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From Simba-C to Athena: Mock X-ray Elemental Abundances in Galaxy Groups and Clusters

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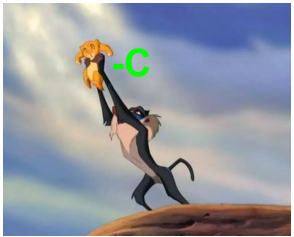
Gizmo + Simba + Chem5 = Simba-C[1]

Base Simulation (Simba):

- Gizmo: Meshless-hydrodynamics, gravity, and thermal evolution.
- **Sub-grid:** Stellar and black-hole formation, feedback systems.



Chemical Enrichment (Chem5):[a]

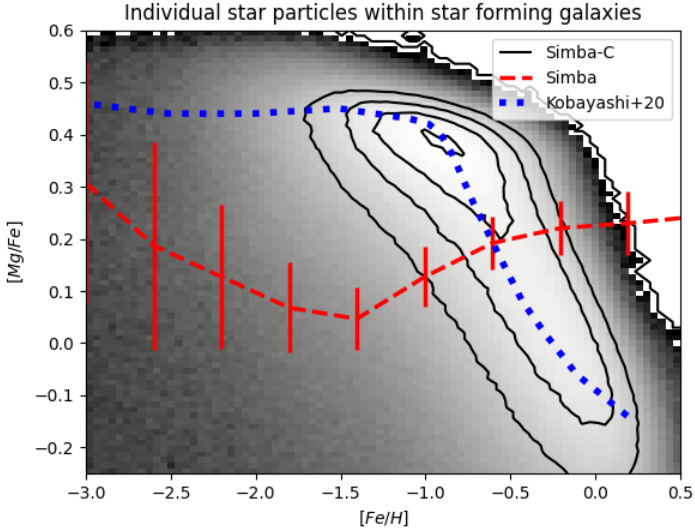
- 32 elements (H→Ge), treating stars as evolving populations.
- **Calibrations:** Chabrier IMF, dust mapping, $f_{\mathrm{SNII}} = 0$, tuned wind/jet scaling.

[a] Kobayashi C., et al. (2007, 2011, 2020); Romano D. et al. (2005)

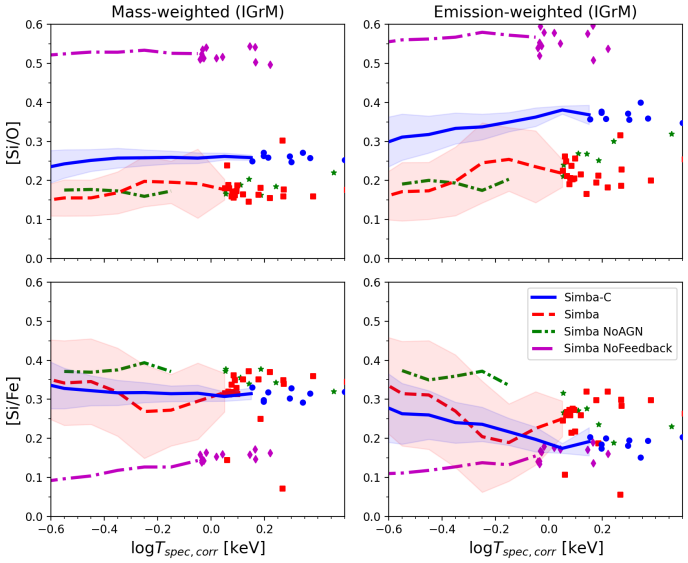
[1] Davé et al. (2016, 2019); Hough R. T., et al. (2023)

So why do we want to make mock X-ray observations for `Simba-C` specifically?

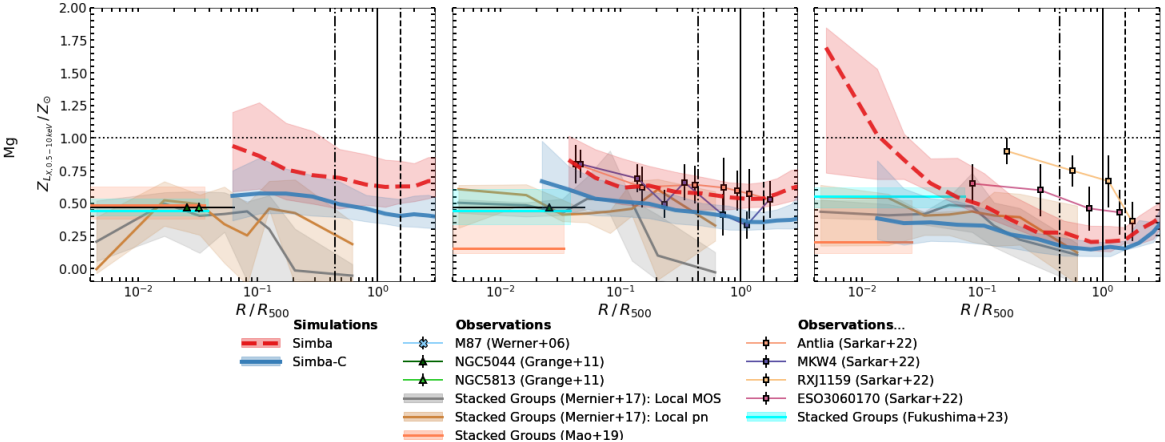
Galaxy [Mg/Fe] abundance ratios



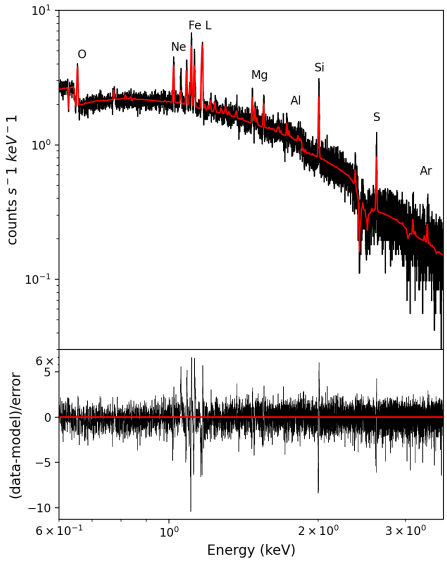
Galaxy group [Si/Fe] and [Si/O] abundance ratios

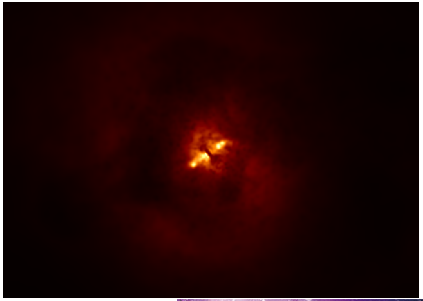


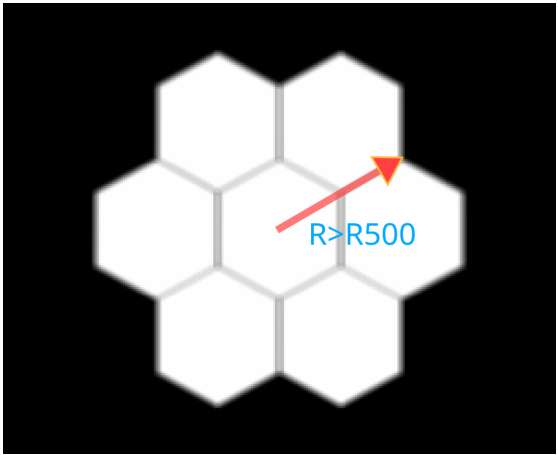
Group and cluster Mg profiles - Padawer-Blatt A., et al (2025)

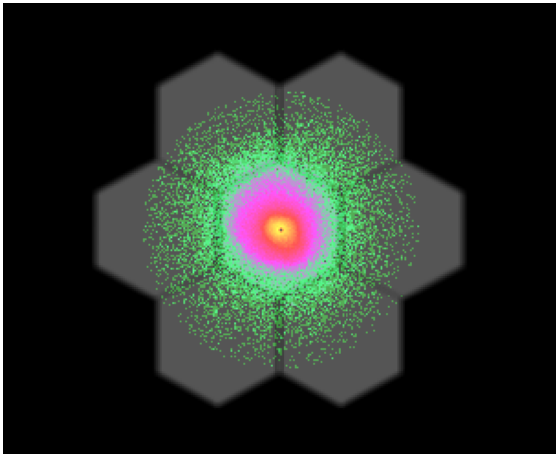


Mock Athena X-IFU observations (Moxha) - original idea

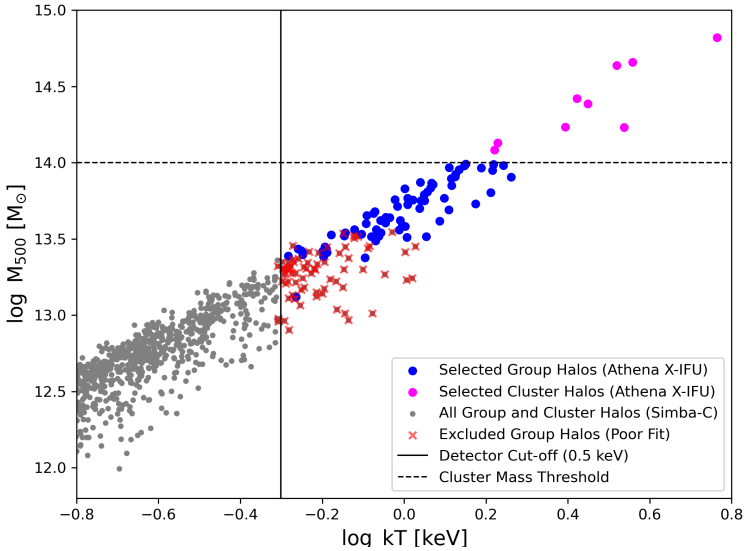




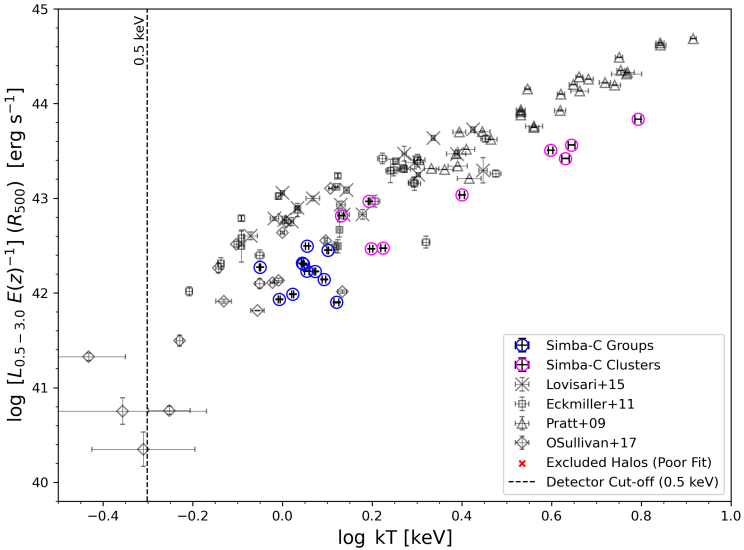

R>R500



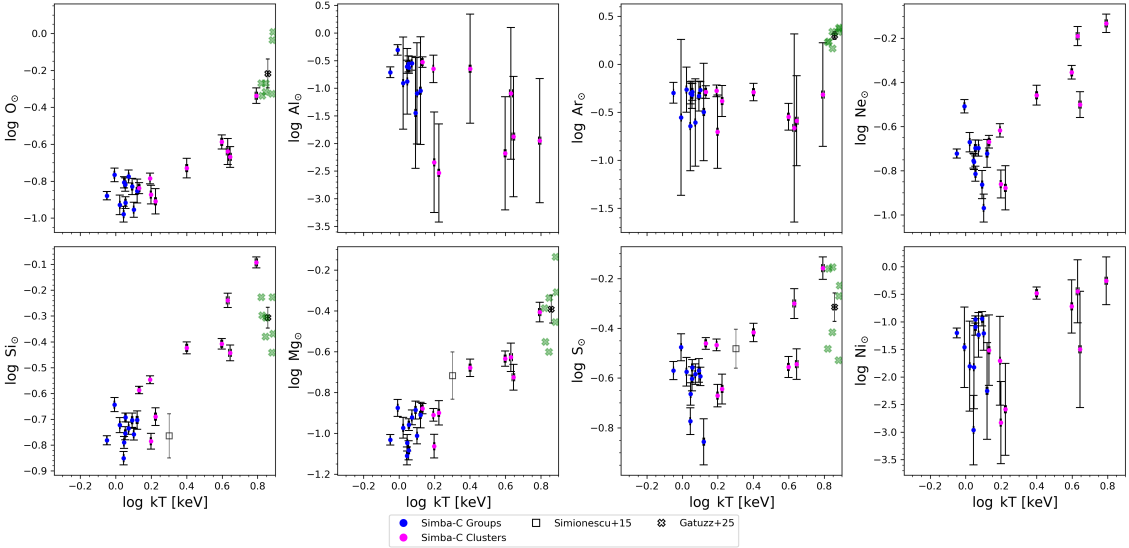
Preliminary project status: Halo selection



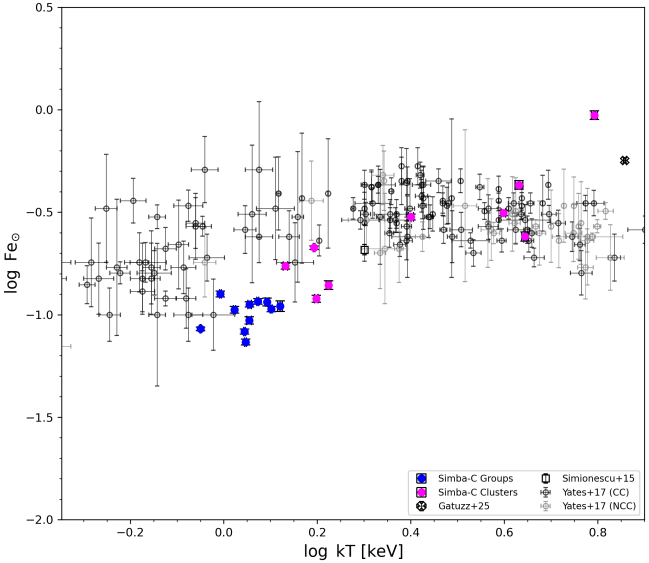
Preliminary project status: $L_x - T$ relation



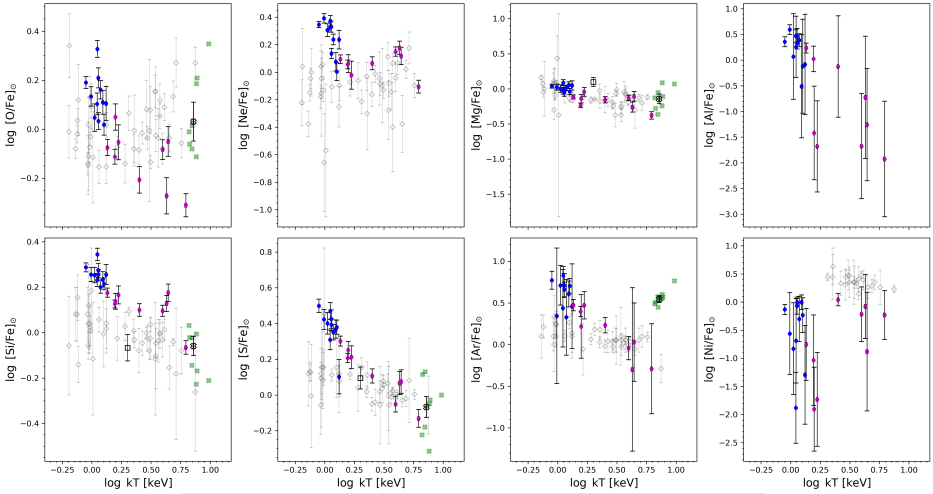
Preliminary project status: Elemental abundances



Preliminary project status: *Fe* abundances



Preliminary project status: Elemental abundances ratios



Summary

- Successfully update the mock X-ray *Athena X-IFU* observations for `Simba-C`.
  - Mosaic observations.
  - Data clean up.
  - Statistical XSPEC analysis setup.
- Started studying the mock X-ray abundance trends :)

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THANK YOU!!!

Upcoming Event: PASEA

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Hough R. T., Jennings F., Loubser S. I., Sonskamble S., Davé R., Babul A. (Planned submission 2026 - authors to be confirmed).