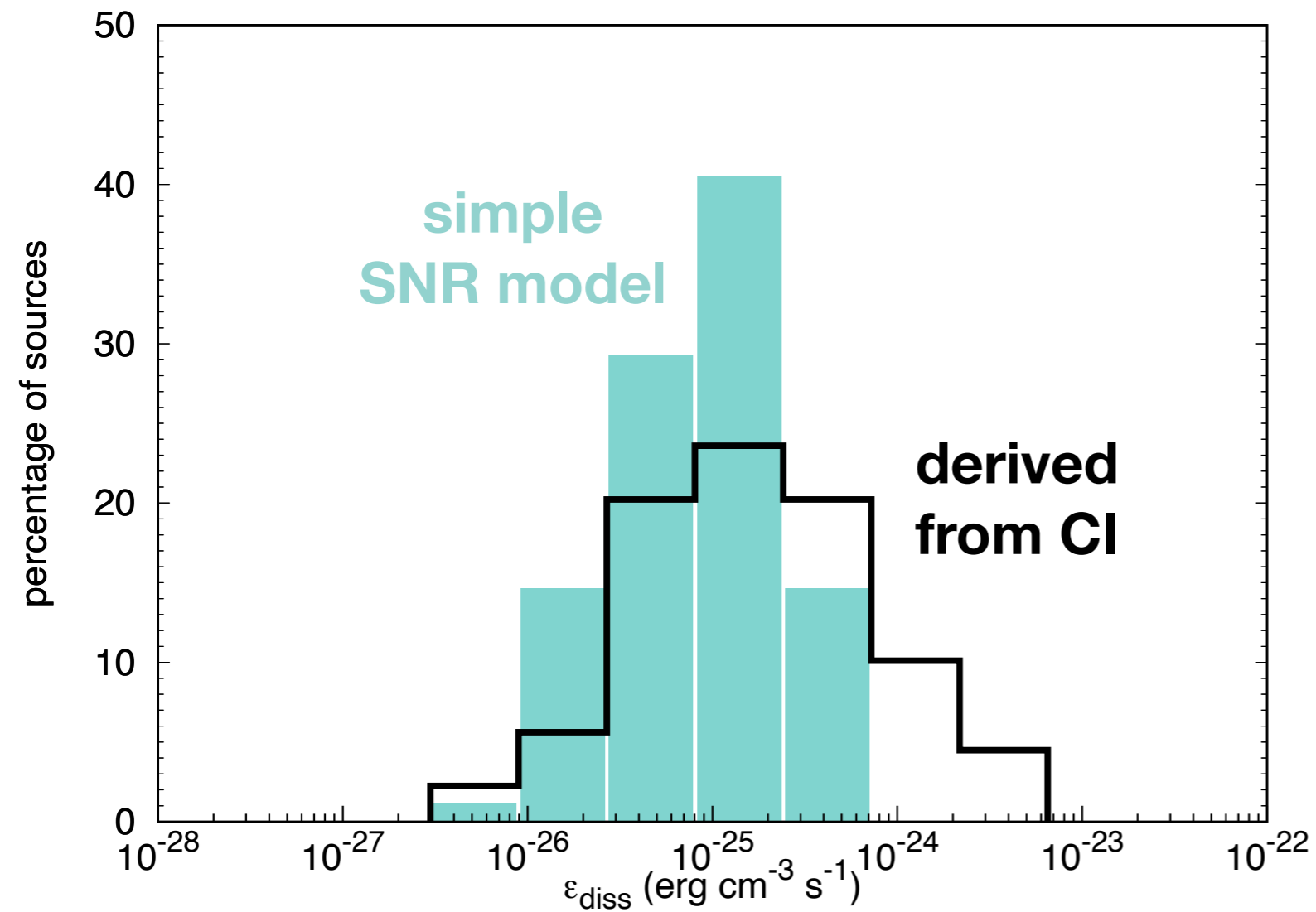
SN 1572, Tycho's SNR
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Draine (2011)
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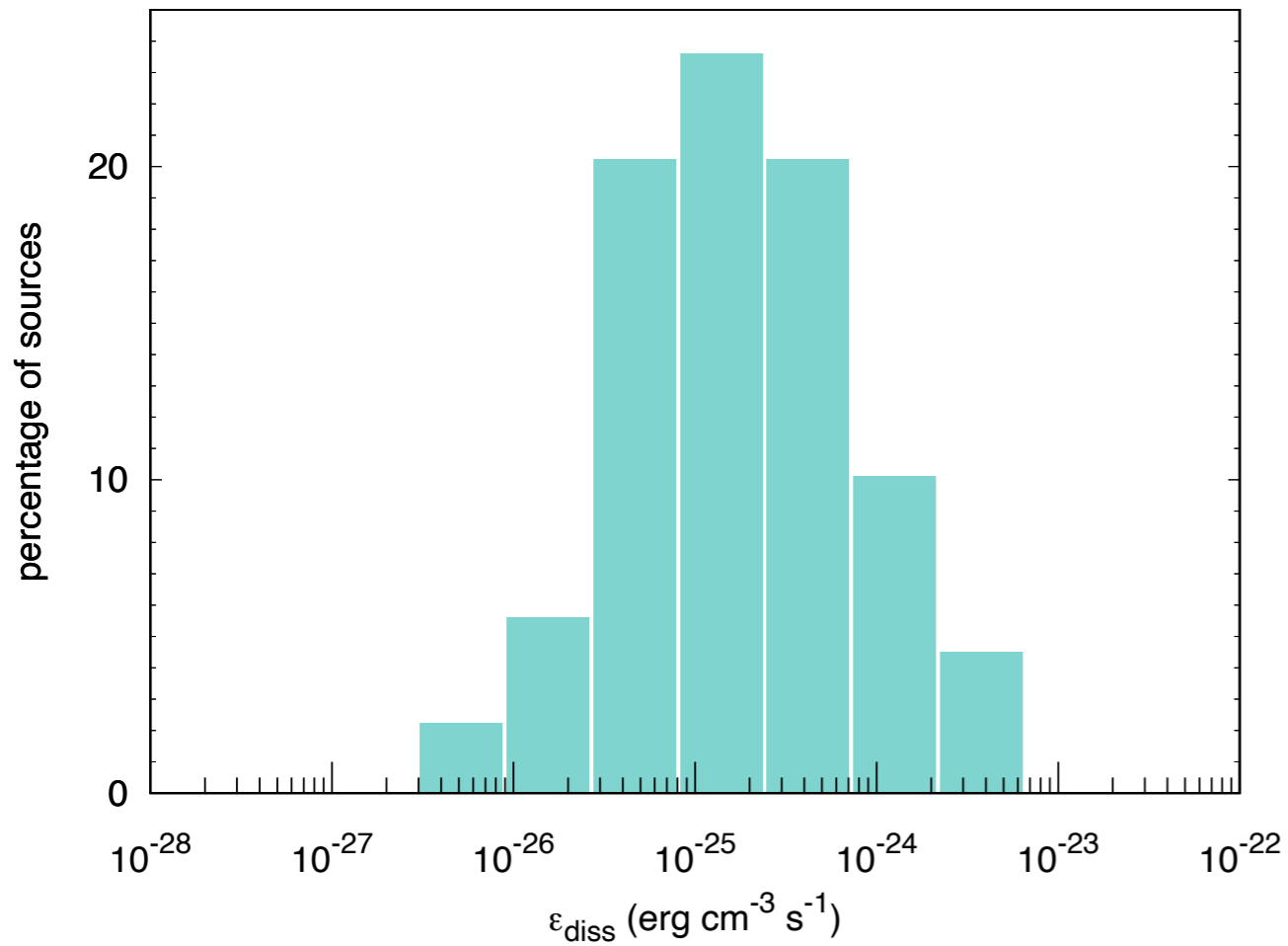




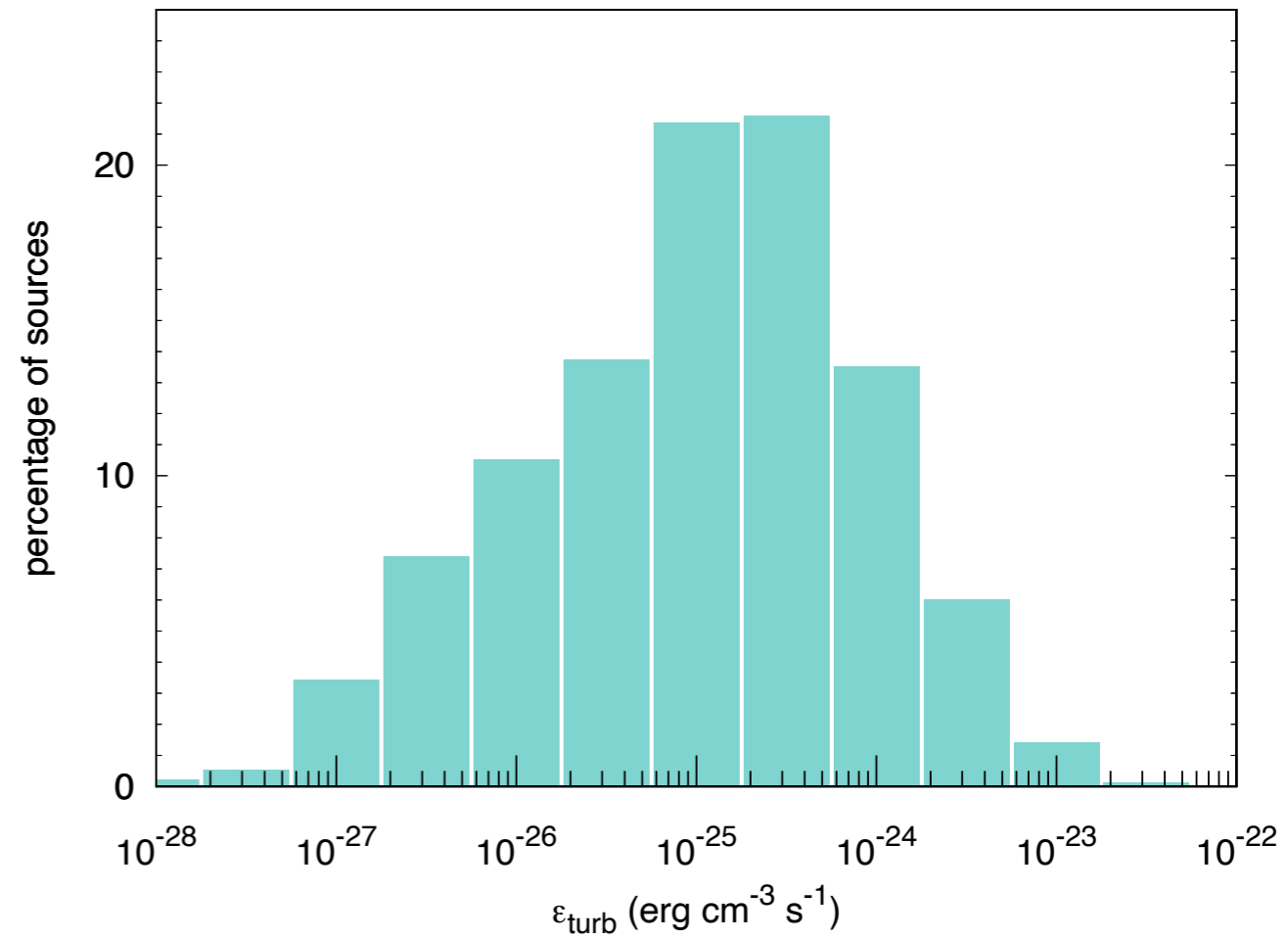


background sources in Jenkins & Tripp sample are OB stars
=> should be correlated with SNR positions

dissipation rate in WNM

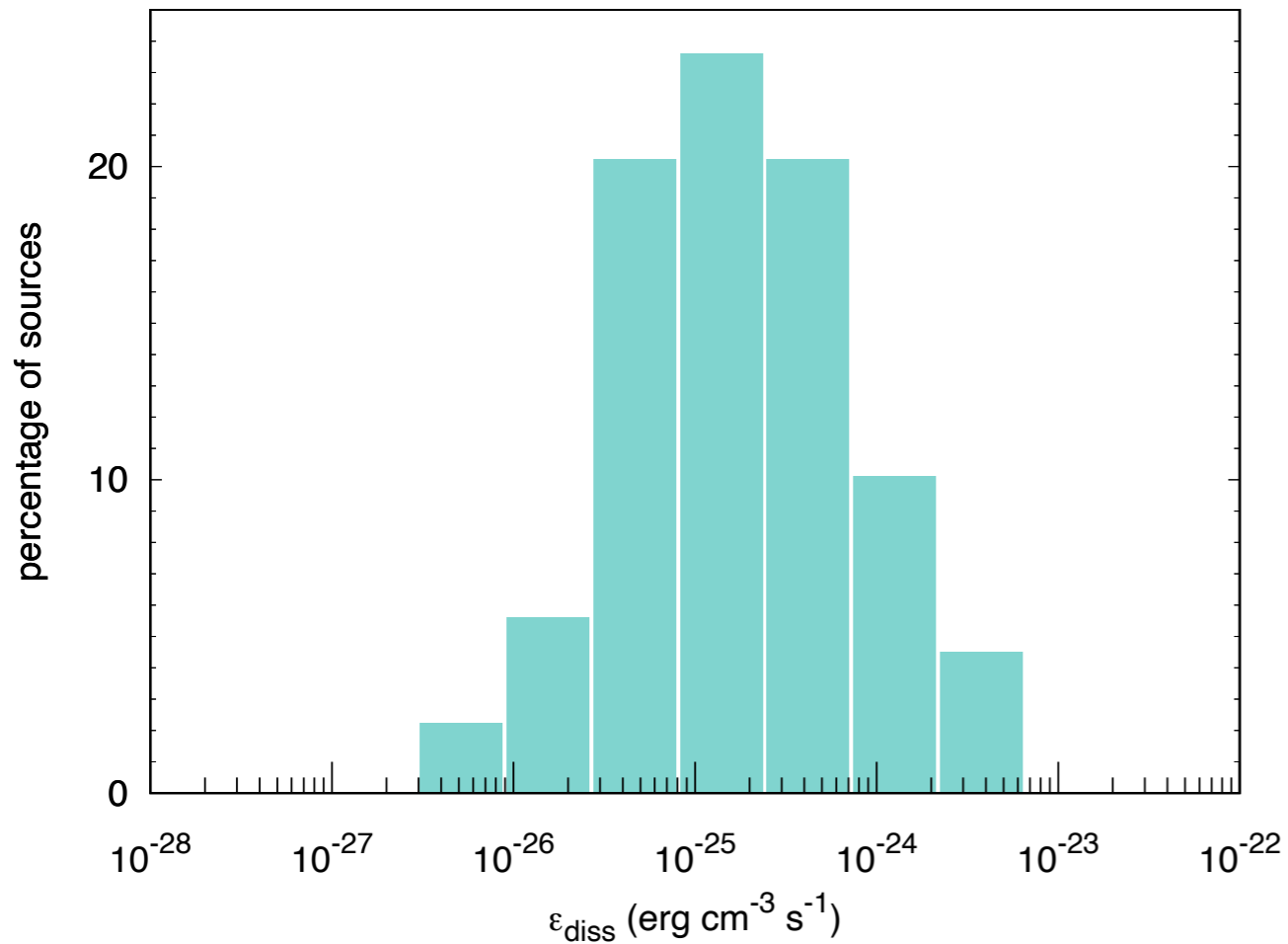


turbulent transfer rate in CNM

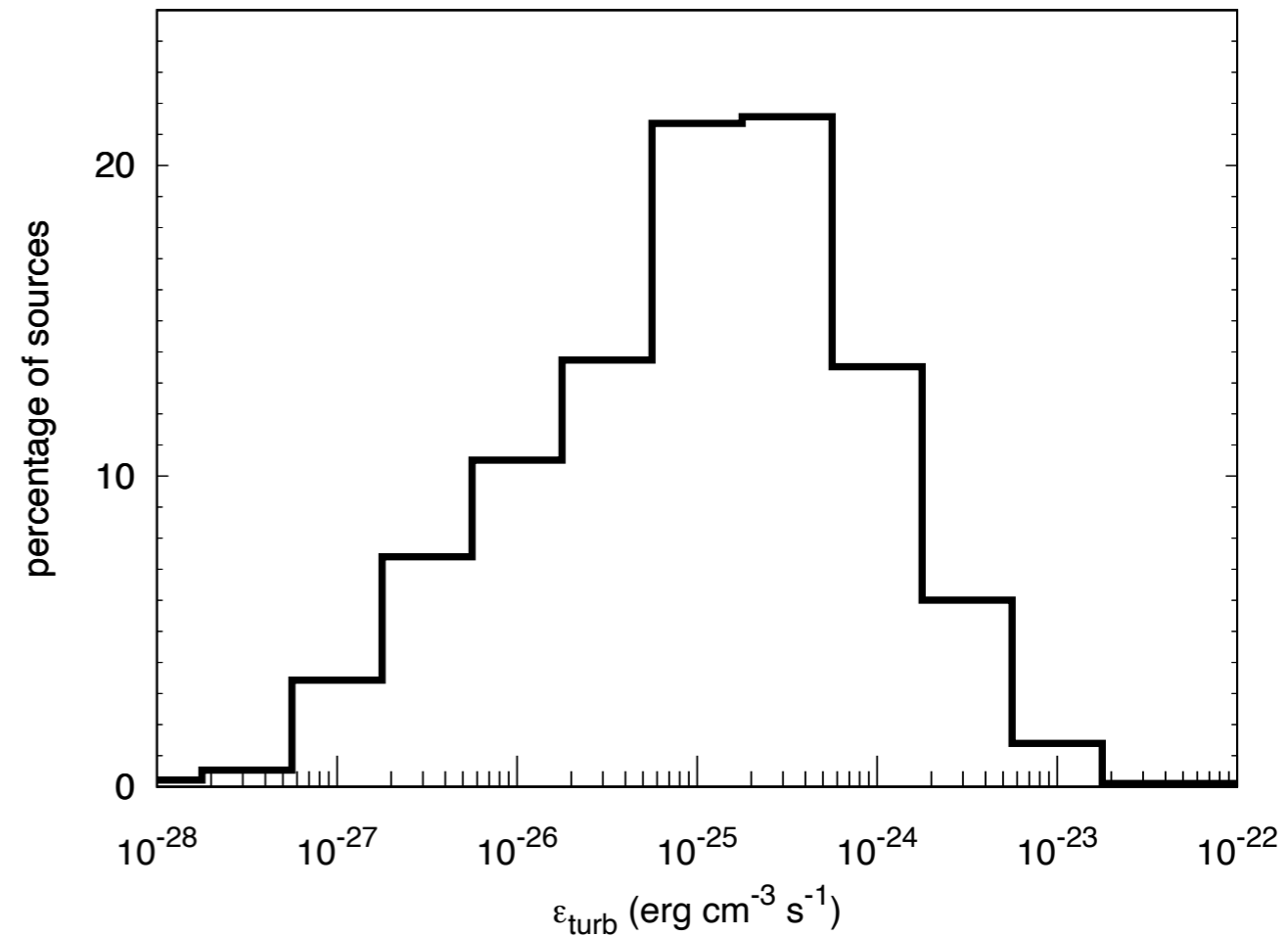


Hennebelle & Falgarone (2012)
Miville-Deschênes et al. (2017)

dissipation rate in WNM



turbulent transfer rate in CNM



- surprising similarity between both quantities
- link between supersonic dissipation & interstellar turbulence