

Revealing the physics of galactic outflows using far-infrared polarimetric capabilities

Enrique Lopez Rodriguez
KIPAC at Stanford University

Susan Clark
KIPAC at Stanford University
Assistant Professor

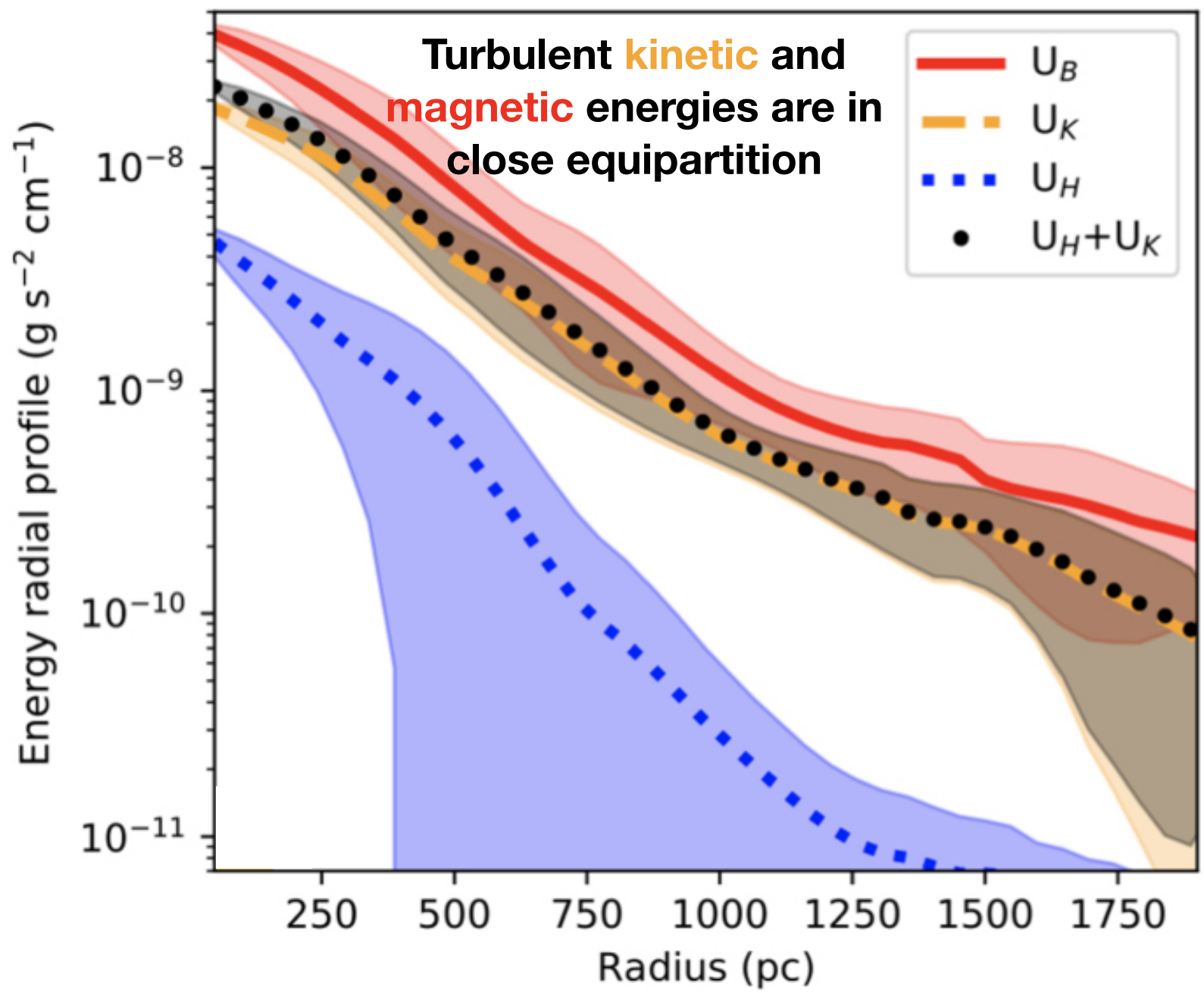
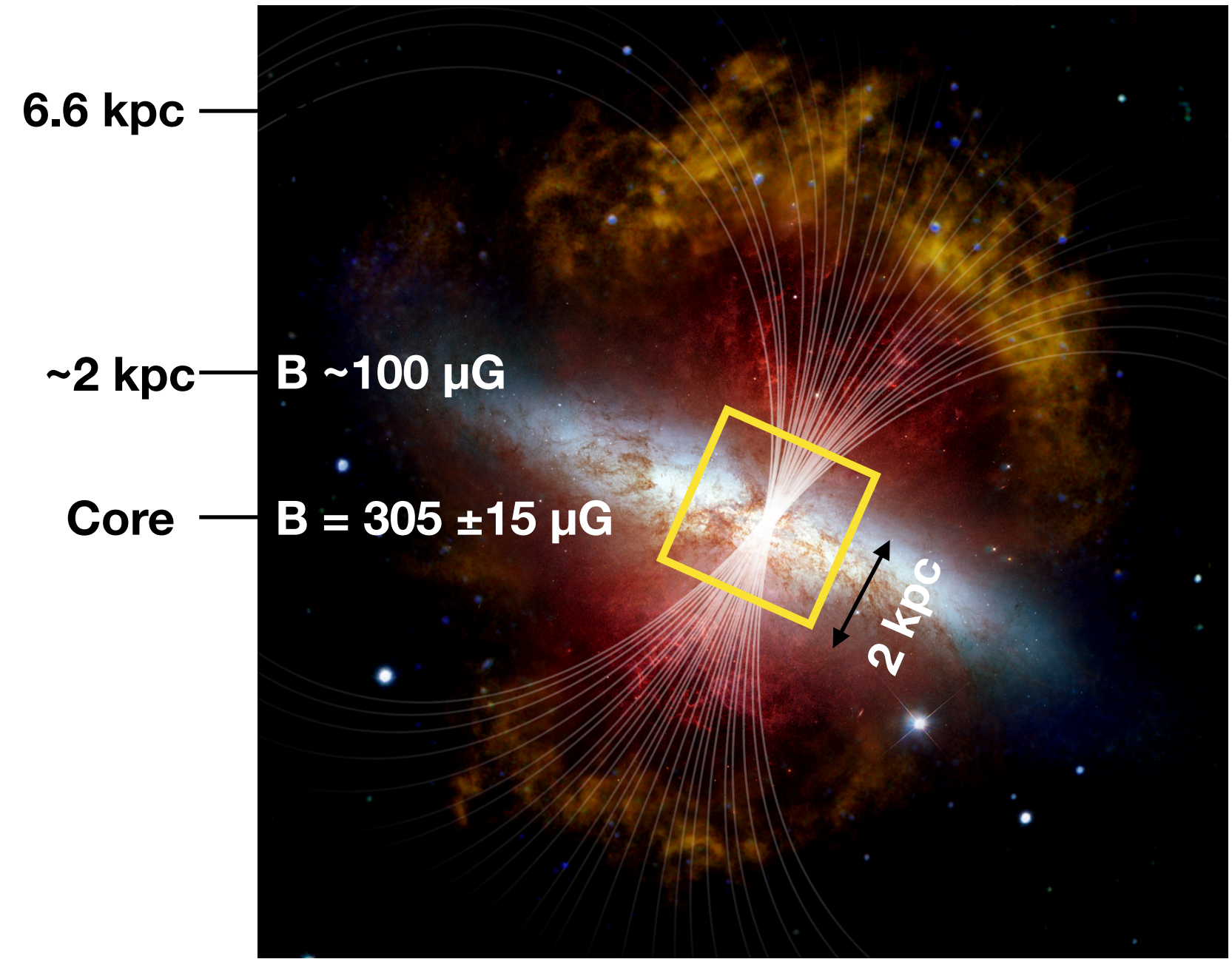
Sergio Martin-Alvarez
KIPAC at Stanford University
KIPAC Fellow

Alejandro Borlaff
NASA Ames Center
NASA Postdoctoral Program Fellow

- **Motivation:**

- Characterizing the cold phase of the CGM.
 - B-fields
 - are main regulators of SF efficiency
 - affect the gas dynamics of the ISM in galaxies
 - affect the dynamics of the ionized gas, dust, and metals outflowing to the CGM via galactic outflows

The B-fields amplified by the starburst galaxy escape into the circumgalactic medium



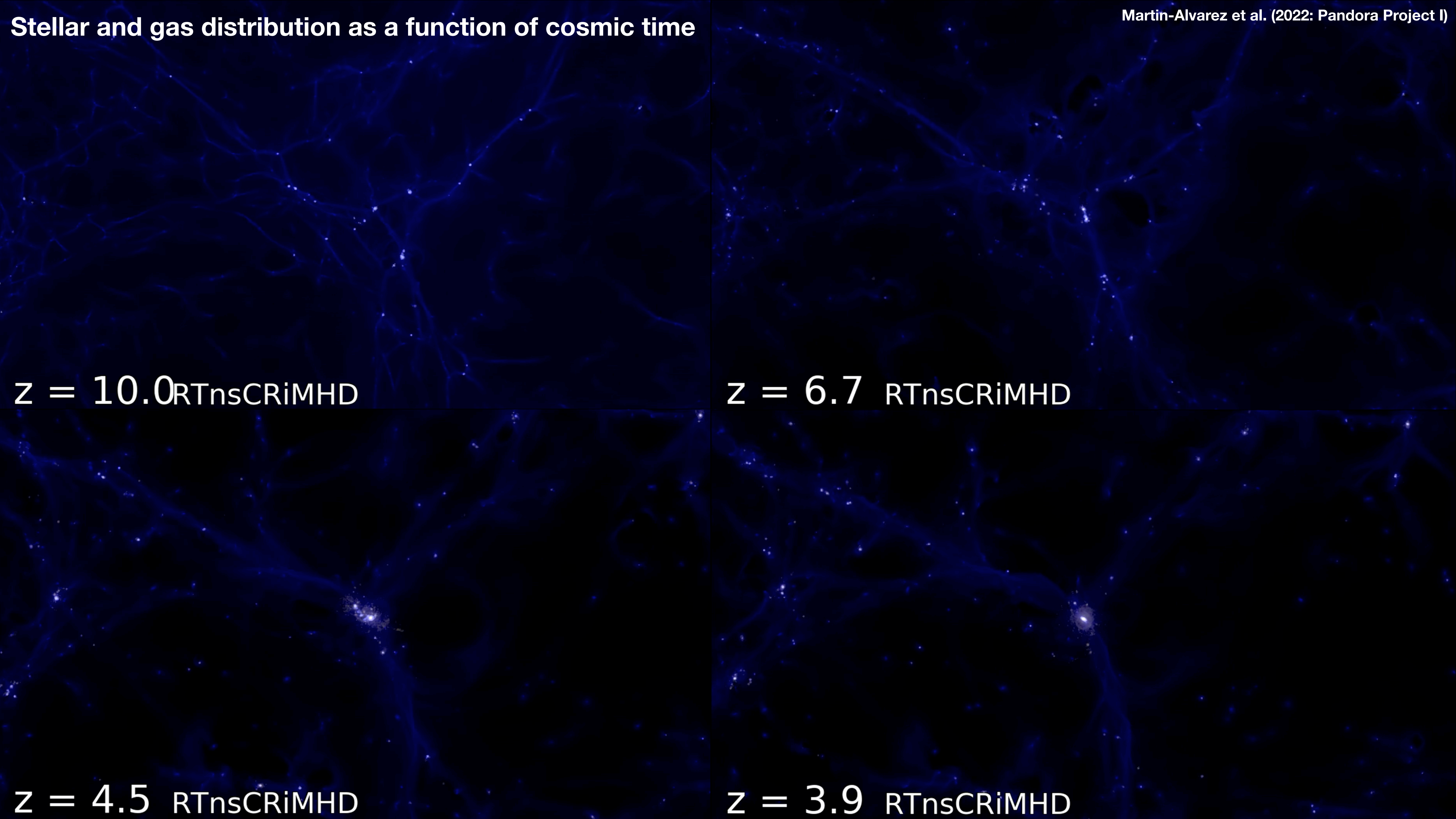
Stellar and gas distribution as a function of cosmic time

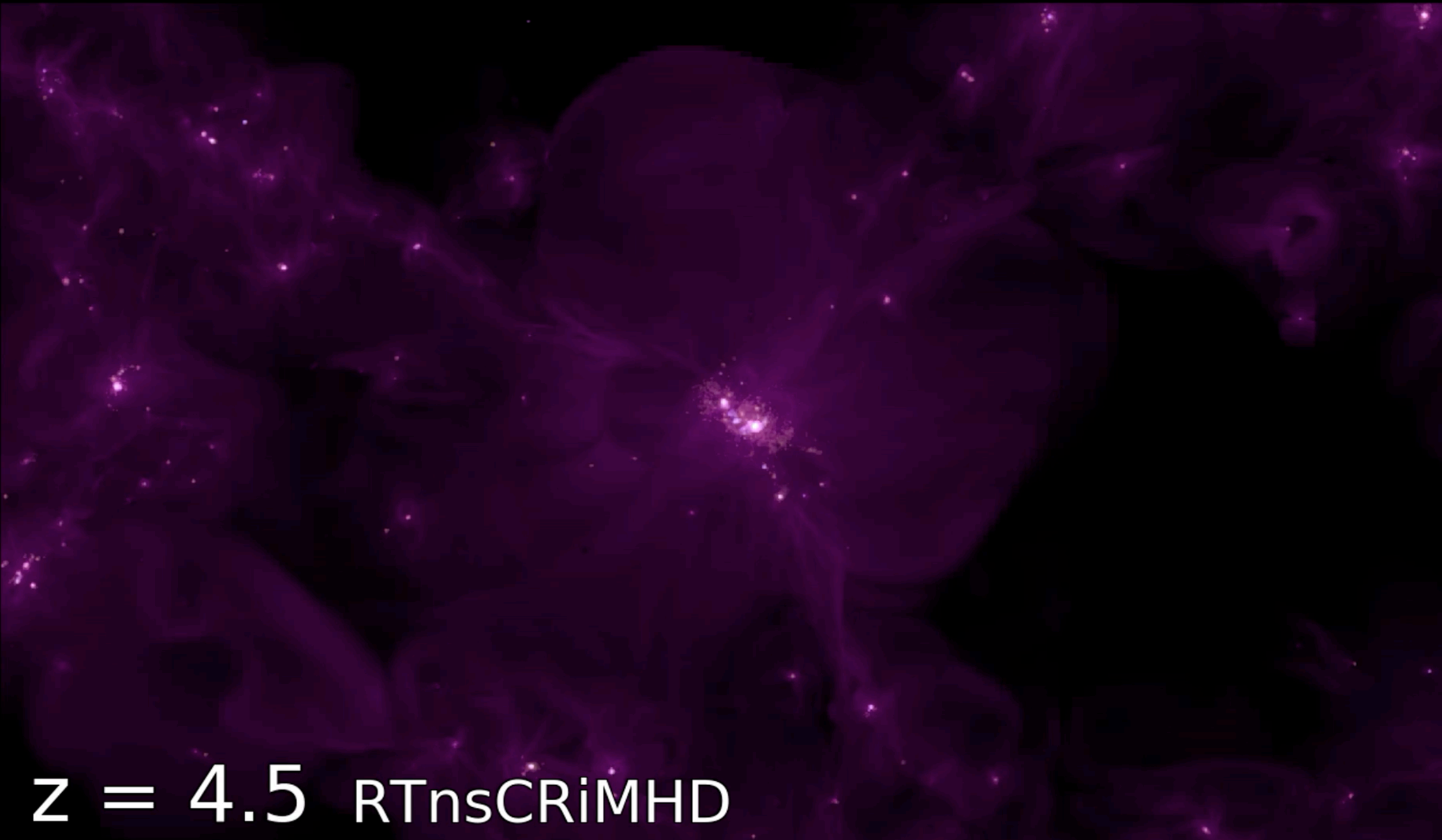
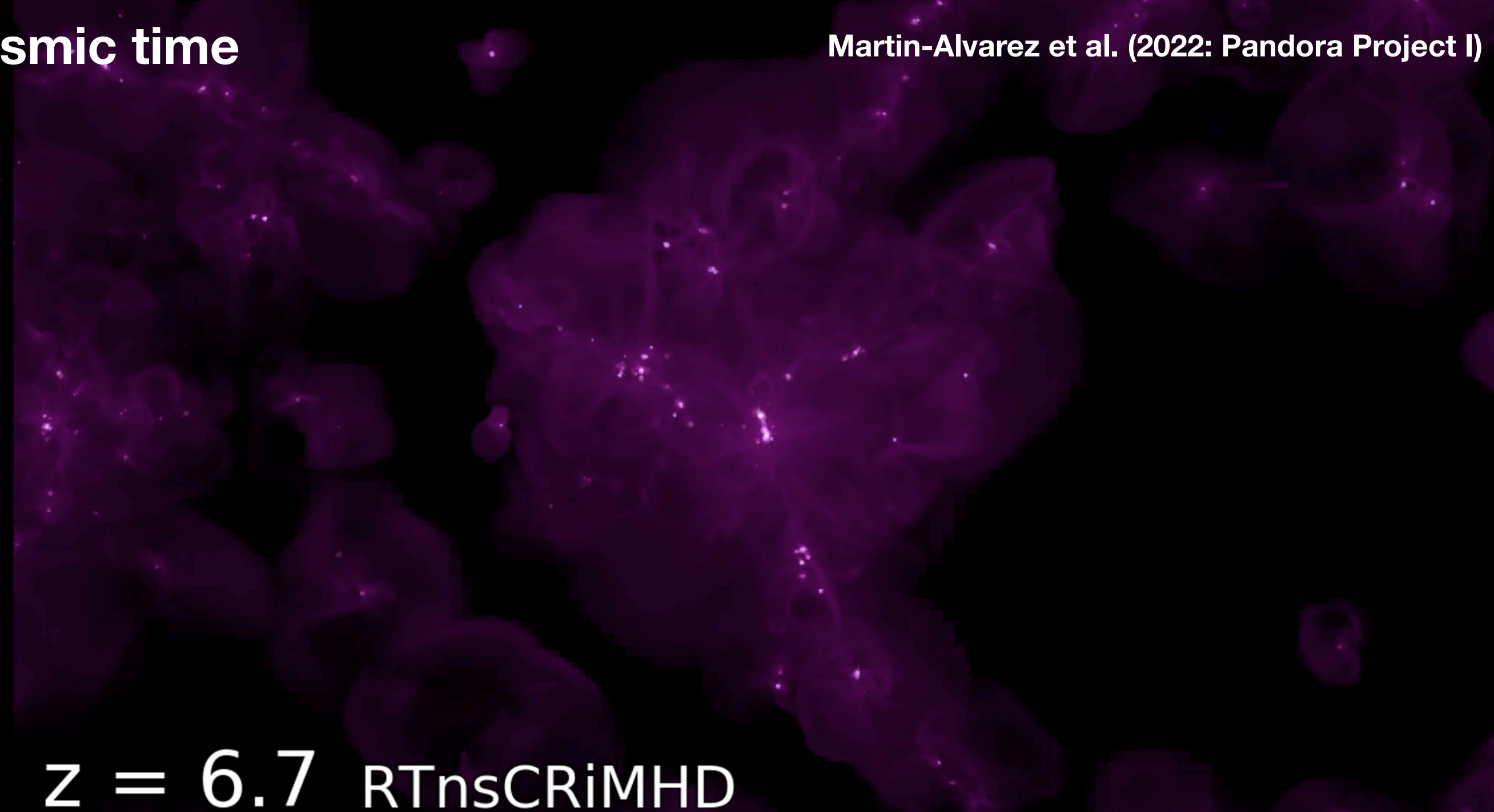
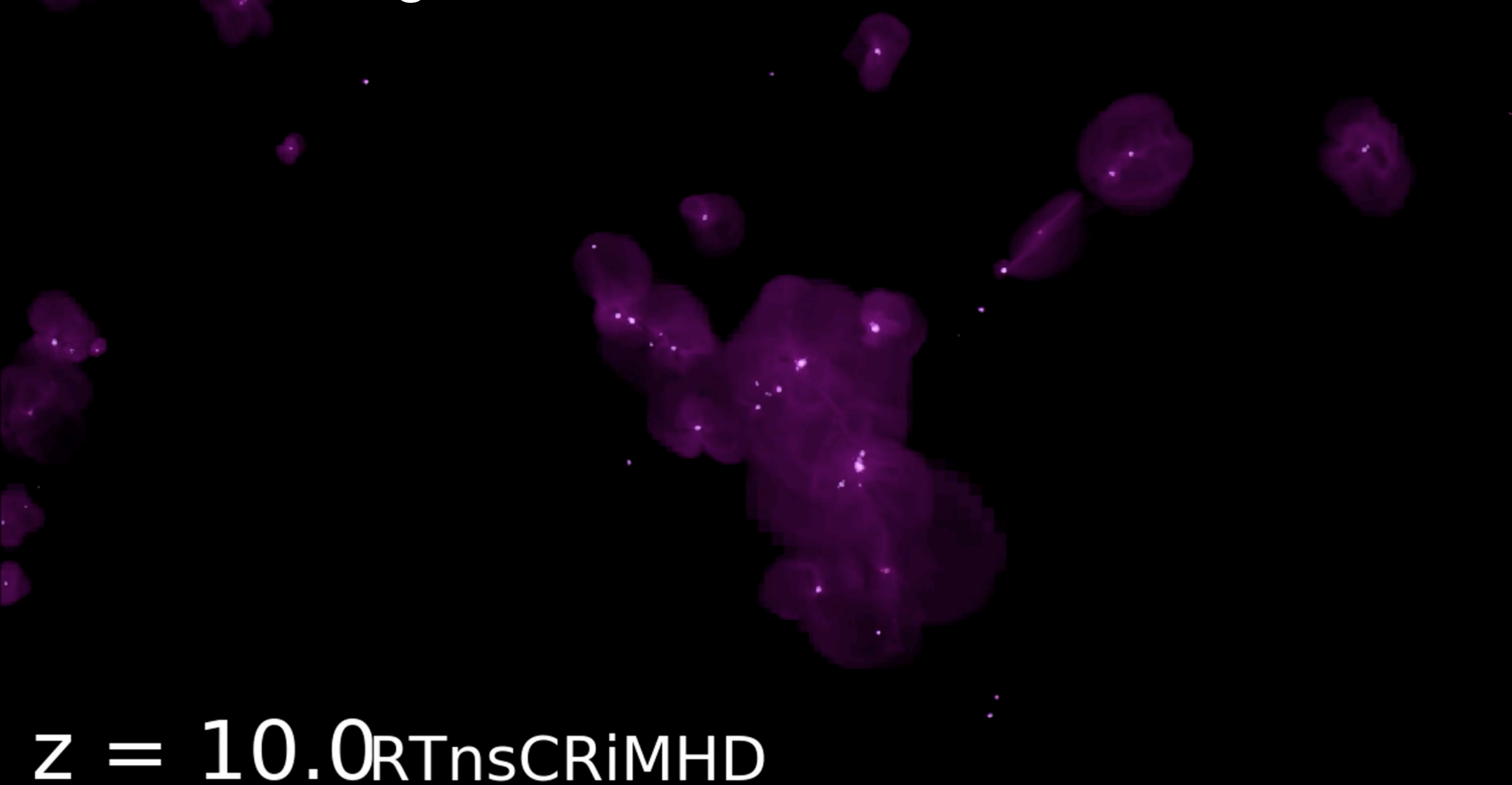
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$z = 6.7$ RTnsCRiMHD

$z = 4.5$ RTnsCRiMHD

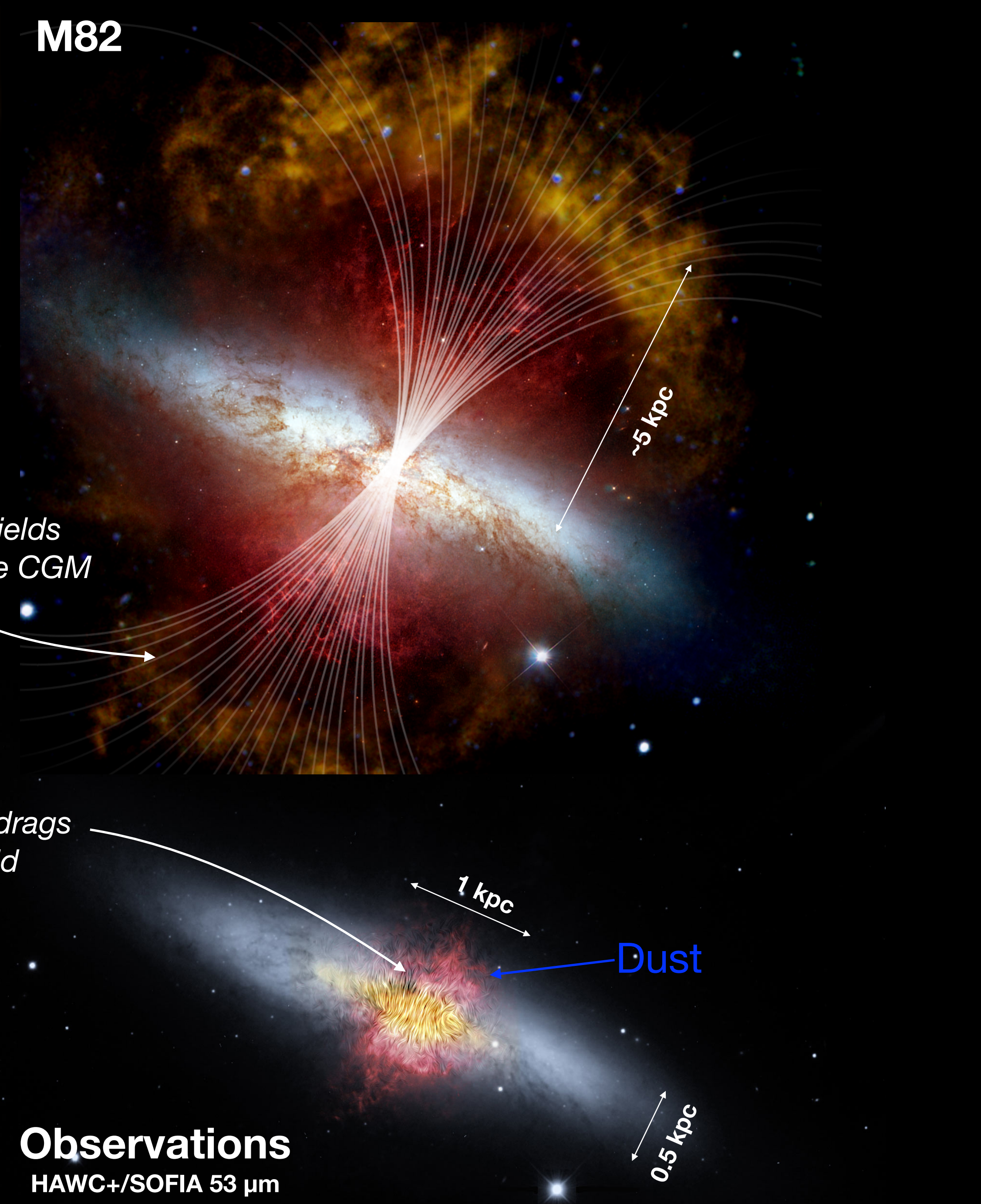
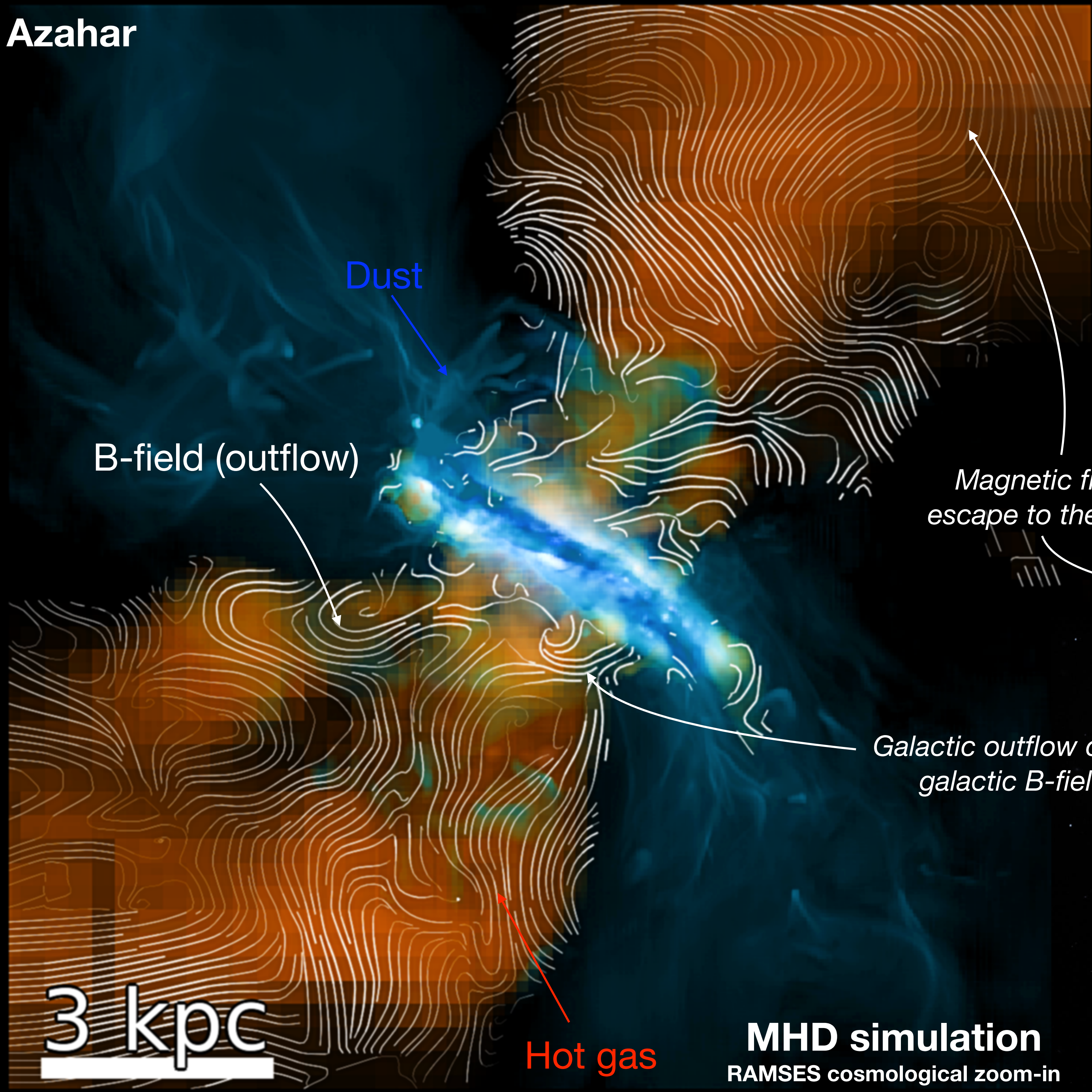
$z = 3.9$ RTnsCRiMHD





Azahar

M82



Dust

B-field (outflow)

3 kpc

Hot gas

MHD simulation
RAMSES cosmological zoom-in

*Magnetic fields
escape to the CGM*

*Galactic outflow drags
galactic B-field*

Observations
HAWC+/SOFIA 53 μm

Dust

0.5 kpc

~5 kpc

1 kpc

- **Need:**
 - FIR polarimetric capabilities
 - Trace the cold phase of the ISM—where most of the mass and the SF reside.
- **Gap:**
 - Lack of FIR instrumentation.
 - SPICA and SOFIA canceled:
 - Disproportional gap in NASA portfolio and wavelength coverage.
 - Uncertainty on how B-fields intervene in galaxy formation:
 - What is the impact of B-fields on stellar feedback processes during starburst activity?
 - How do cosmic rays propagate and affect the dynamics of the ISM and galactic outflows?
- **Goals and deliverables:**
 - Characterize the effect of B-fields in the cold phase of galactic outflows in starburst galaxies.
 - Guide FIR polarimeters for the next generation of NASA FIR missions (i.e., traceability matrix):
 - Wavelength coverage to sample the polarized spectrum.
 - Mapping sizes, sensitivities, and angular resolution to cover extended regions while resolving the turbulent B-field.

Inclusion Plan:

- To build the next generation of NASA *Great Observatories*, we must foster the next generation of *great* Scholars.
 - Post-baccalaureate program to increase access for recent college students from underrepresented minorities (1.5yr fully paid program)
- I did a study using the National Center for Educational Statistics Census 2000:
 - Black and Hispanic/Latinx represent ~15% and ~25% of the student population.
 - They obtain Lecture and Instructor positions at a double rate compared to Professor positions.
- Metrics of the NASA Precursor Science:
 - Post-bacc. Scholar to be admitted to a highly competitive graduate school program
 - At least a submitted paper before graduate school application
 - Provide training on professional skills.
 - We want all members of our team to feel respected, accepted, supported, and valued:
 - Quarterly surveys to quantify development of scientific and personal skills, and feeling of belonging in the Post-Bacc. Program and astrophysics community.
 - Quarterly discussions about the outputs of these surveys. Individual meetings as needed during the quarter.
 - Summaries and actions will be submitted to NASA at the end of each year.

