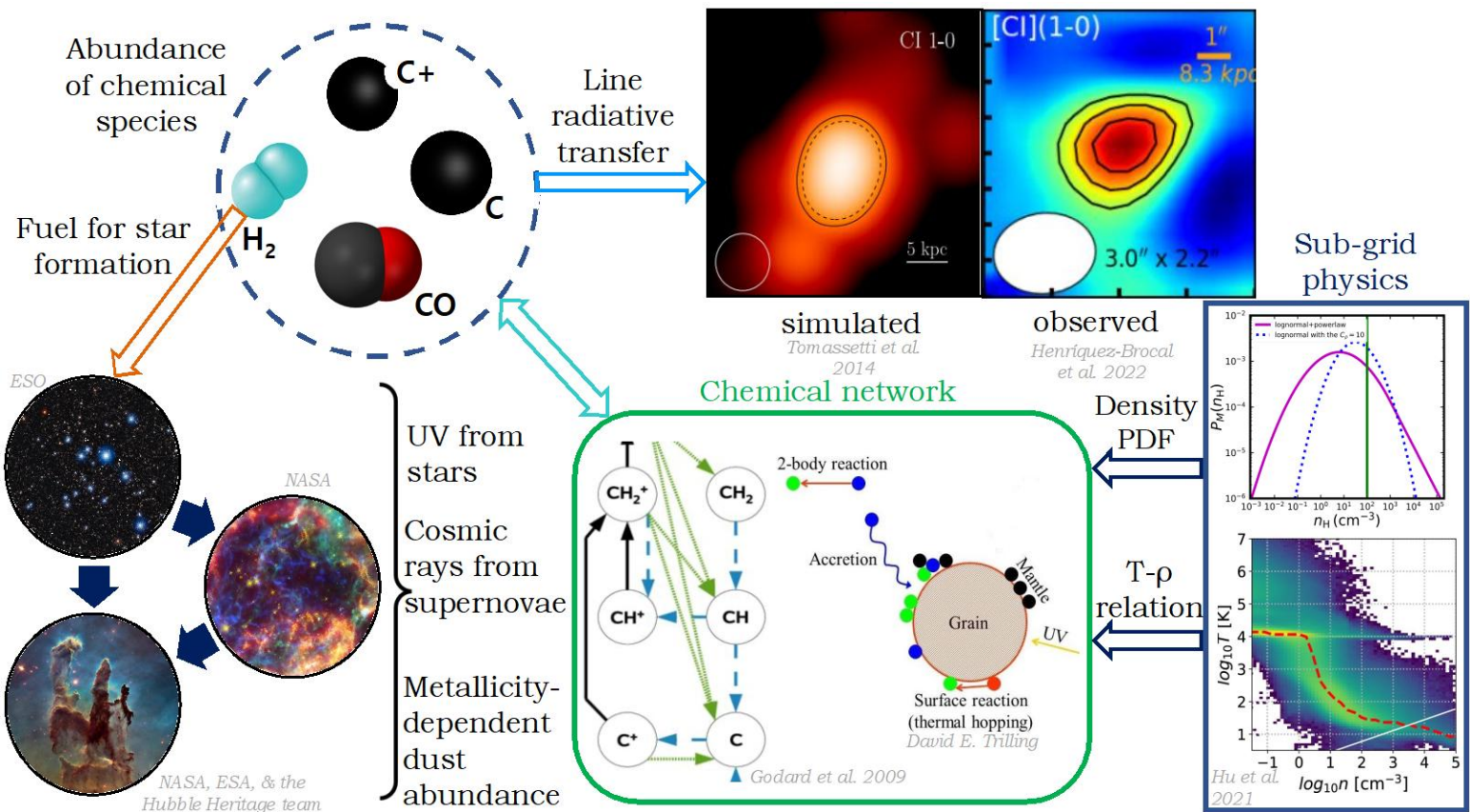


Chemistry Coupled Radiative Transfer using RAMSES-RT

HYACINTH and MARIGOLD

HYACINTH (Khatri et. al. 2024)



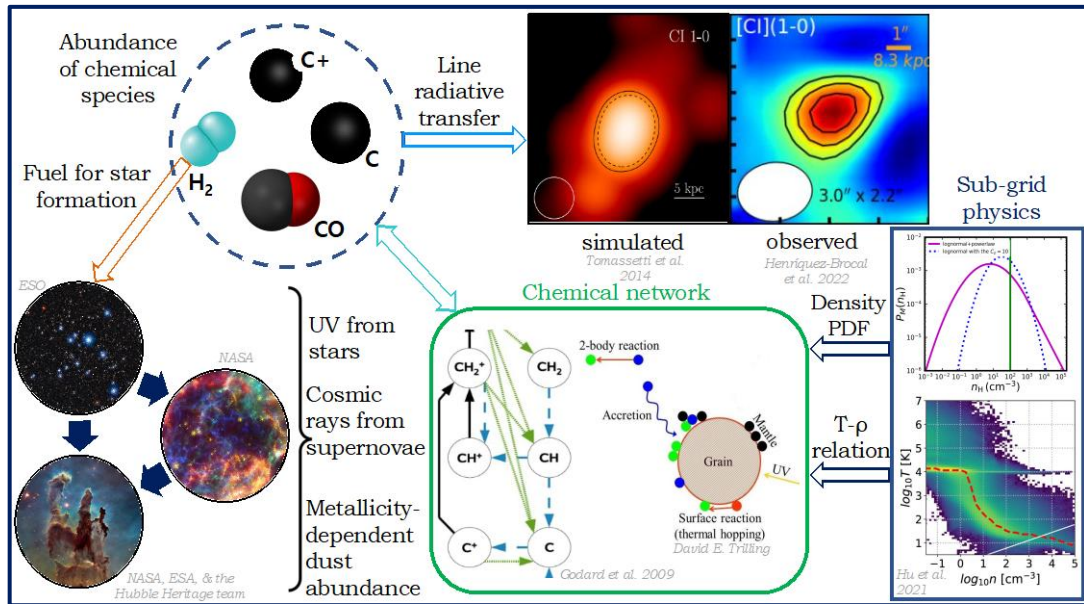
MARIGOLD Simulation suite (Khatri et. al. 2025)

Box	M25	M50
Volume	$(25 \text{ cMpc})^3$	$(50 \text{ cMpc})^3$
m_{DM}	$5 \times 10^5 M_{\odot}$	$4 \times 10^6 M_{\odot}$
$m_{\star}$	$7.2 \times 10^3 M_{\odot}$	$5.76 \times 10^4 M_{\odot}$
Δx	32 pc	64 pc
Z_{ini}	$10^{-3} Z_{\odot}$	$10^{-2} Z_{\odot}$

$$\rho_{\star} = \epsilon_{\text{SF}} \frac{\rho_{\text{H}_2}}{t_{\text{ff}}}$$

$$z = 99 - 3$$

HYACINTH + RAMSES-RT



$$\frac{\partial N_{\nu}}{\partial t} + \nabla \cdot \mathbf{F}_{\nu} = - \sum_j^{\text{H}_2, \text{H I}, \text{He I}, \text{He II}} n_j \sigma_{\nu j} c_{\text{r}} N_{\nu} - \kappa_{\text{P}} \rho_{\text{d}} c_{\text{r}} N_{\nu} + \dot{N}_{\nu}^{\star} + \dot{N}_{\nu}^{\text{rec}},$$

$$\frac{\partial \mathbf{F}_{\nu}}{\partial t} + c_{\text{r}}^2 \nabla \cdot \mathbf{P}_{\nu} = - \sum_j^{\text{H}_2, \text{H I}, \text{He I}, \text{He II}} n_j \sigma_{\nu j} c_{\text{r}} \mathbf{F}_{\nu} - \kappa_{\text{R}} \rho_{\text{d}} c_{\text{r}} \mathbf{F}_{\nu},$$

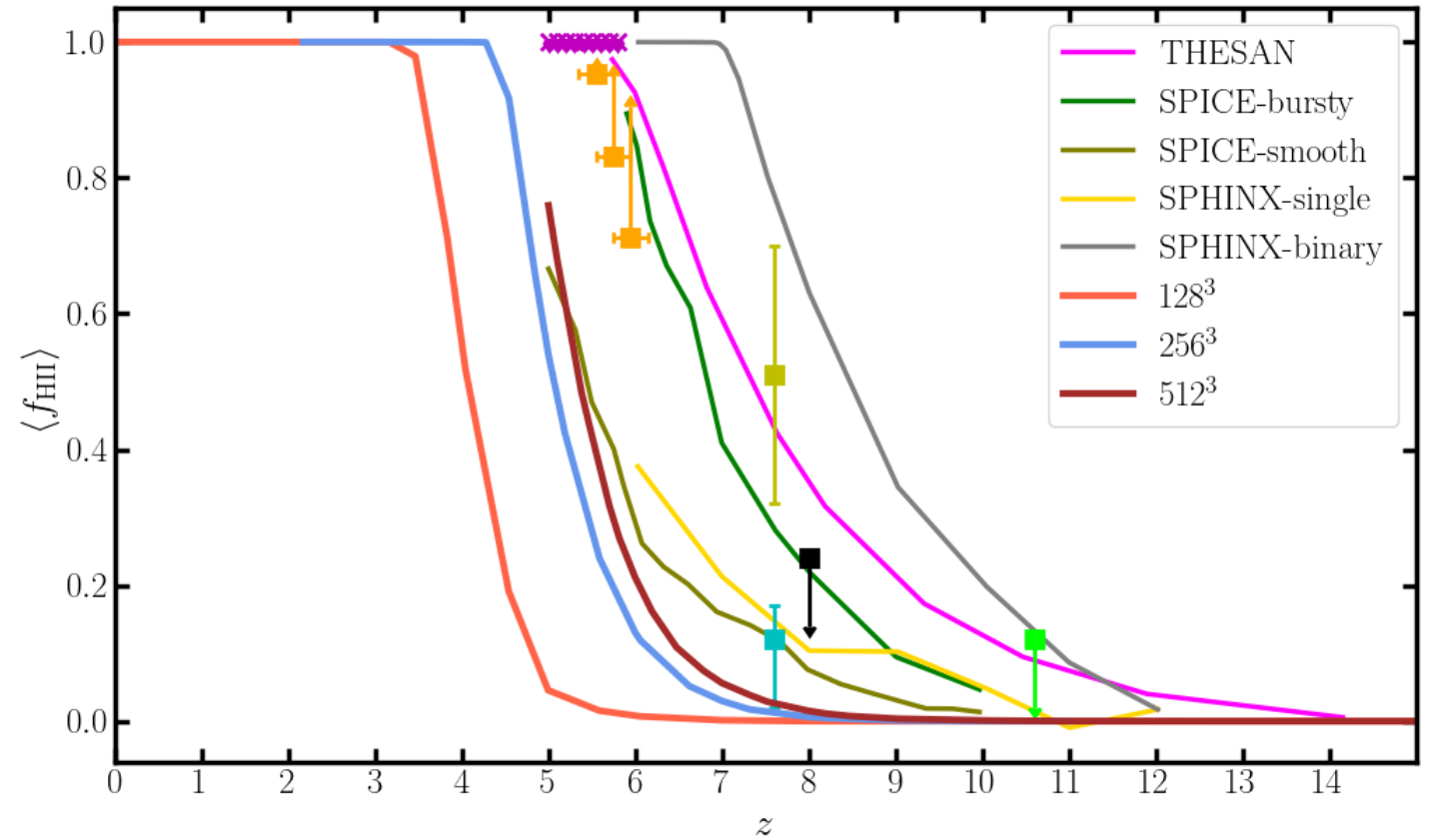
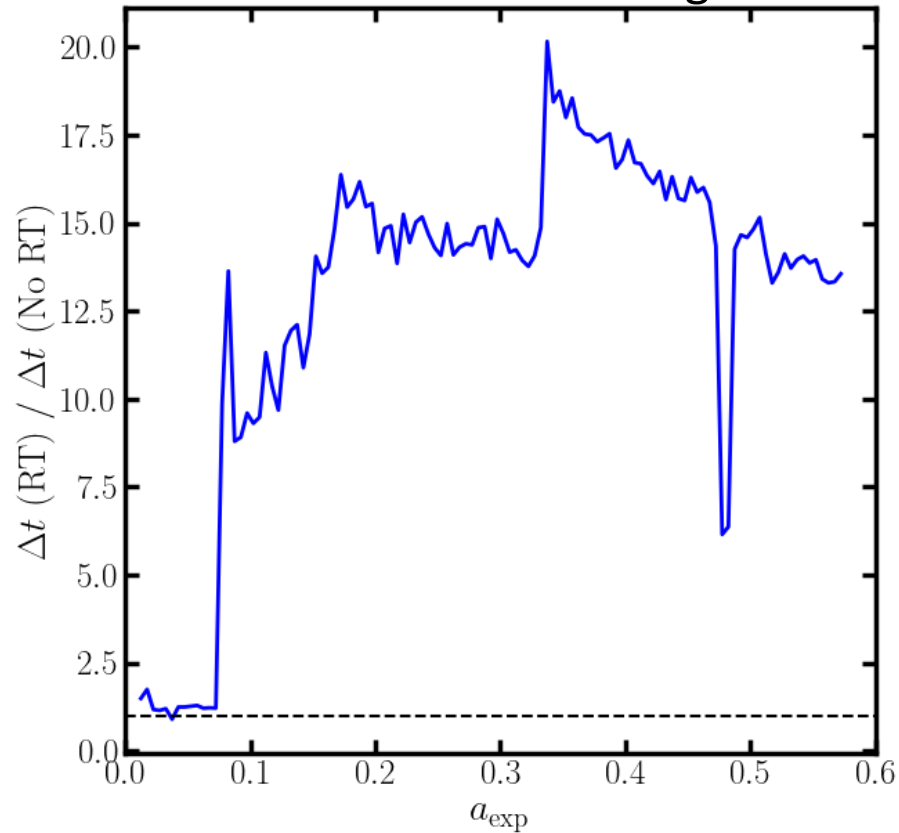
Nickerson+18

Cosmological or zoom simulations to investigate neutral hydrogen in galaxies up to $z \lesssim 1$

RAMSES-RT: Test Runs

Test runs: $L_{\text{box}} = 50 \text{ Mpc}$; $N_{\text{part}} = 128^3; 256^3; 512^3$

RT takes 15x – 20x longer



Thank You!

