Title: Flash Talks - 1 min, 1 slide

Speakers:

Collection/Series: Cosmic Ecosystems

Subject: Cosmology

Date: July 28, 2025 - 4:10 PM

URL: https://pirsa.org/25070061

Abstract:

Presenters:

Bhuvan Manojh
Calvin Osinga
Cassandra Lochhaas
Daria Kozlova
Dorsa Sadat Hosseini
Emily Costello
Guandi Zhao
Henry Liu
Ian Roberts
Isaac Cheng
Joe Bhangal
John Pharo
Jonah Conley
Junwu Huang
Mukesh Singh Bisht
Nihar Dalal
Noah Sailor
Pierre Burger
Ray Wang
Stephanie Ho
Yongming Liang

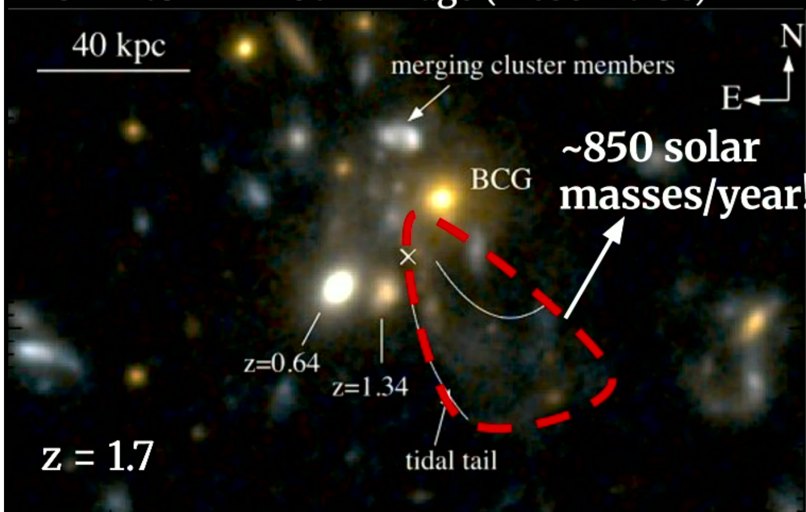
Searching for SpARCS1049 Analogues in TNG-Cluster

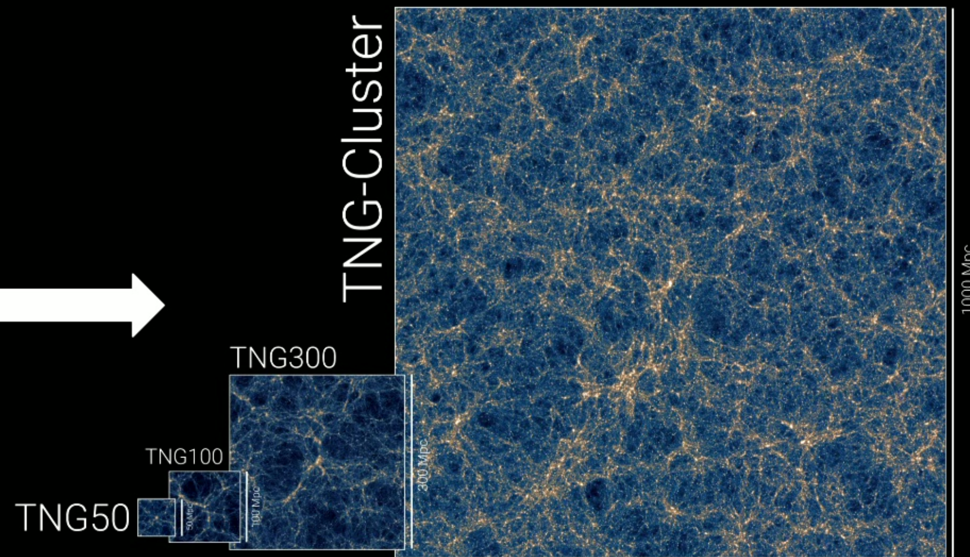
Cosmic Ecosystems 2025

Bhuvan Manojh (McGill University)
Supervisor: Prof. Tracy Webb

McGill | TSI Trottier Space Institute at McGill | Institut spatial Trottier de McGill

HST F105W + F160W Image (Webb+2015b)





How do extremely star-forming clusters at high redshift behave and why?
We turn to cosmological simulations for the answer...

Calvin Osinga
Benedikt Diemer

Tracers with a Twist

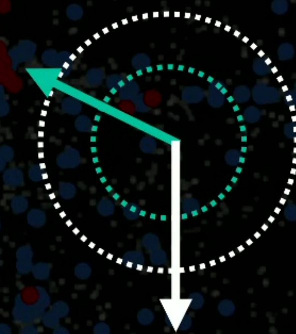
25/07/28
Cosmic Ecosystems

Expectation

Tracers cluster more with time and follow their host halos.

Results from IllustrisTNG

Red/blue galaxies and HI cluster less with time...



And bulk velocities of HI and host halos are misaligned.

Implications:

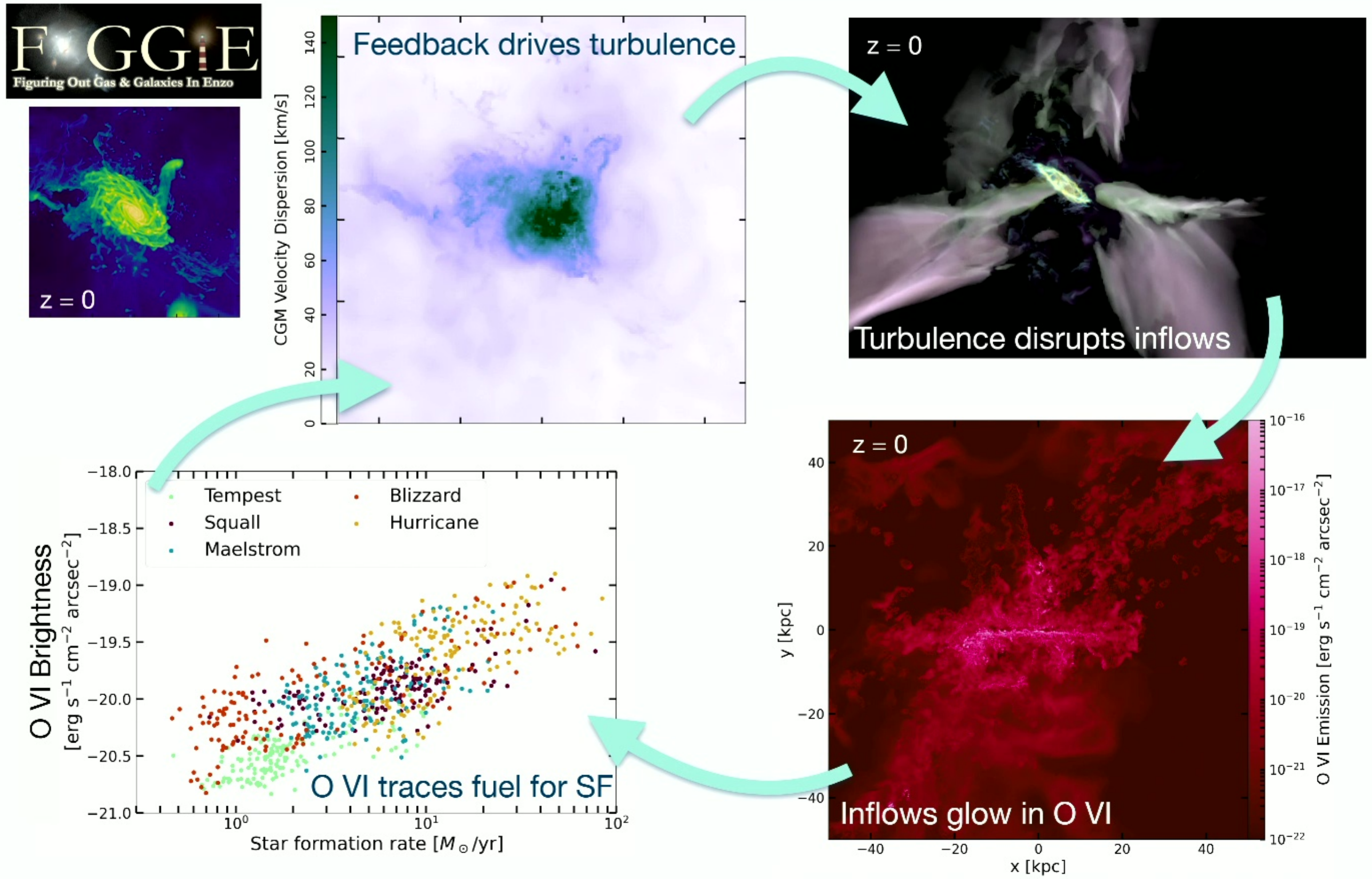
- Occupational effects on velocity bias
- Tracer clustering impacted by "small-scale" physics

even out to $\gtrsim$ 150 Mpc

UNIVERSITY OF MARYLAND

The Impact of Feedback on Galactic Accretion through the Circumgalactic Medium

Cassi Lochhaas

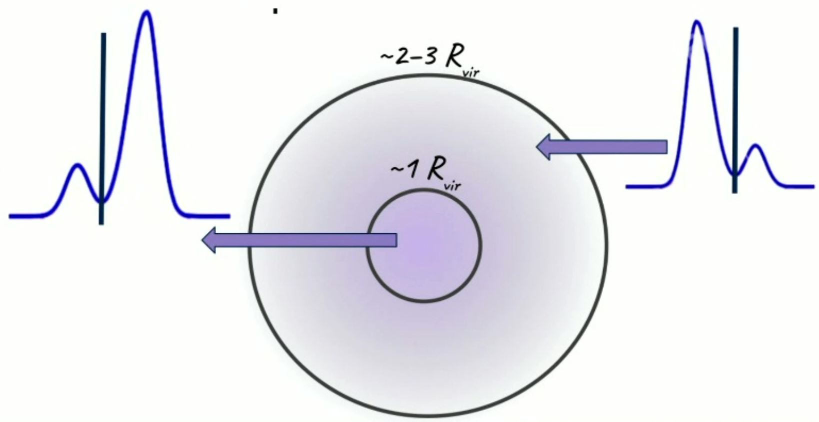


Spectro-mapping Lya halos as a tracer of gas flows in the circumgalactic medium at z > 3

Leibniz-Institut für Astrophysik Potsdam

Daria Kozlova, Lutz Wisotzki, John Pharo et al.

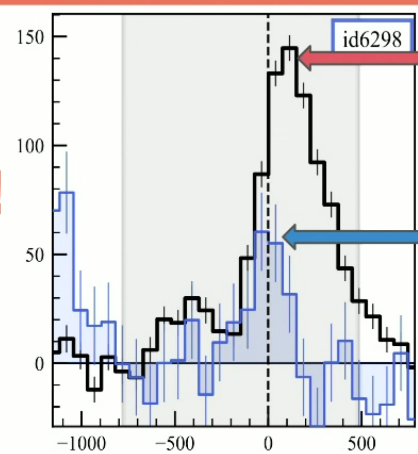
Inner CGM Lya emission:
- dominates integrated Lya halo spectrum;
- is caused by galactic outflows;
- is redshifted from z_{sys}



Outer CGM Lya emission:
- in stacked Lya halo is blueshifted from inner Lya peak and possibly z_{sys}
- possible explanations: inflowing gas, CGM properties, faint neighbours

Can we detect bluewards Lya spectral shift in outer CGM of individual Ly alpha halos?

Yes!



Inner CGM:
Lya peak at ~ 150 km/s

Outer CGM:
Lya peak at ~ -20 km/s

Visit the poster to see the results for the whole sample, discuss systemic redshifts of Lya emitters and possible physics behind this new exciting spectral phenomena!

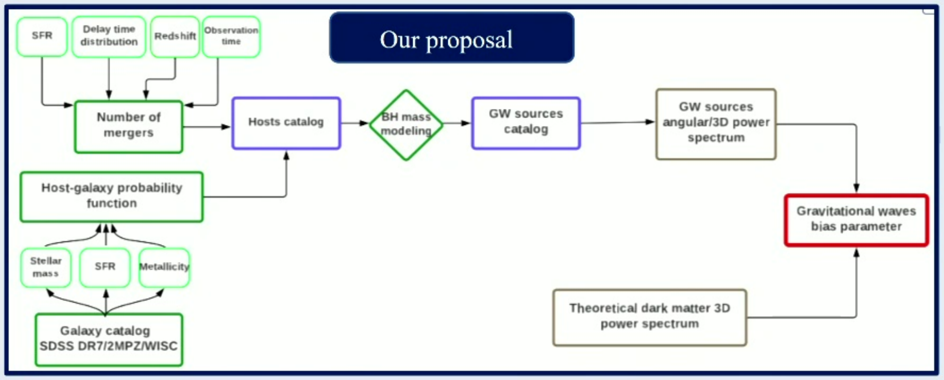
The Gravitational Wave Bias Parameter
Bridging Between Galaxies and Binary Black Holes

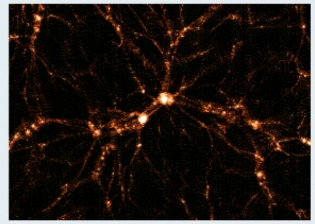
PERIMETER INSTITUTE

arXiv:2411.11965 & arXiv:2506.11201/ JCAP 04 (2025) 056

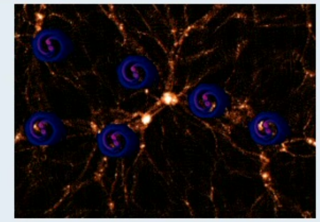
UNIVERSITY OF WATERLOO

Dorsa Sadat Hosseini
- PhD, UWaterloo/ Perimeter institute
- d2sadath@uwaterloo.ca

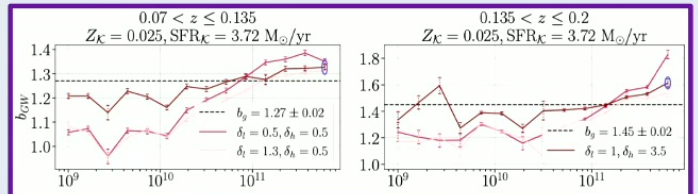


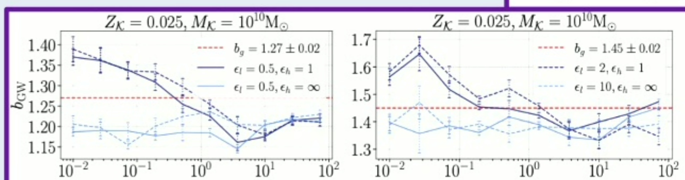


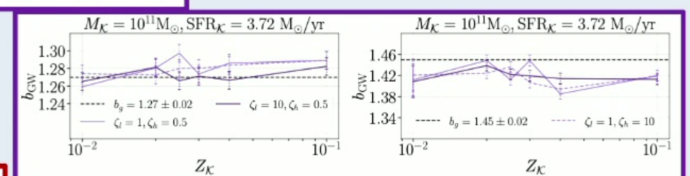
$$\delta_{GW} \equiv b_{GW}[\delta]$$



Results





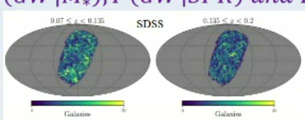


Host-galaxy probability functions

Broken power laws
Encapsulating the physics from the formation to the merger of BBHs

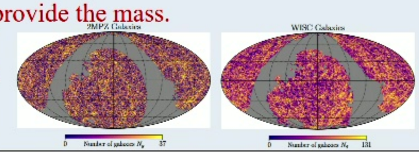
$$\boxed{P(GW|M_*, SFR, Z)}$$

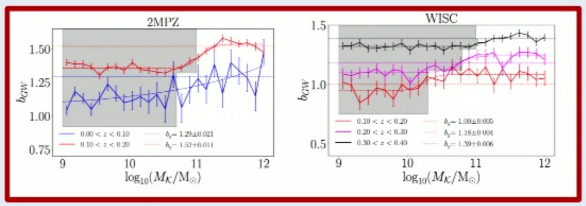
- **SDSS** provides the mass, SFR, and metallicity.
- Joint probability distribution of $P(GW|M_*)$, $P(GW|SFR)$ and $P(GW|Z)$
- Spectroscopic surveys
- 3D power spectrum



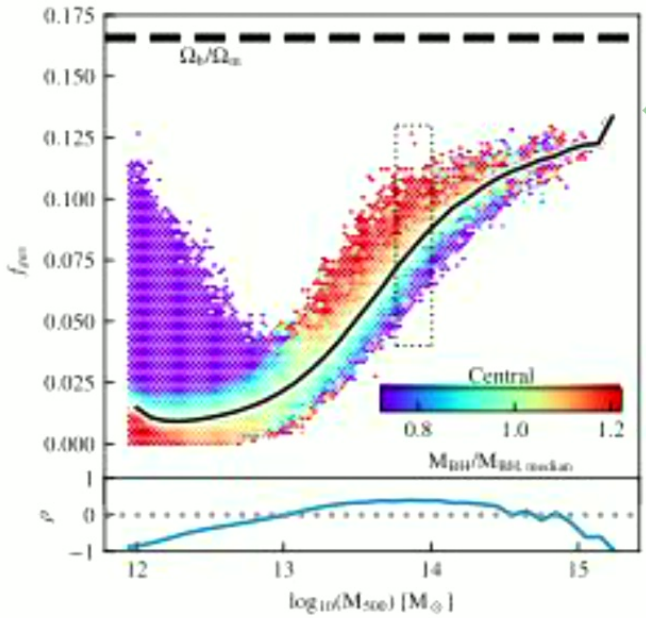
$$\boxed{P(GW|M_*)}$$

- **2MPZ** and **WISC** only provide the mass.
- Photometric surveys
- Angular power spectrum

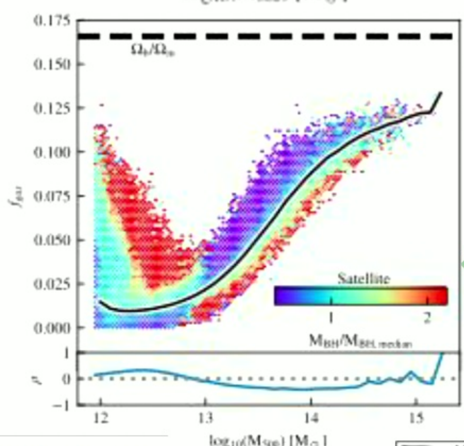




Collaborators:
Amir Dehghani , J. Leo Kim
Alex Krolewski , Suvodip Mukherjee
Supervisor: Ghazal Geshnizjani



Reversal in correlation?



Anti-correlation between central and satellite BHs?

Tracing the Coevolution of Gas and Black Holes in FLAMINGO

Emily E. Costello (ariecost@ljmu.ac.uk) | I G. McCarthy, R A. Crain

Astrophysics Research Institute, Liverpool John Moores University

LIV.INNO

LIVERPOOL JOHN MOORES UNIVERSITY

ETH zürich PERIMETER INSTITUTE

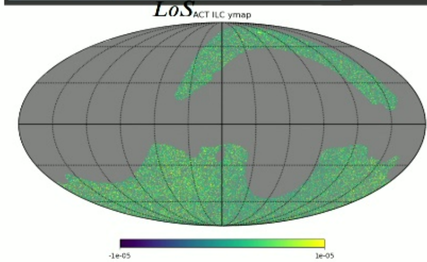
Evidence for Galaxy Central Pressure Deficit from unWISE – tSZ Angular Correlation

Guandi Zhao[1], Alex Krolewski[2,3], Niayesh Afshordi[2,3]
[1]D-PHYS, ETH Zurich; [2]Perimeter Institute for Theoretical Physics; [3]Waterloo Centre for Astrophysics, University of Waterloo

Thermal SZ

$$y = \frac{\sigma_T}{m_e c^2} \int_{LoS} P(r)dl$$

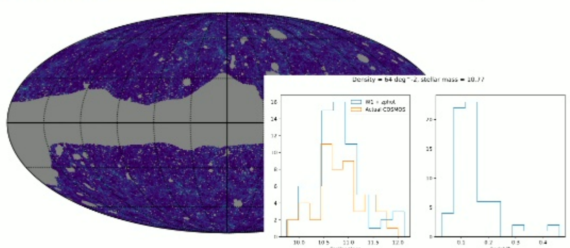
Y



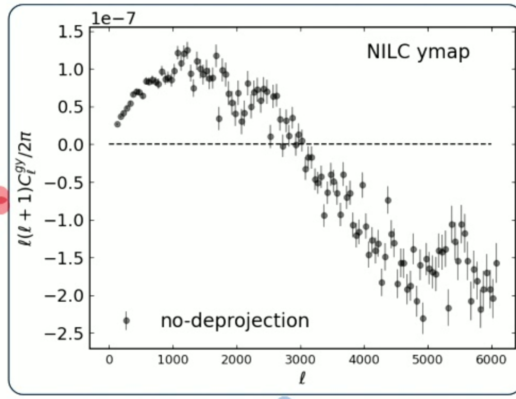
Galaxy Number Counts

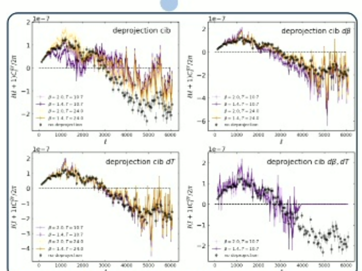
unWISE Galaxy Catalog
1585300 Low Redshift Galaxies

G



Negative Angular Correlation at $\ell > 2500$.



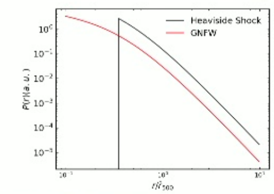


Resilient to CIB Contamination.

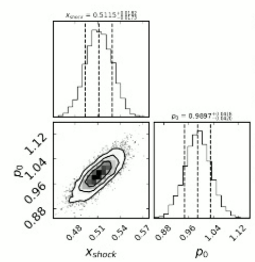
Galaxy Pressure Profile

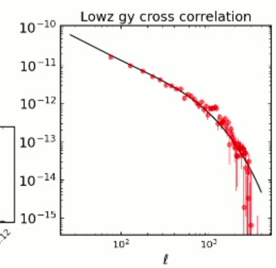
P

$$P_e(x) \propto \Theta(x - x_s) P_{GNFW}$$
$$x = r/\tilde{r}_{500}$$



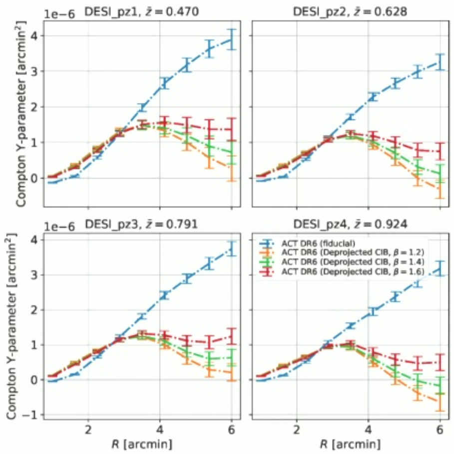
PYCCL
Halo Model



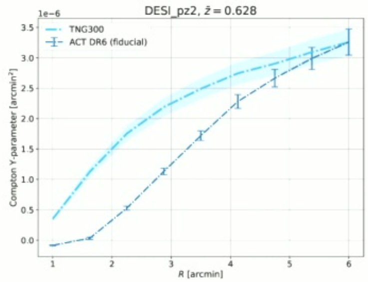


Central Pressure Deficit!

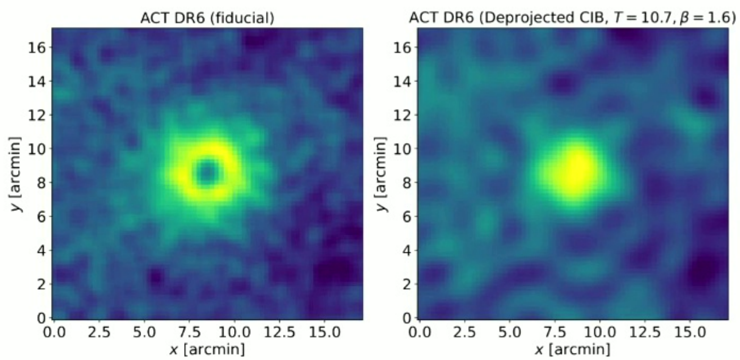
Constraining the Thermal Sunyaev-Zeldovich effect with DESI and ACT
arXiv:2502.08850



tSZ Measurement



Comparison to IllustrisTNG

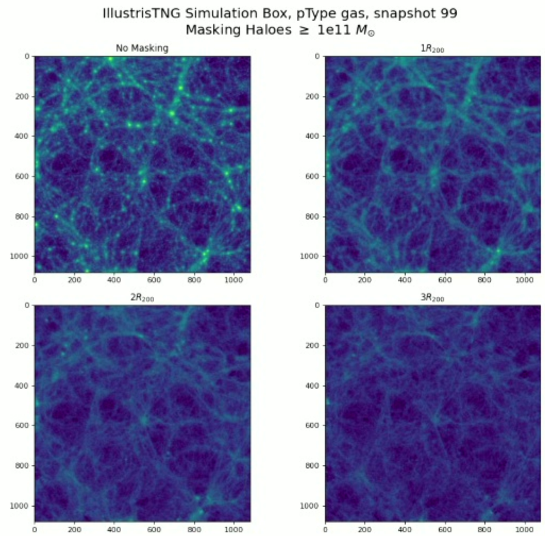


Effects of CIB Dust Emissions on Measurement

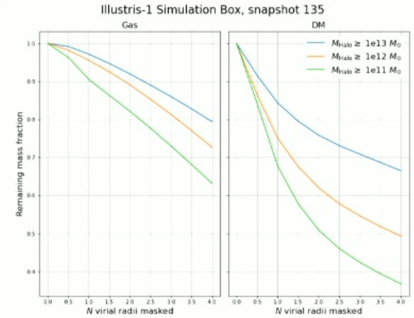
Berkeley
UNIVERSITY OF CALIFORNIA

R. Henry Liu
rh_liu@berkeley.edu

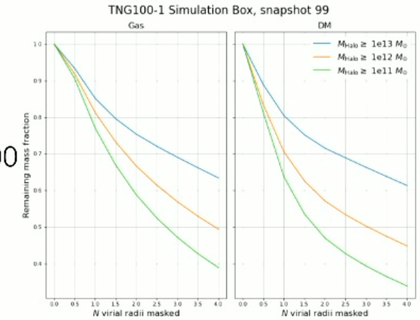
Current Project: Studies of Bound and Unbound Gas in Cosmological Simulations



Old Illustris

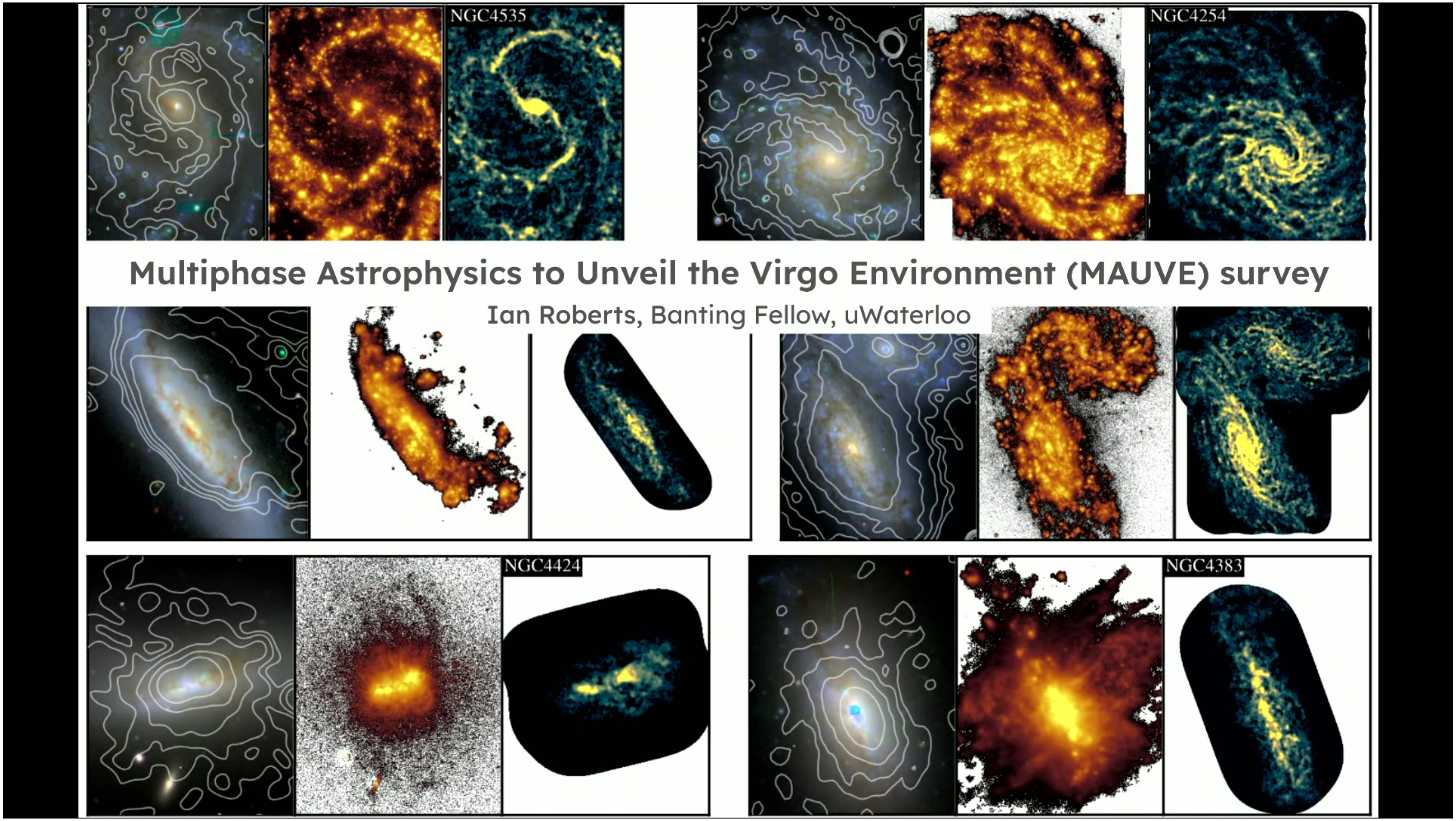


TNG100



Other Work:

- Fast Field Pasting of the SZ effects on simulations (*arXiv*:2504.11794)

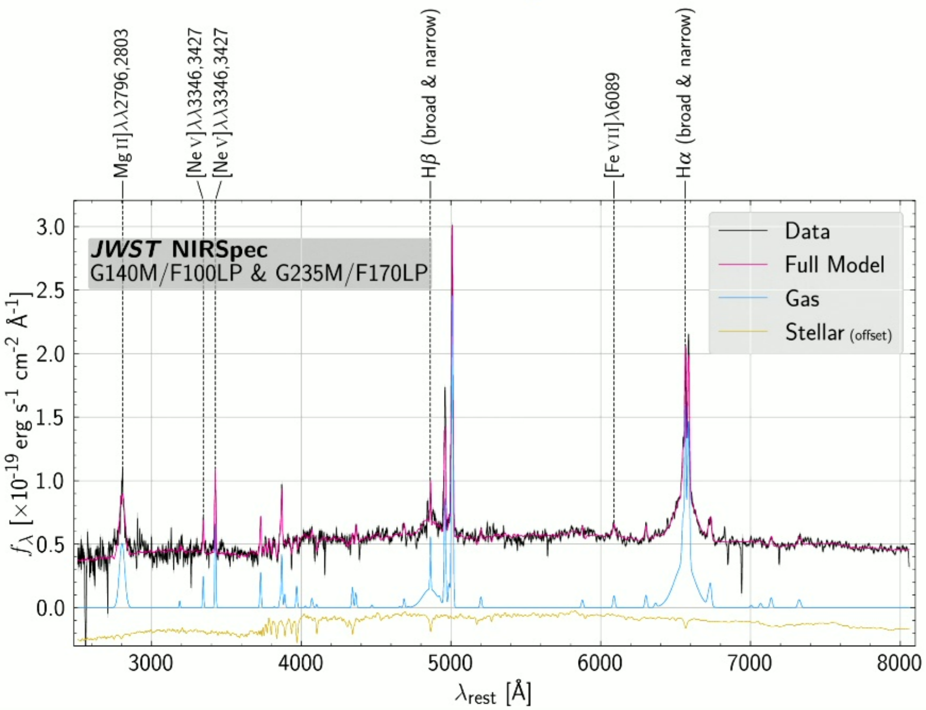

NGC4535
NGC4254
Multiphase Astrophysics to Unveil the Virgo Environment (MAUVE) survey
Ian Roberts, Banting Fellow, uWaterloo
NGC4424
NGC4383

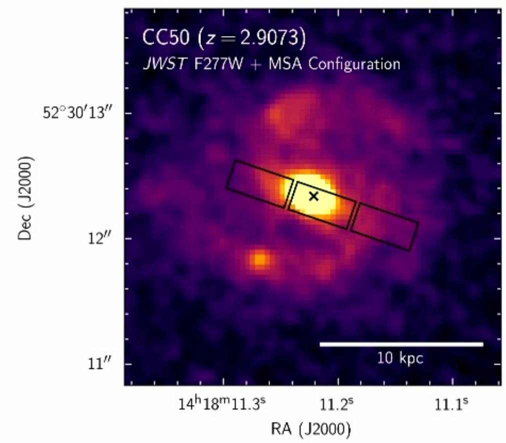
Feedback in the Early Universe: A Multiwavelength Analysis of a Massive, Barred-Spiral Galaxy with an Active Galactic Nucleus at Redshift 2.9

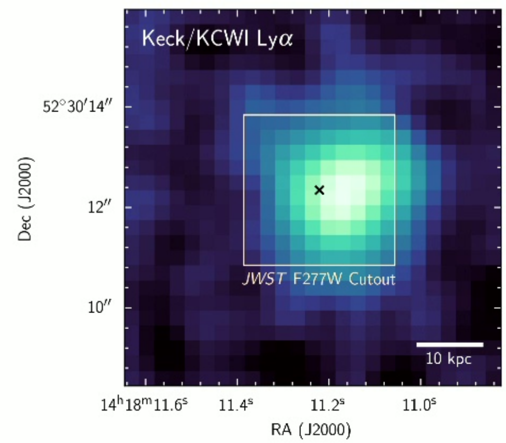
Isaac Cheng[1] Charles C. Steidel[1] Rui Marques-Chaves[2] Yuanze Ding[1] Naveen A. Reddy[3] Daniel Schaerer[2] Zhuyun Zhuang[1]
[1]California Institute of Technology [2]University of Geneva [3]University of California, Riverside

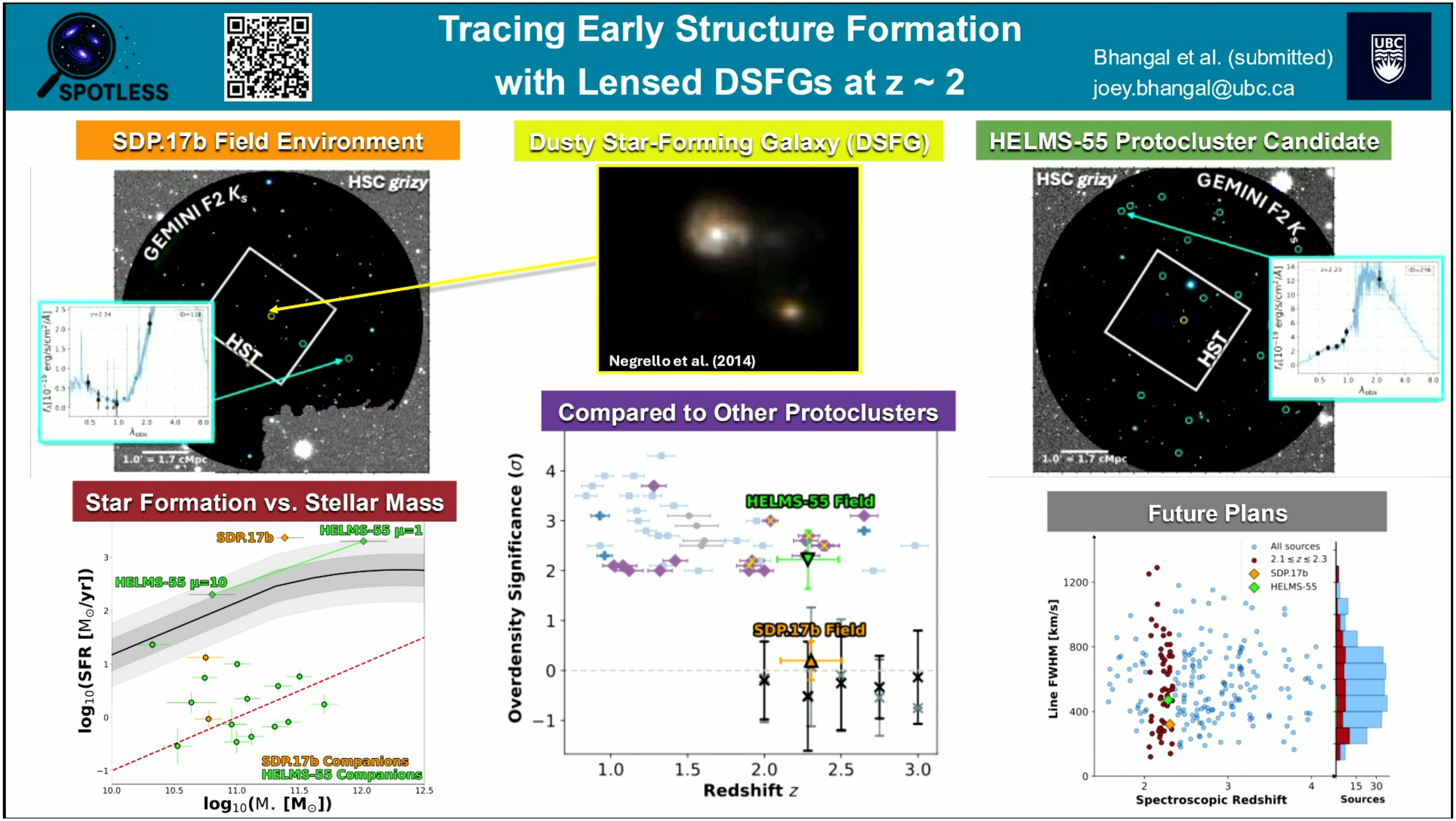
CC50 is a giant barred-spiral galaxy ($M_\star = 2.3 \times 10^{11}\ \mathrm{M}_\odot, M_{\mathrm{BH}} = (3.5 \pm 1.1) \times 10^8\ \mathrm{M}_\odot$) at $z = 2.9073$ featuring ongoing star formation, AGN activity, outflows, and a Lyα emission halo
⟶ **a perfect laboratory for studying feedback mechanisms in the early Universe!**

- **How do these massive spirals form in the early Universe?**
- **What is the role of AGN feedback from nuclear to galactic scales?**



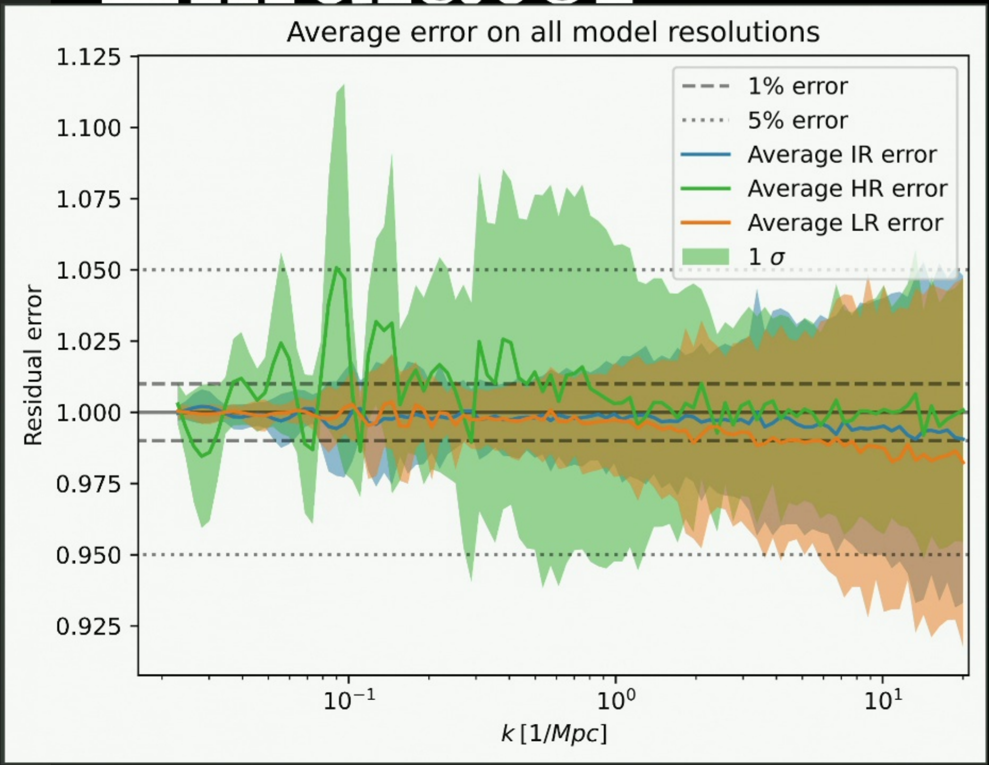


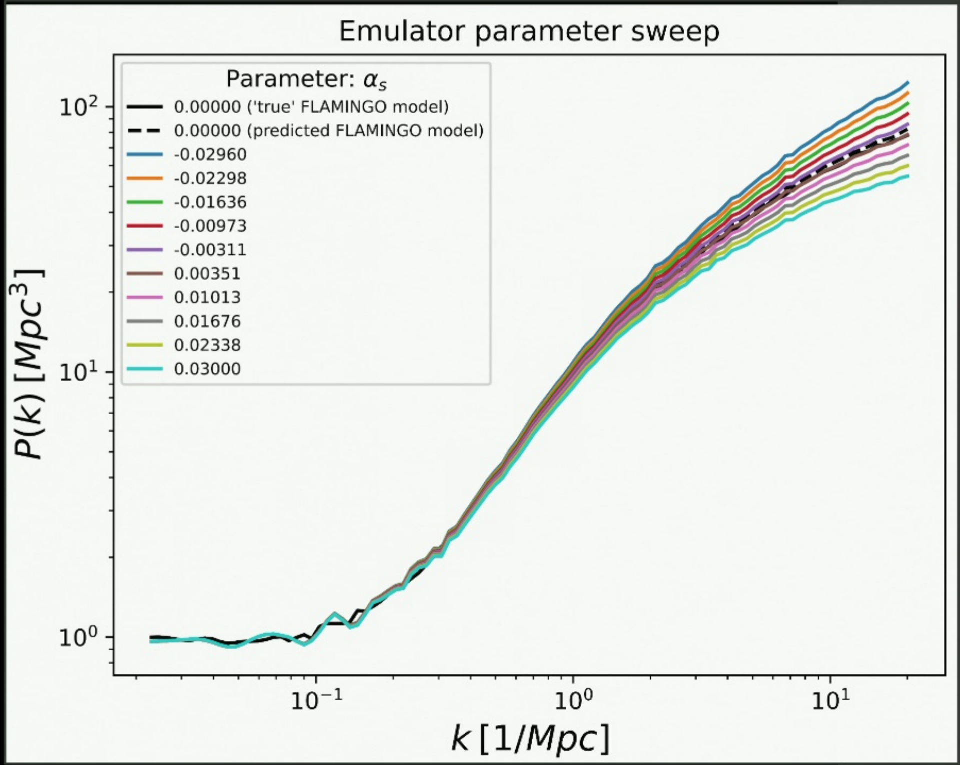



SPOTLESS
Tracing Early Structure Formation
with Lensed DSFGs at z ~ 2
Bhangal et al. (submitted)
joey.bhangal@ubc.ca
UBC
SDP.17b Field Environment
GEMINI F2 Ks
HSC grizy
HST
1.0' = 1.7 cMpc
Dusty Star-Forming Galaxy (DSFG)
Negrello et al. (2014)
HELMS-55 Protocluster Candidate
HSC grizy
GEMINI F2 Ks
HST
1.0' = 1.7 cMpc
Compared to Other Protoclusters
Overdensity Significance (σ)
Redshift z
HELMS-55 Field
SDP.17b Field
Star Formation vs. Stellar Mass
SDP.17b
HELMS-55 μ=1
HELMS-55 μ=10
SDP.17b Companions
HELMS-55 Companions
log10(SFR [M⊙/yr])
log10(M* [M⊙])
Future Plans
All sources
2.1 ≤ z ≤ 2.3
SDP.17b
HELMS-55
Line FWHM [km/s]
Spectroscopic Redshift
Sources

Jonah Conley
GitHub: https://github.com/J0nl15a/BAHAMAS_XL-emu

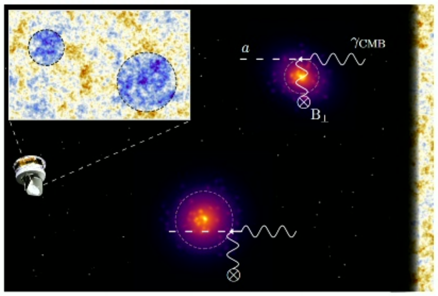
BAHAMAS-XL Cosmological Emulator





Particle physics wish list

CMB photon to light boson conversion (in CGM)

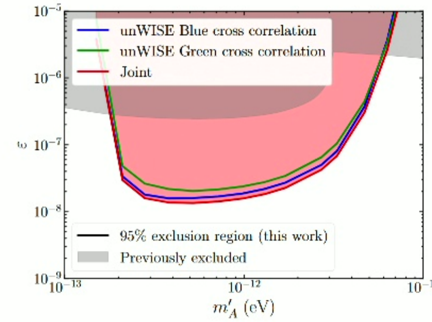


1. S. Goldstein, F. McCarthy, C. Mondino, J. C. Hill, J. Huang and M. C. Johnson, "Constraints on axions from patchy screening of the cosmic microwave background,", Phys. Rev. Lett. **134** (2025) no.8, 081001, arXiv:2409.10514 [astro-ph.CO].

2. F. McCarthy, D. Pirvu, J. C. Hill, J. Huang, M. C. Johnson and K. K. Rogers, "Dark photon limits from patchy dark screening of the cosmic microwave background", Phys. Rev. Lett. **133** (2024) no.14, 141003, arXiv:2406.02546 [hep-ph].

3. C. Mondino, D. Pîrvu, J. Huang and M. C. Johnson, "Axion-Induced Patchy Screening of the Cosmic Microwave Background", JCAP **10** (2024), 107, arXiv:2405.08059 [hep-ph].

4. D. Pîrvu, J. Huang and M. C. Johnson, "Patchy screening of the CMB from dark photons," JCAP **01**, 019 (2024), arXiv:2307.15124 [hep-ph].



$$\text{BSM Signal} \propto \int d\chi \delta(n_e - n_e^c)$$

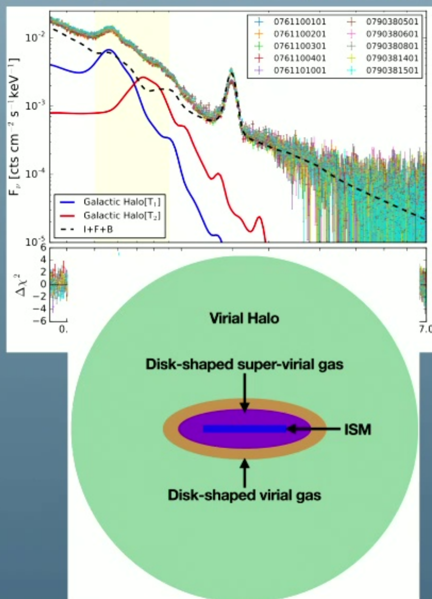
...to give us models of

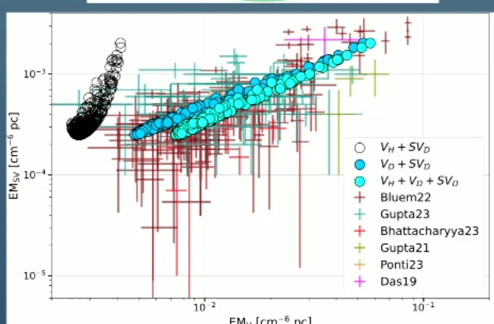
- Distribution of electrons in the Universe (n_e)
- Magnetic field profile

Super-virial ($\sim 10^7$ K) gas in the CGM of MW

Mukesh Singh Bisht (RRI)

X-ray emission (Das+19b)





Observations:

1) Detected in X-ray emission and absorption.

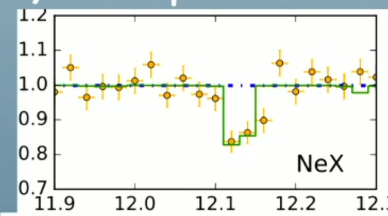
2) two distinct origins for emitting and absorbing gas

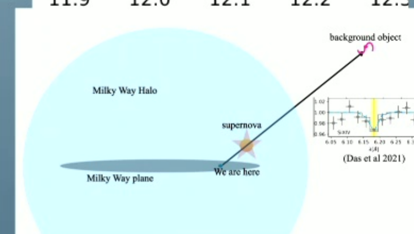
Models:

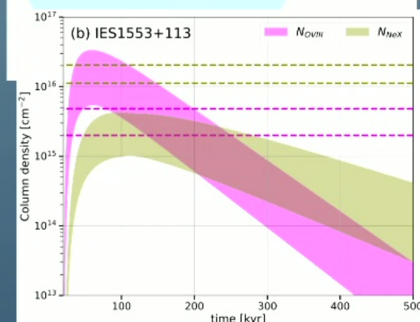
1) Emission: puffed-disk shaped region (scale height ≈ 1kpc) —> disk-wide stellar outflows.

2) Absorption: core-collapse supernovae of massive runaway stars—> reverse shock in supernova- hot and α-enriched.

X-ray absorption (Das+19a)







Bisht+ 2024 (ApJ **975** *49 ApJ* **975** *26)*

Deciphering Baryonic Feedback from ACT tSZ Galaxy Clusters

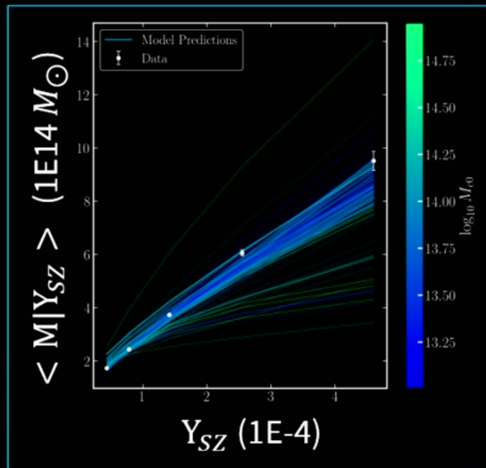
Nihar Dalal[1], Chun-Hao To[1,2], Chris Hirata[1], Tae Hyeon-Shin[3], Matt Hilton[4], Shivam Pandey[5], J. Richard Bond[6]
1. The Ohio State University, 2. University of Chicago, 3. Carnegie Mellon University, 4. University of the Witwatersrand, 5. Johns Hopkins University, 6. CITA

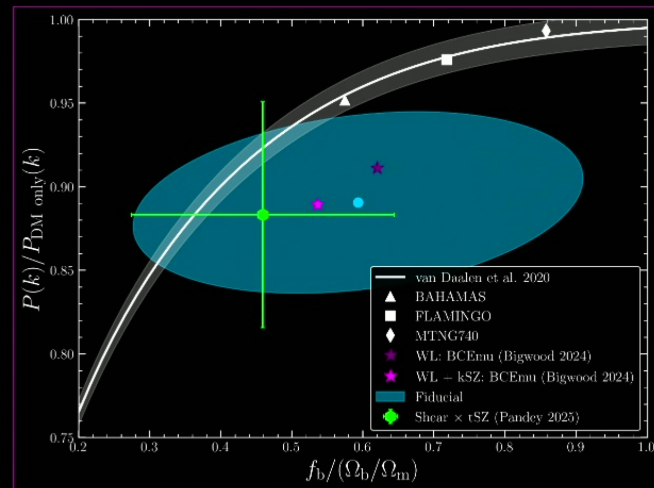
THE OHIO STATE UNIVERSITY

CCAPP ccapp.osu.edu

Model the tSZ profiles in ACT galaxy clusters with a baryonified halo model

Results paper: arxiv.org/abs/2507.04476

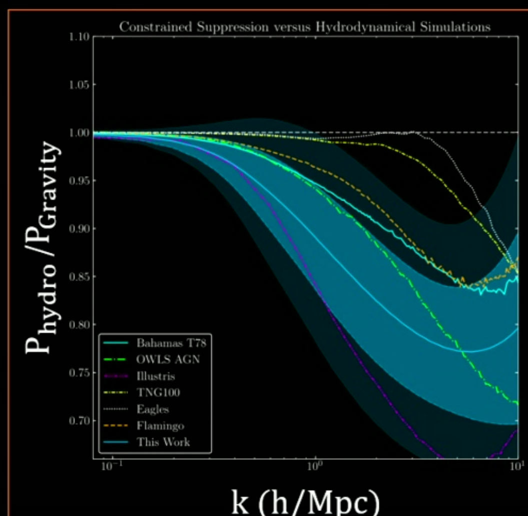


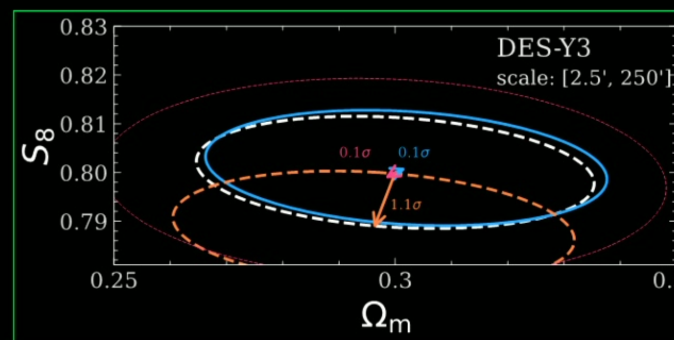


Better calibration of hydrodynamic simulations

Method paper: arxiv.org/abs/2402.00110

Compute suppressions in the matter power spectrum

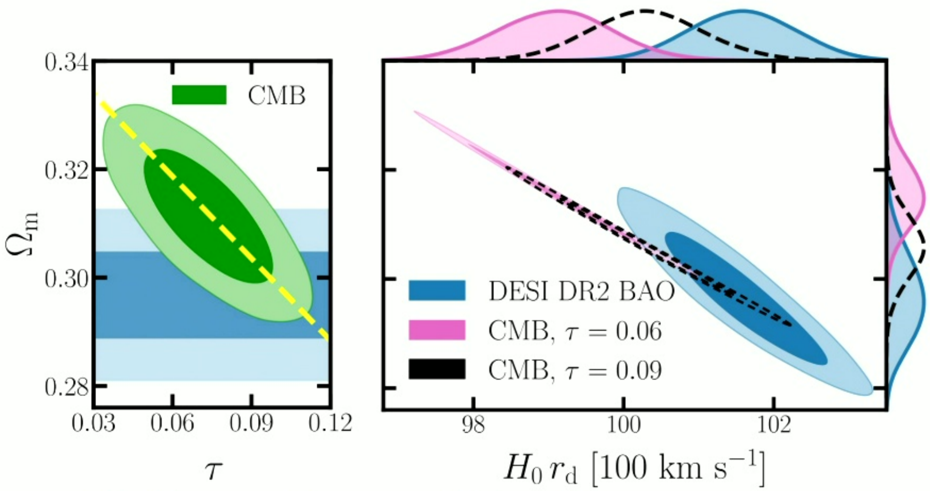




More precise cosmology using smaller scales

The CMB optical depth: resolving tensions with τ

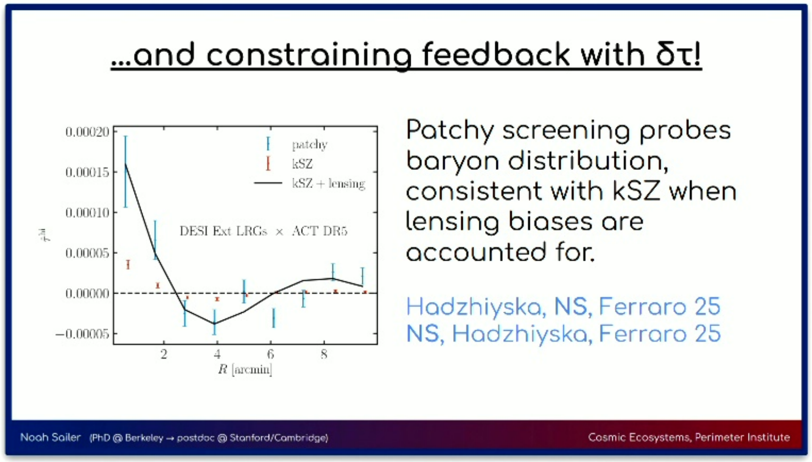
A larger optical depth to reionization (τ) would restore concordance between current CMB and BAO data when interpreted within ΛCDM.



NS, Farren, Ferraro, White 25

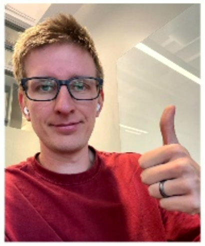
see also Boryana, Gerrit, and Simone's slides!

- inconsistent with large-scale CMB, but that measurement is systematics limited...
- did reionization start much earlier than we thought?



EUCLID: An emulator for baryonic effects on the matter bispectrum

by Pierre Burger

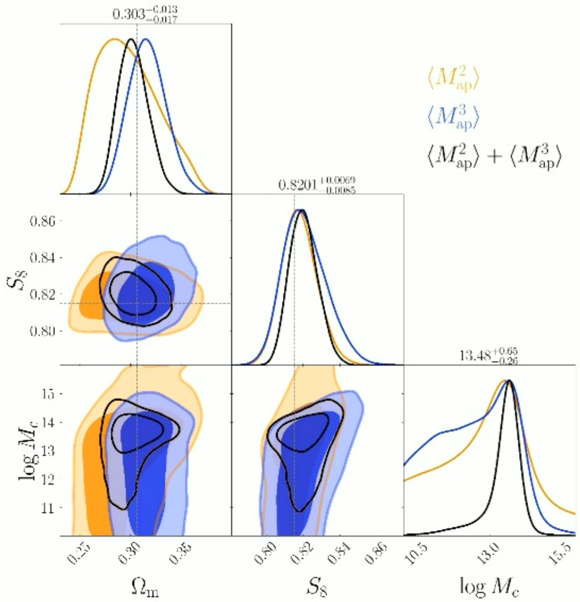


Why do we care about the bispectrum:

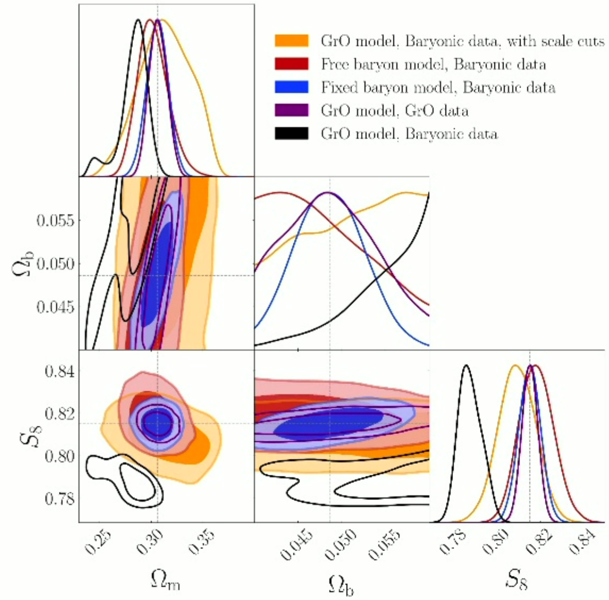
- Because only higher-order statistics (HOS) are able to extract also non-Gaussian information
- These HOS add significant constraining power mostly due to different degeneracies breaking

Why are we concerned about baryonic effects:

- Because the S/N of HOS peaks are at small scales where baryonic effects play an important role
- Scale cuts decrease the precision of parameter constraints
- Ignoring baryonic effects decreases the accuracy of parameter constraints



Check out my paper and poster



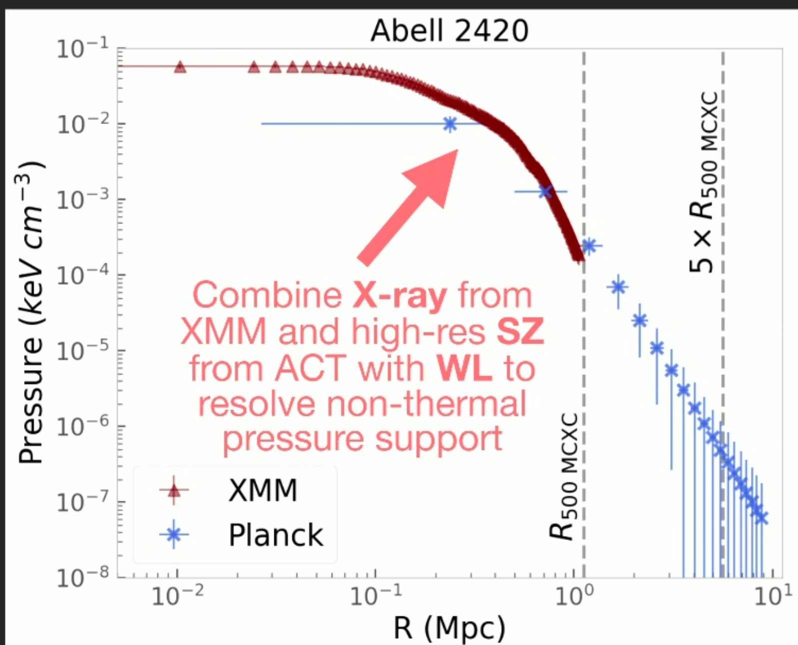
SZ Study of Clusters with Weak-lensing Masses

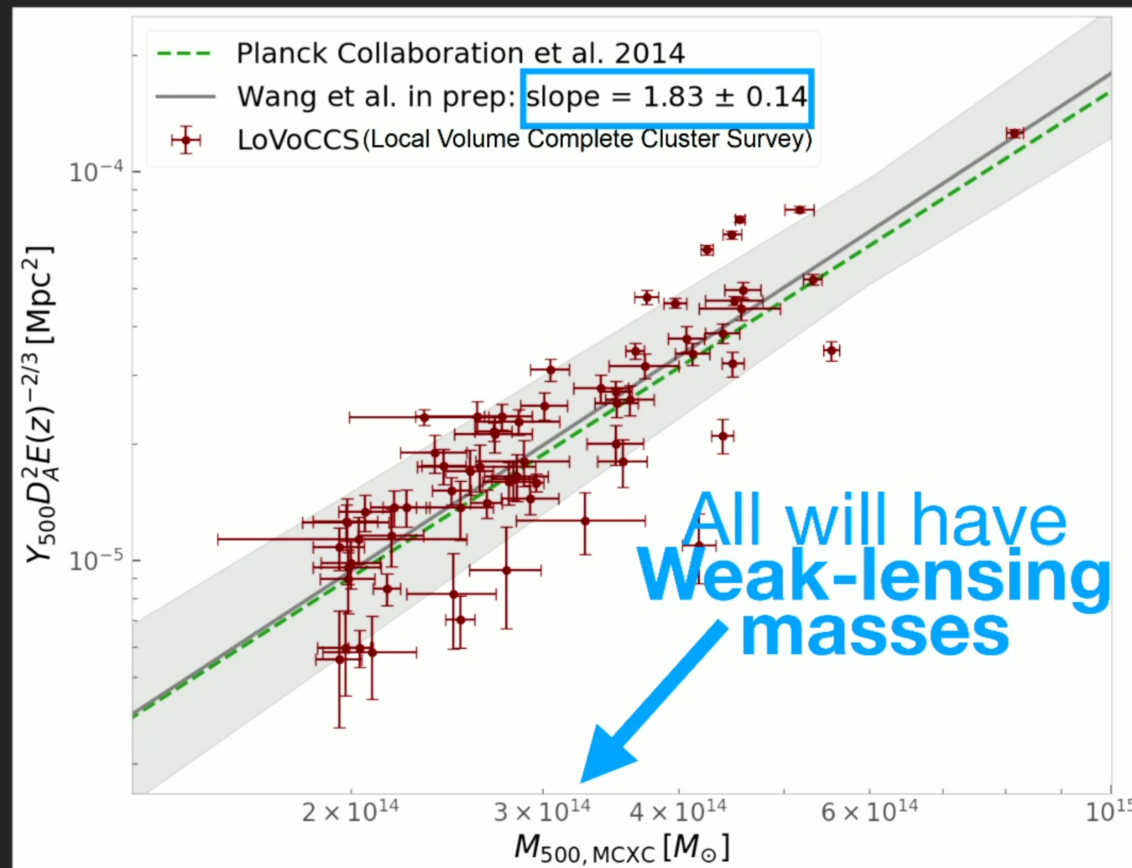
SZ Flux and Thermal Pressure from Planck

Ray Wang *(wangru46@msu.edu)*
Ph.D. Student / **Michigan St. Univ.**

$$\nabla(\boxed{P_{thermal}} + P_{non-thermal}) = -\rho\nabla\boxed{\Phi_{grav}}$$

SZ + X-Ray **?** **Weak Lensing**





Kinematics of Circumgalactic O VI Gas and Disk Rotation of $z \approx 0.2$ Star-forming Galaxies

arxiv: 2507.11664

Stephanie Ho (New Mexico State University)

Collaborators: Crystal Martin (UCSB), Hasti Nateghi (Swinburne), Glenn Kacprzak (Swinburne), Jonathan Stern (Tel Avi Uni.)

- **Focus**: O VI kinematics and its comparison with that of low ions and galactic disk rotation
- **Sample**: 18 quasar sightlines near the major axes of SF galaxies
- While individual O VI velocity components do not correlate with disk rotation, the *bulk* of O VI gas rarely counter-rotates.
- O VI velocity components with low-ion matches are typically found at small impact parameters and corotate with the disk.
  - → O VI **with** low-ion match: gas co-spatial with low ions near the extended disk plane in the inner CGM
  - → O VI without low-ion match: gas at large 3D radii with weaker correlation with disk angular momentum

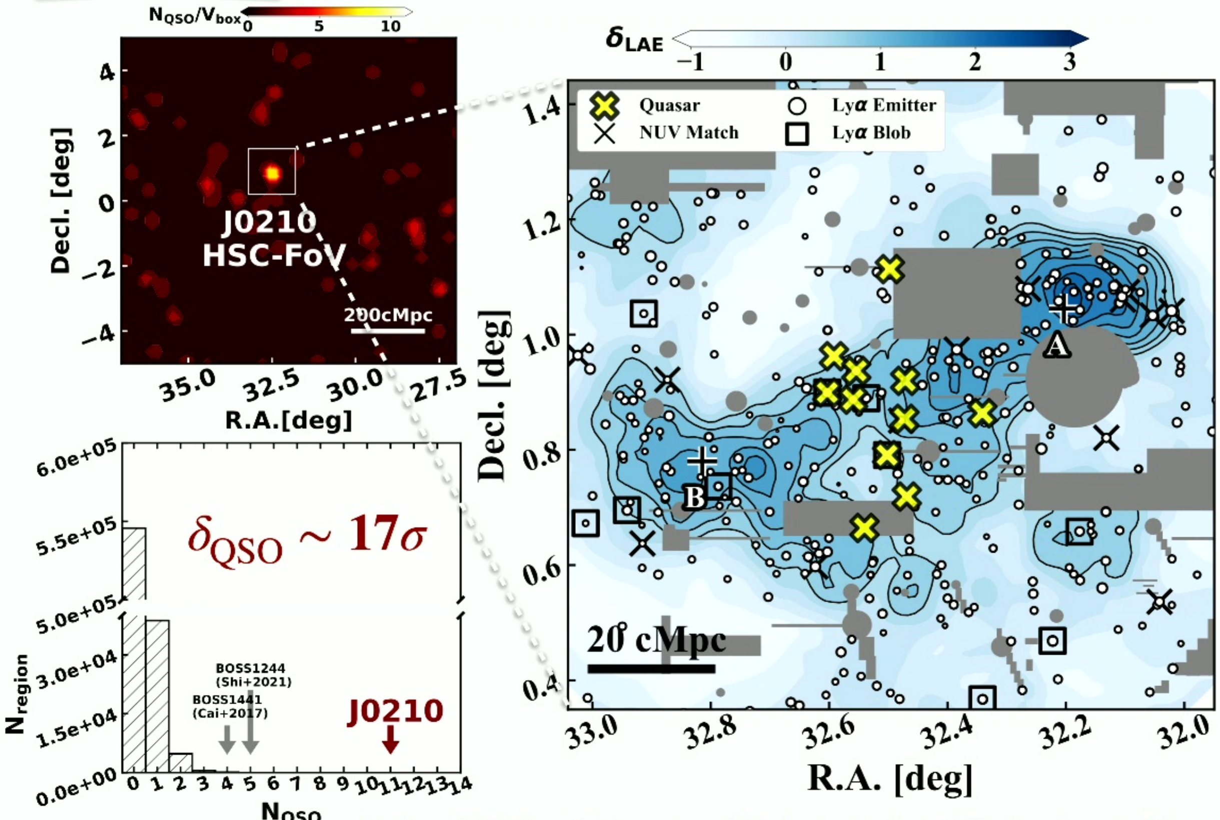
Cosmic Himalayas: The Densest Quasars at Cosmic Noon
—A Bridge Between AGNs, Galaxies, and the IGM—

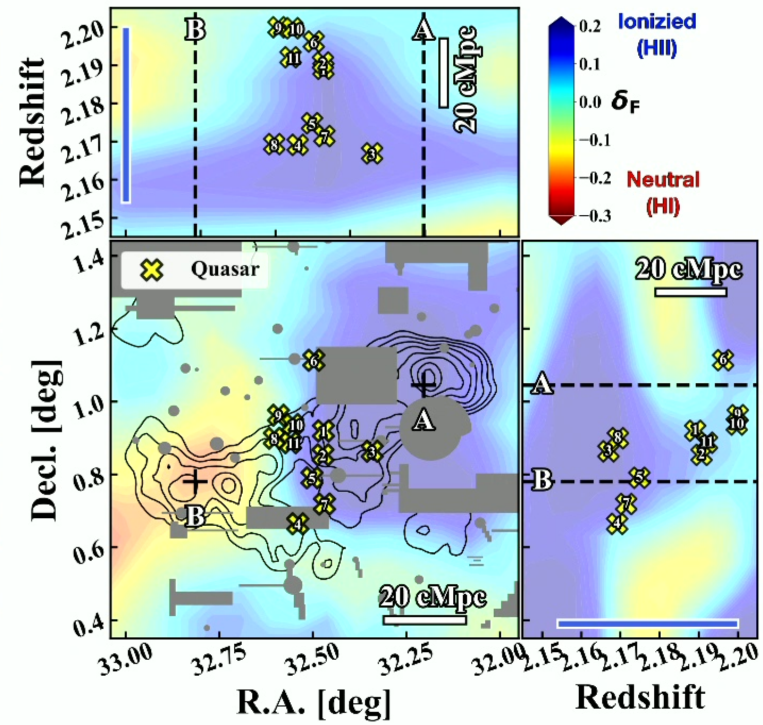
Liang, Yongming
(NAOJ / UTokyo)

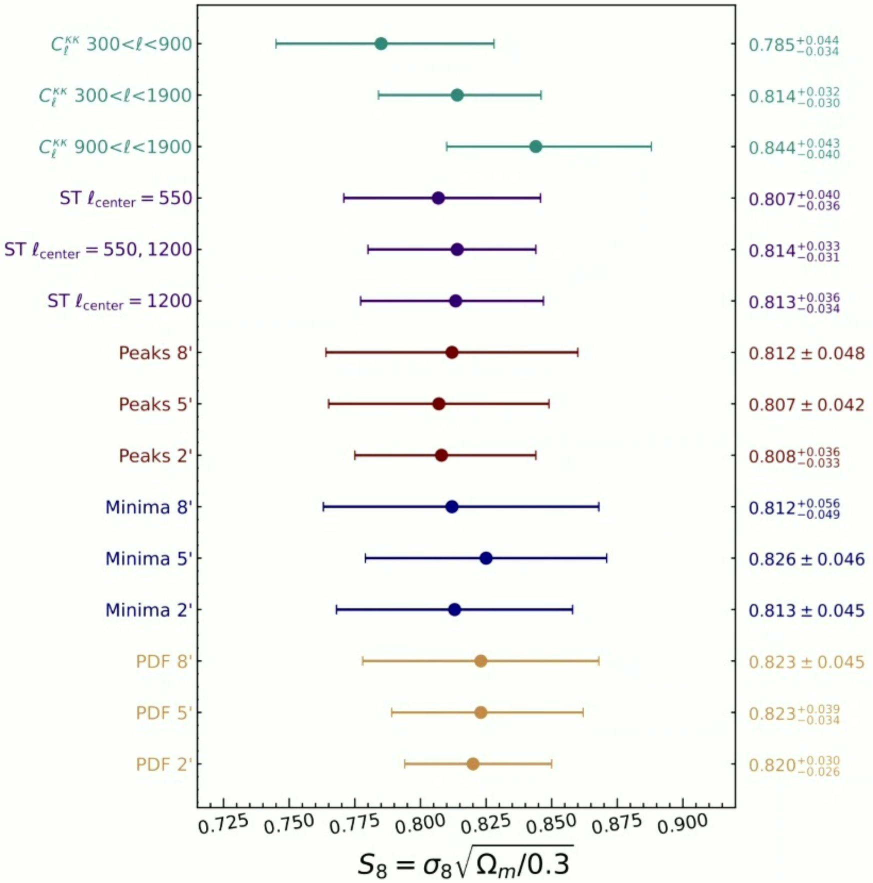
Liang et al. 2025, ApJ, 986, 60

- The densest quasars at Cosmic Noon, with ~25 Mpc spatial offset to galaxies (LAE mapped by HSC).

- 3D HI Tomography from bg SDSS/eBOSS QSOs: Distinct IGM ionization at the two galaxy nodes with a significant transition around QSOs .







(Not a lot) "**Impact of baryonic feedback on HSC-Y1 weak lensing non-Gaussian statistics**"

Grandon+ 2024 (arxiv: 2403.03807)

Jia Liu

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Director, Center for Data-Driven Discovery (CD3)

Please chat with me about (I'm here today and tomorrow!):

- Painting baryons (current focuses: kSZ, CIB, Gamma-Ray, radio) to our **HalfDome multi-wavelength cosmological simulations** (https://halfdomesims.github.io/)
- **Higher-order statistics** as a tool to extract cosmology and understand cosmic ecosystem
- Next CMB space mission **LiteBIRD**
- **Postdoc and faculty positions** at CD3