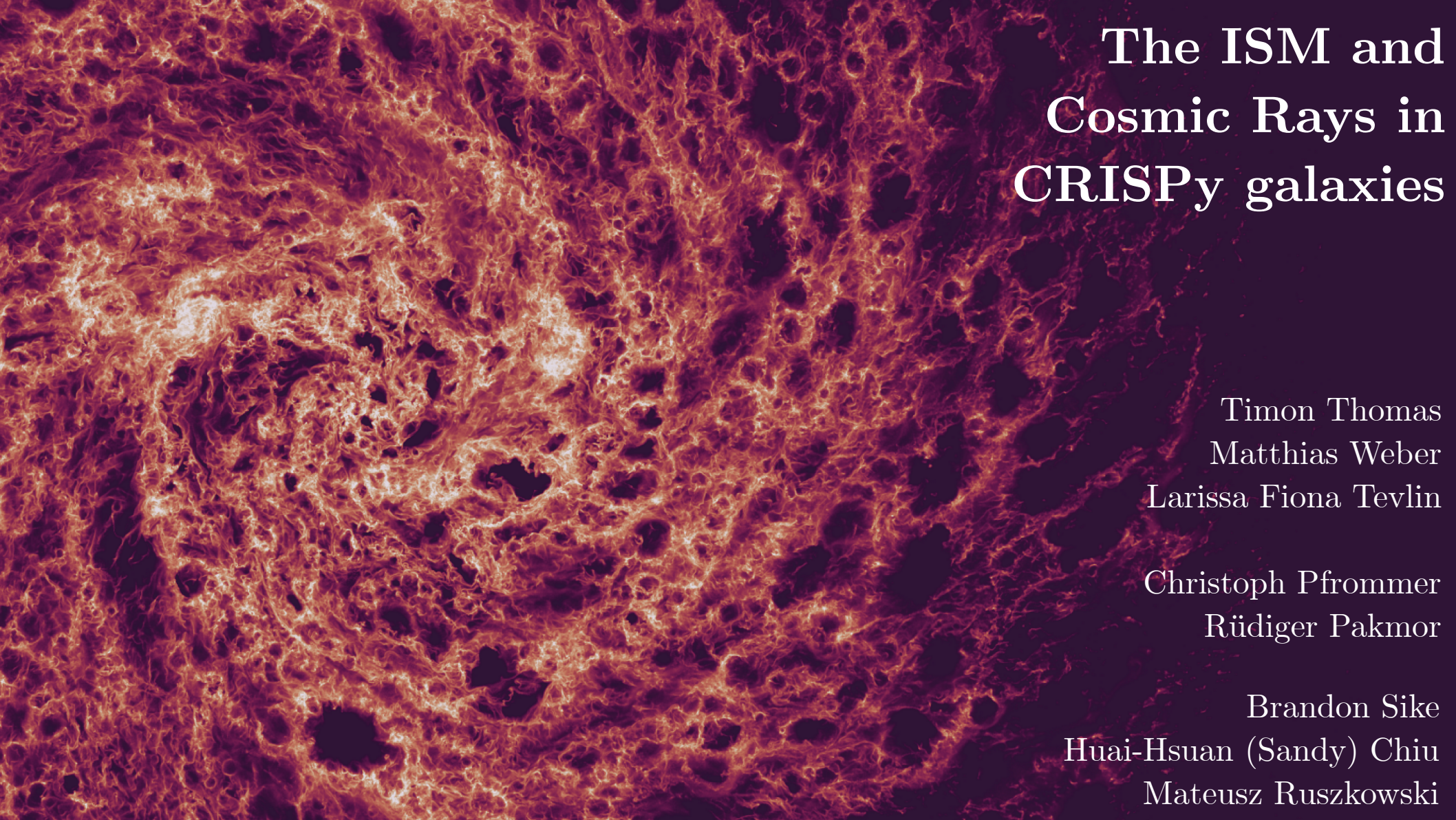




The ISM and Cosmic Rays in CRISPy galaxies

Timon Thomas

Matthias Weber

Larissa Fiona Tevlin

Christoph Pfrommer

Rüdiger Pakmor

Brandon Sike

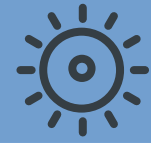
Huai-Hsuan (Sandy) Chiu

Mateusz Ruszkowski

CRISP framework

Cosmic Rays and InterStellar Physics





Feedback



ISM



CR

Novel CR hydrodynamics
coarse graining plasma physics

CR ionization

impacting



Chemistry

CR microphysics

Follow $\mathcal{E}_{\text{cr}}$
and v_{cr}

Self-consistently
evolve K_{cr}



CR



ISM



Feedback

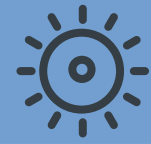
- Improved SNe treatment
and stellar winds

- FUV NUV OPT radiation fields
absorbed by dust — impacting



Chemistry

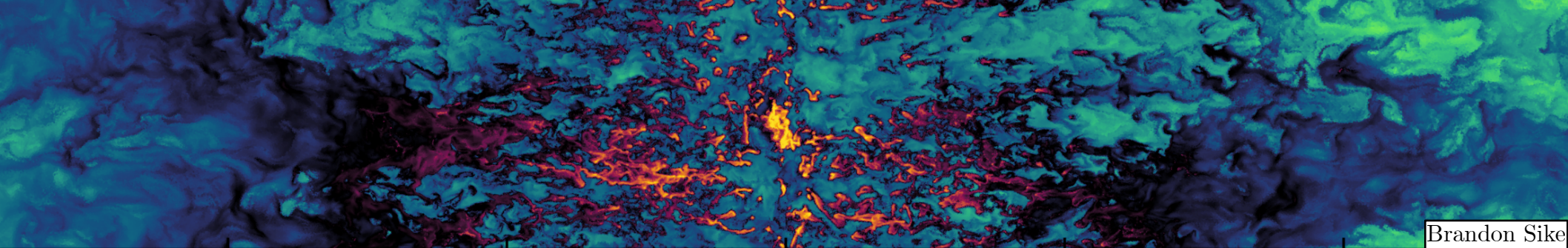
- Metal Enrichment



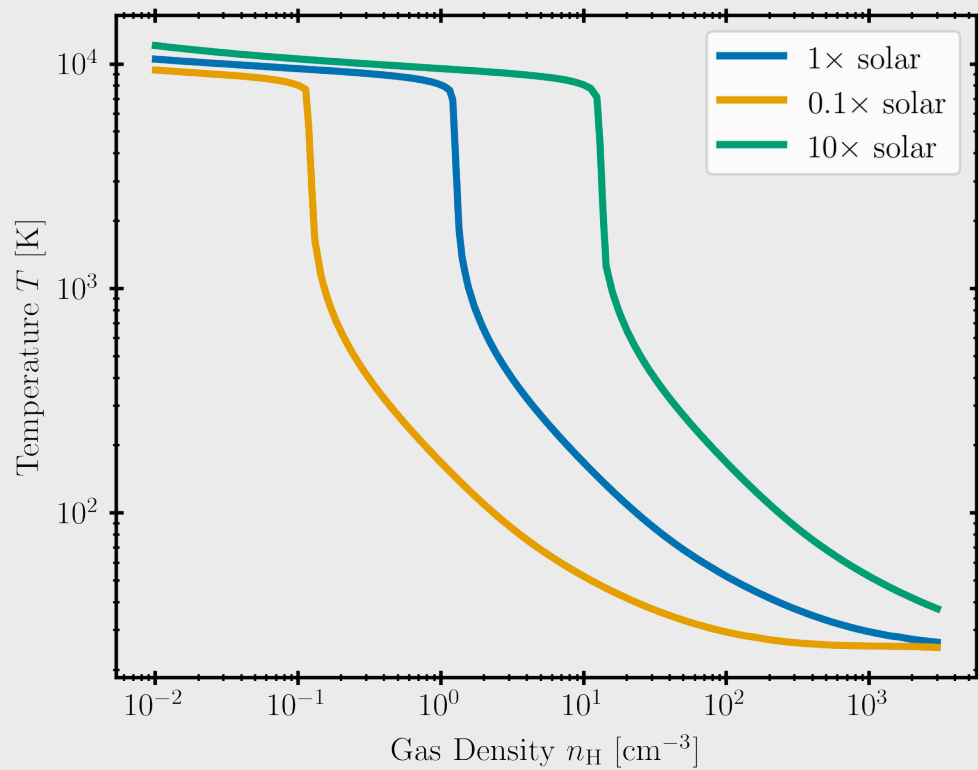
Full H – H₂ – He chemistry
sets ionization degree

First Ionization Stages of C – O – Si
low temperature cooling

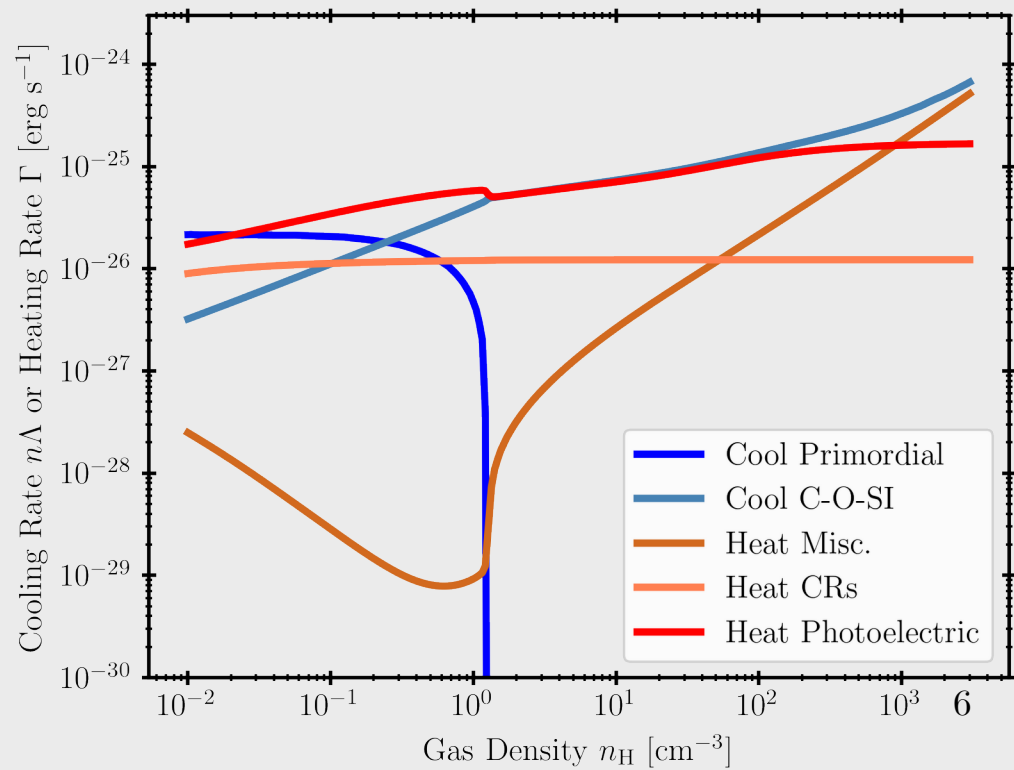
Photoelectric Heating by Dust



Thermal Equilibrium

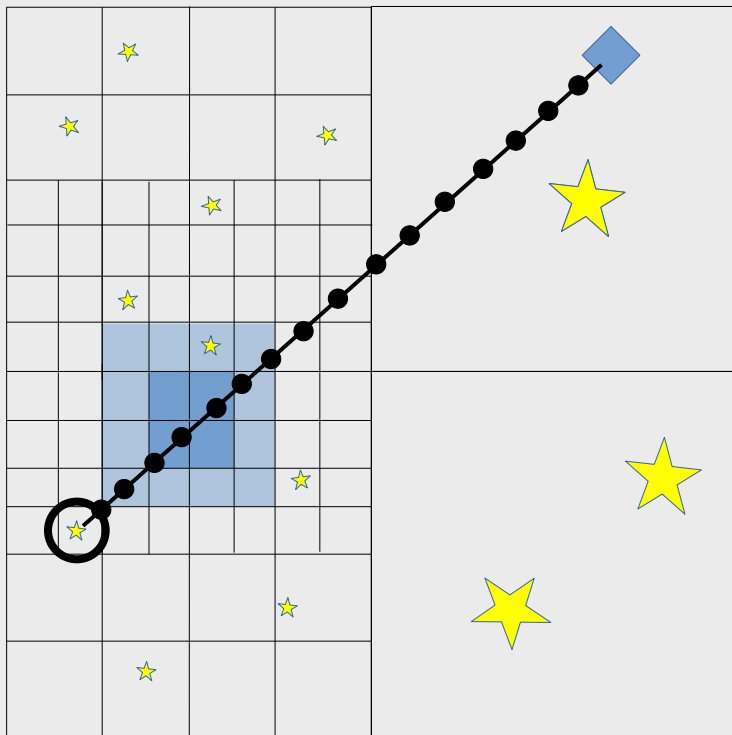


Cooling vs Heating



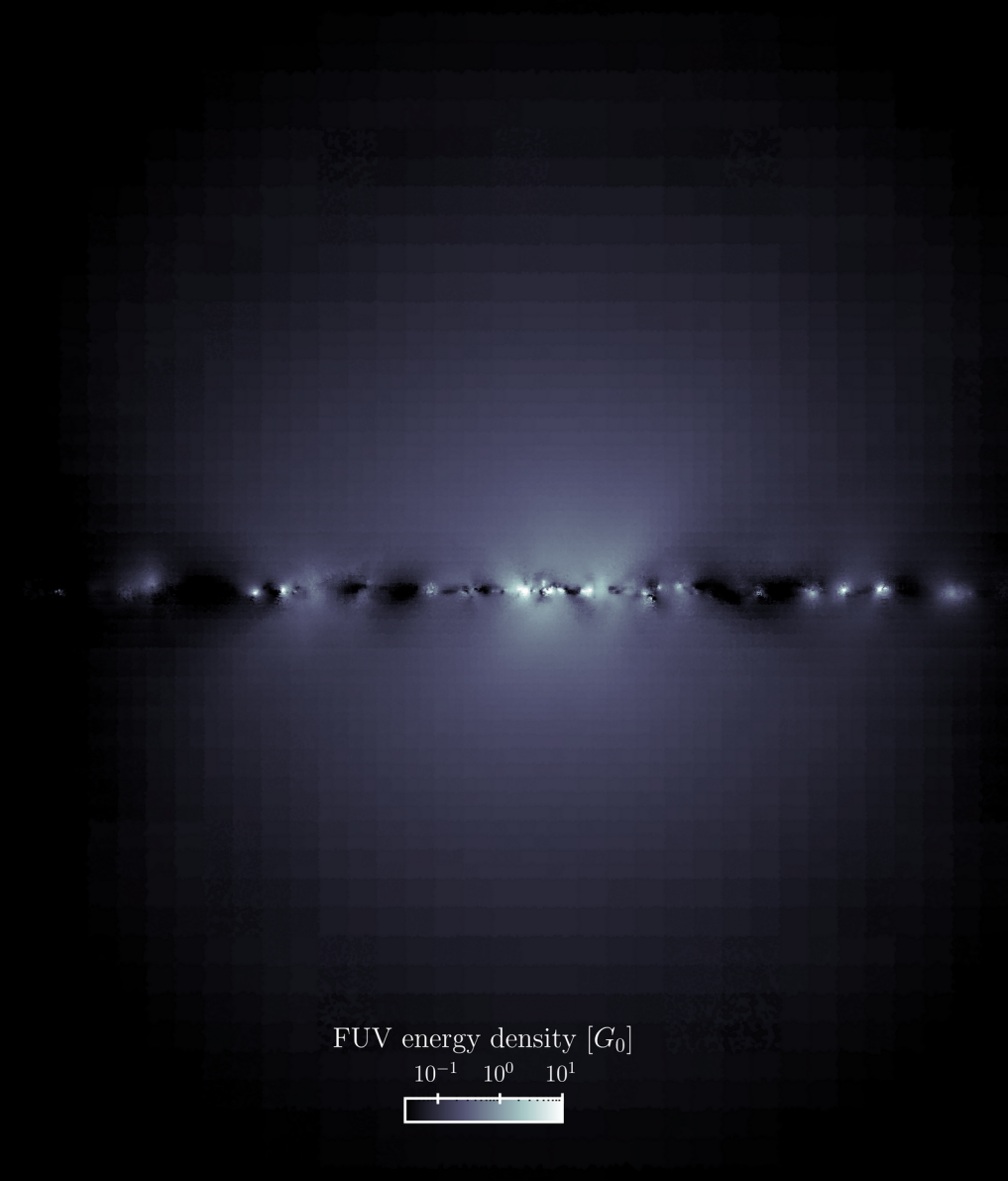
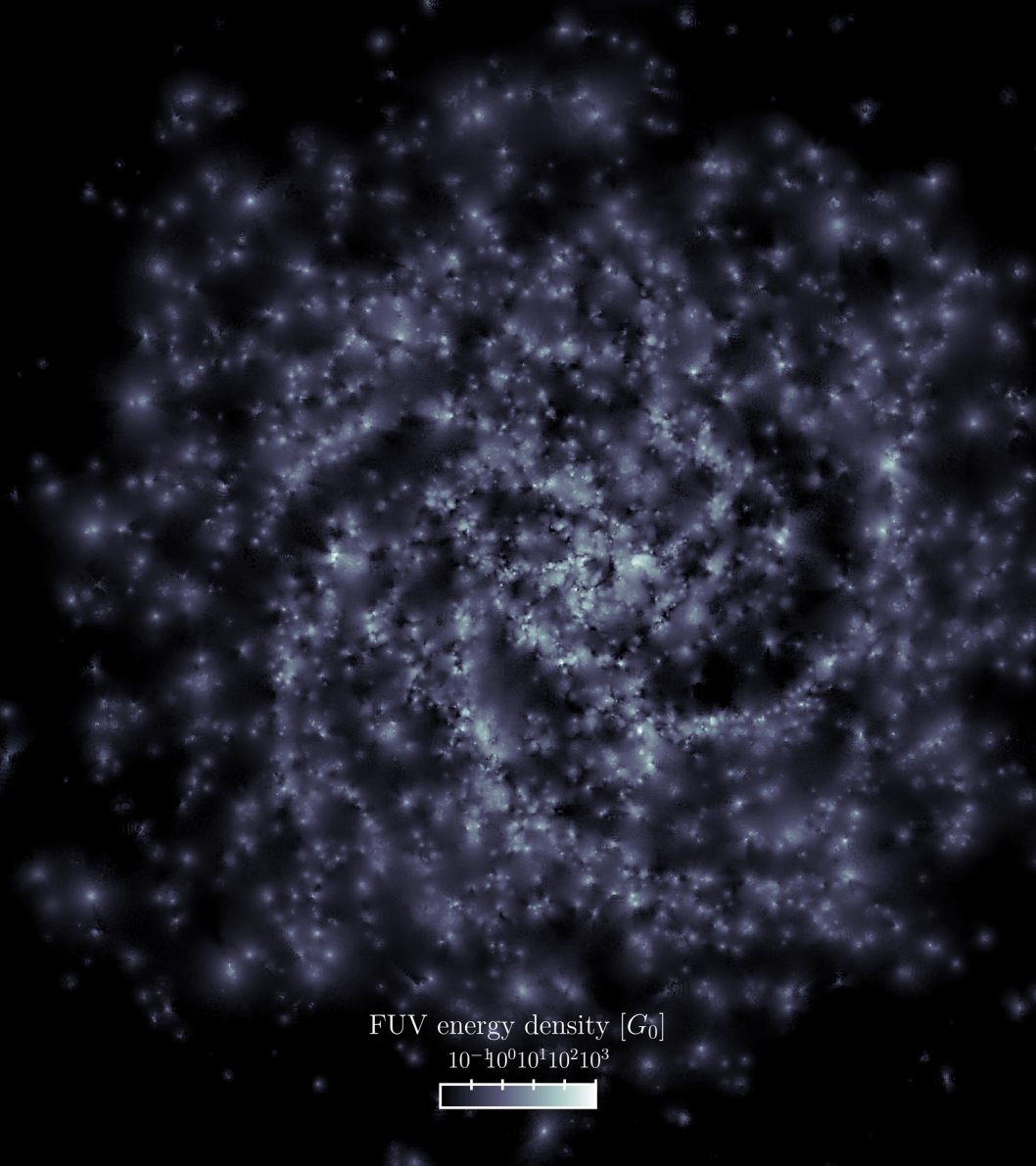
Radiation tree

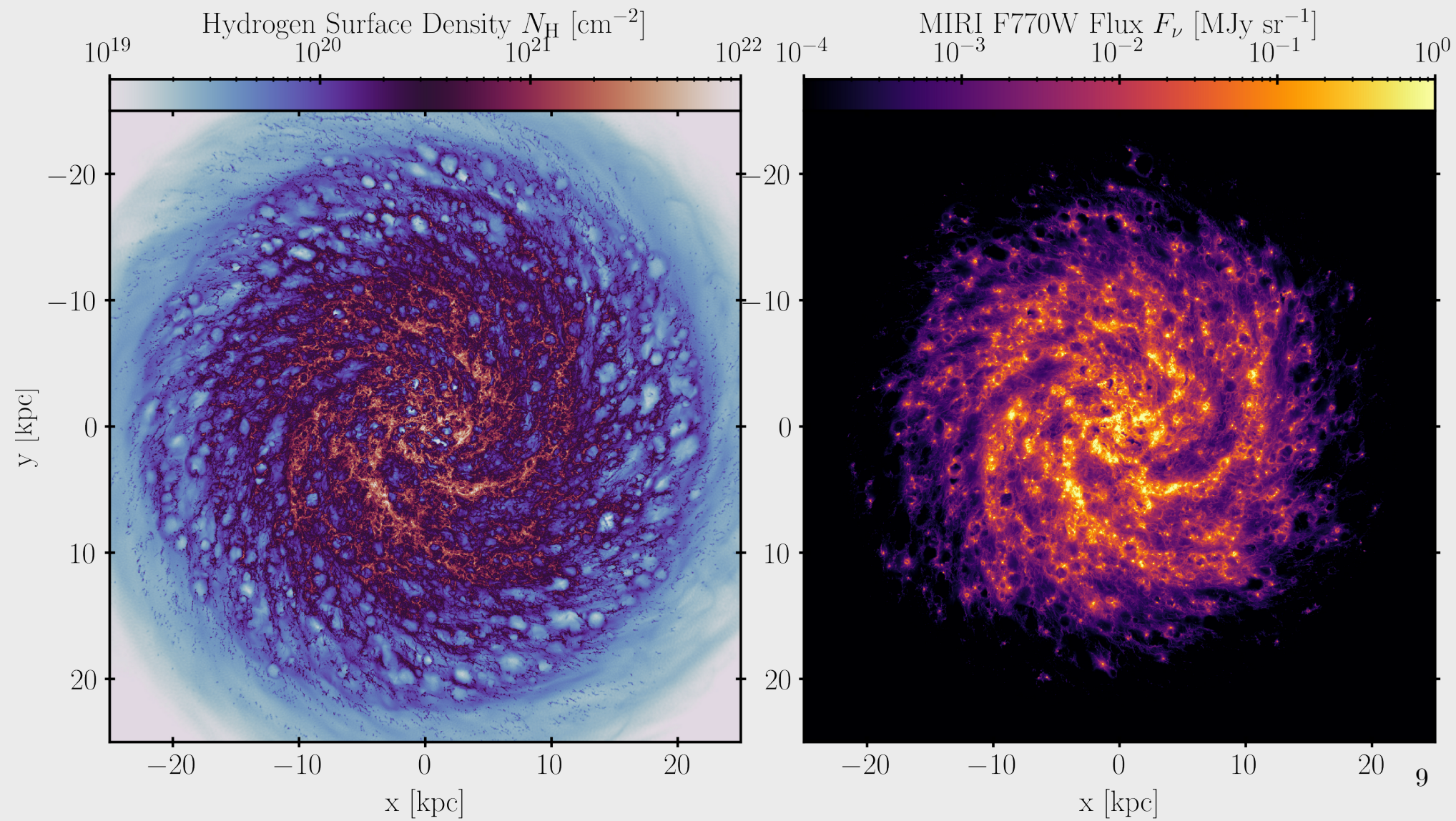
$$F = \sum_i \frac{L_i}{4\pi r_i^2} \exp(\tau_i)$$

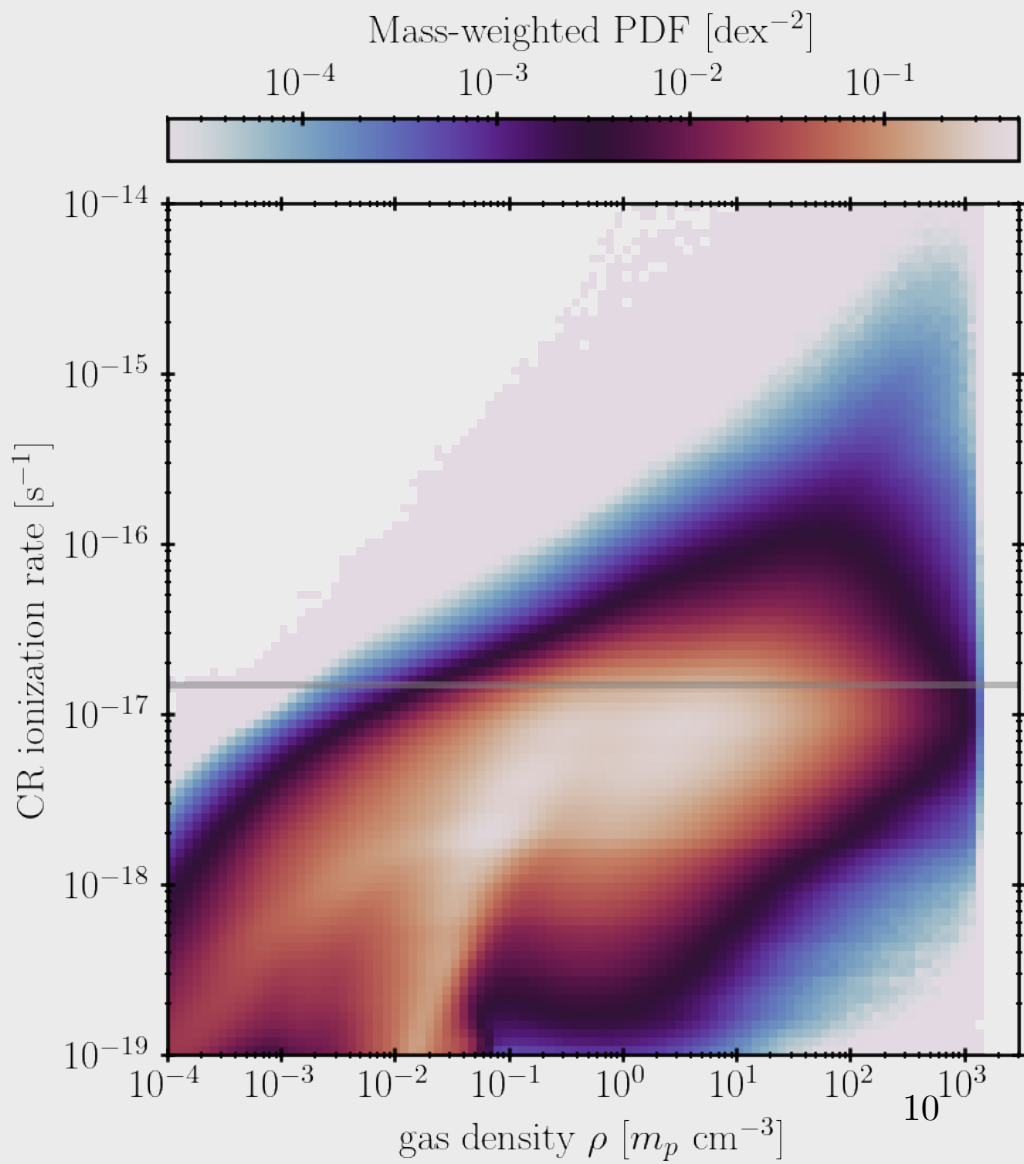
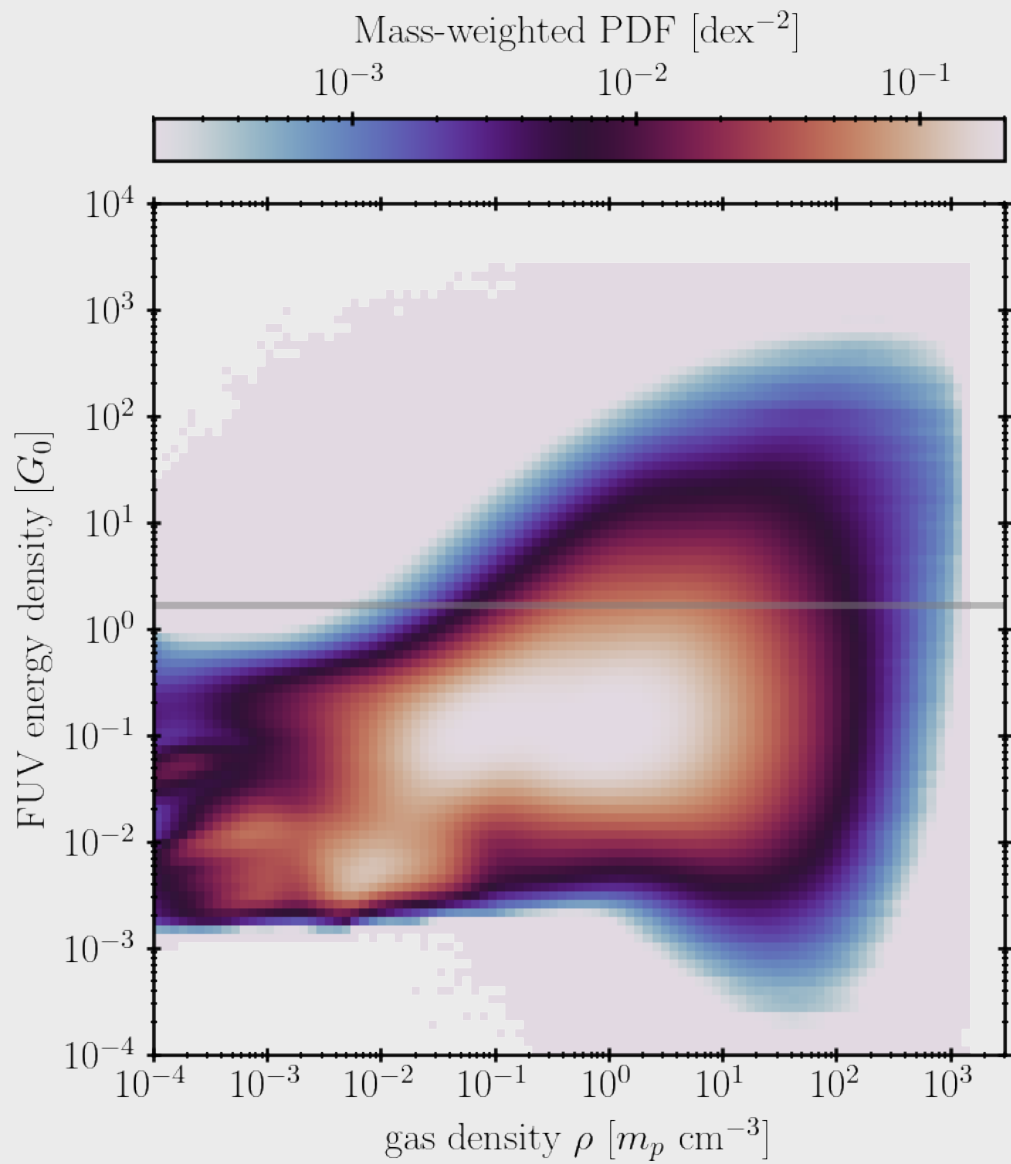


- 1) Build tree with (stellar) sources
- 2) Build tree with the absorbing material
- 3) Normal tree walk to gather optical thin flux
- 4) For every interaction calculate optical depth

$$\begin{aligned}\tau_\nu &= \int ds \, \sigma_\nu(s) n_H(s) \\ &= \sum_{\text{sampling points}} \Delta s_i \, \sigma_\nu(s_i) n_H(s_i)\end{aligned}$$



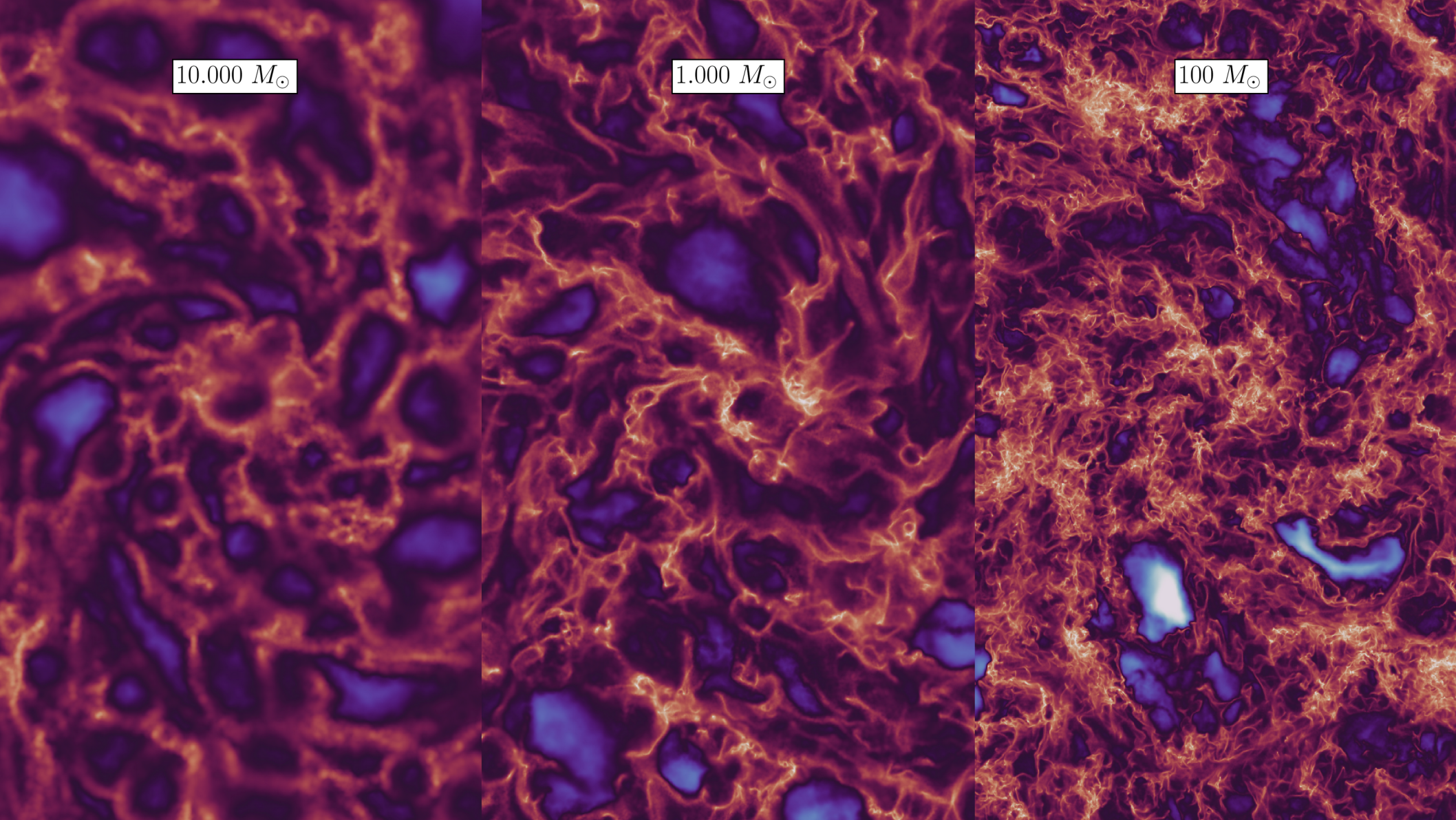




10.000 $M_{\odot}$

1.000 $M_{\odot}$

100 $M_{\odot}$



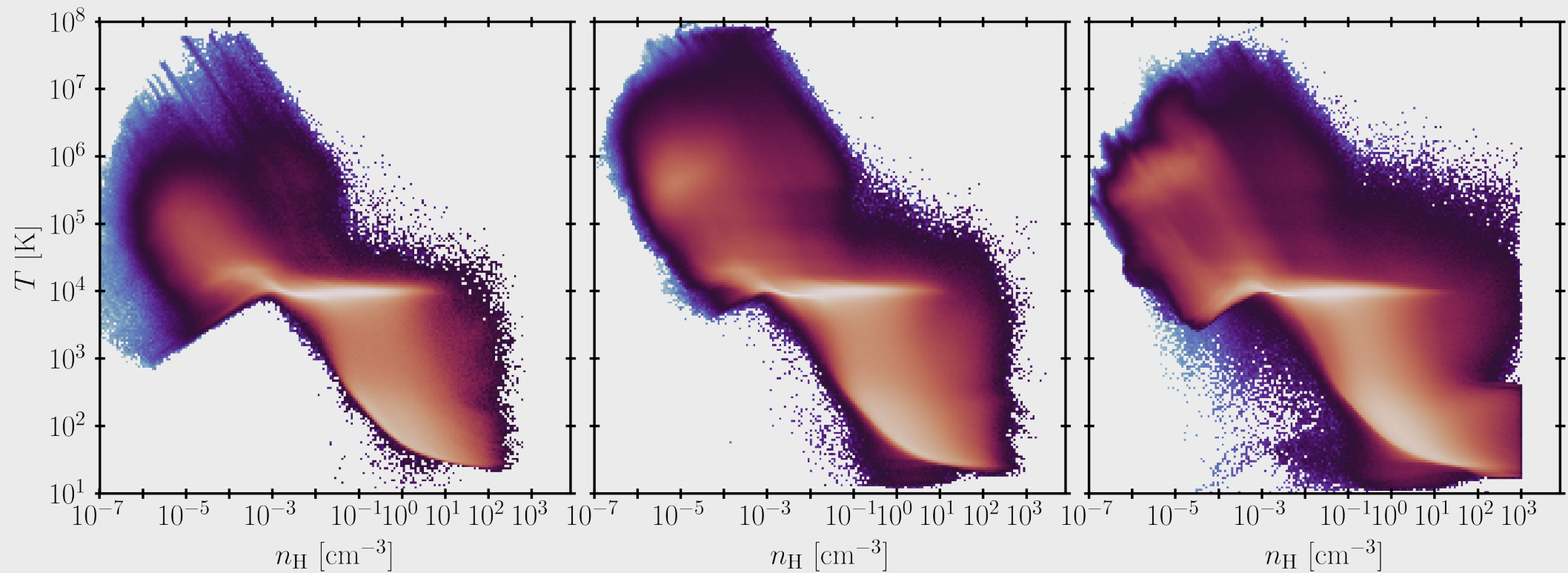
Resolution
 $10.000 M_{\odot}$

$10\times$
 $\longrightarrow$

$1.000 M_{\odot}$

$10\times$
 $\longrightarrow$

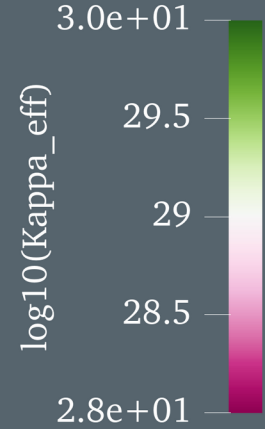
$100 M_{\odot}$



Effective CR Diffusion Coefficient

NLLD

NLLD+IND



CRMHD

$\Sigma \text{ [cm}^{-2}\text{]}$ $10^{19} 10^{20} 10^{21} 10^{22}$

MHD

