Forging Connections between Intergalactic and Circumgalactic Media with Lyman-α Absorption

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Max Planck Institute for Astronomy (MPIA)

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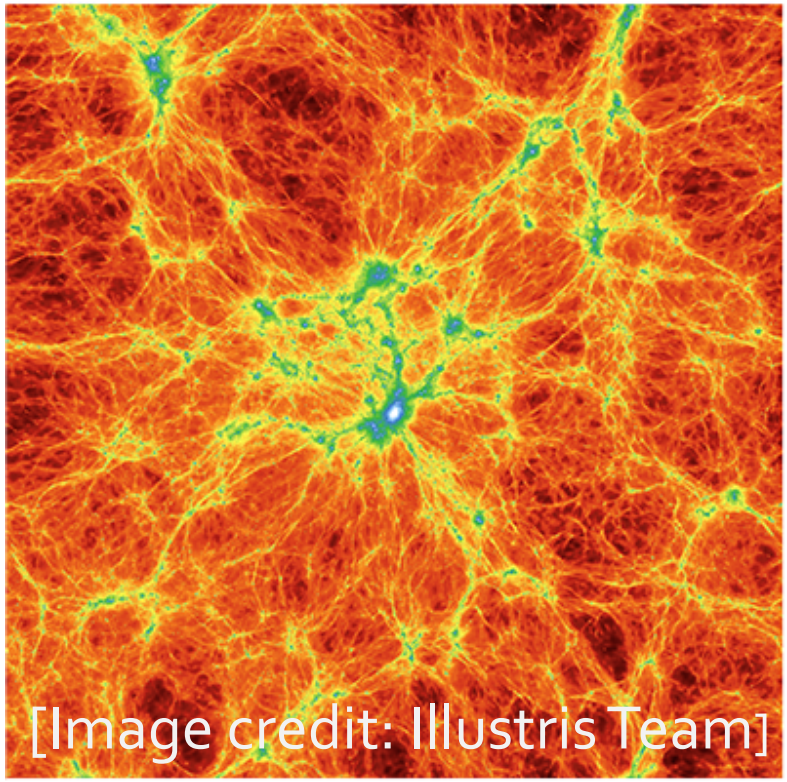
Forging Connections: From Nuclei to the Cosmic Web
East Lansing, Michigan
26th June 2017

Simulating Large and Small Scales



IGM

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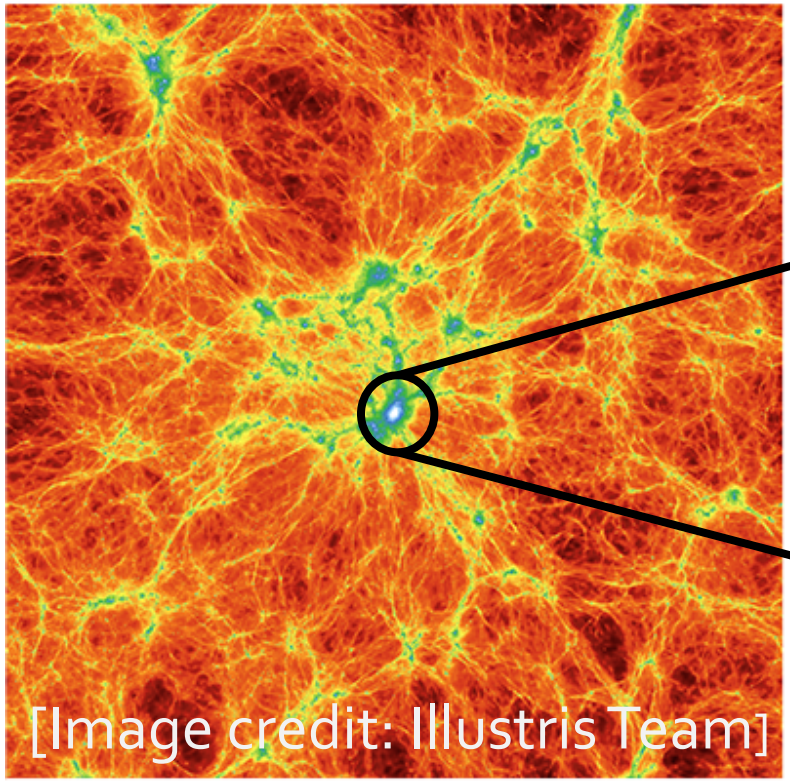

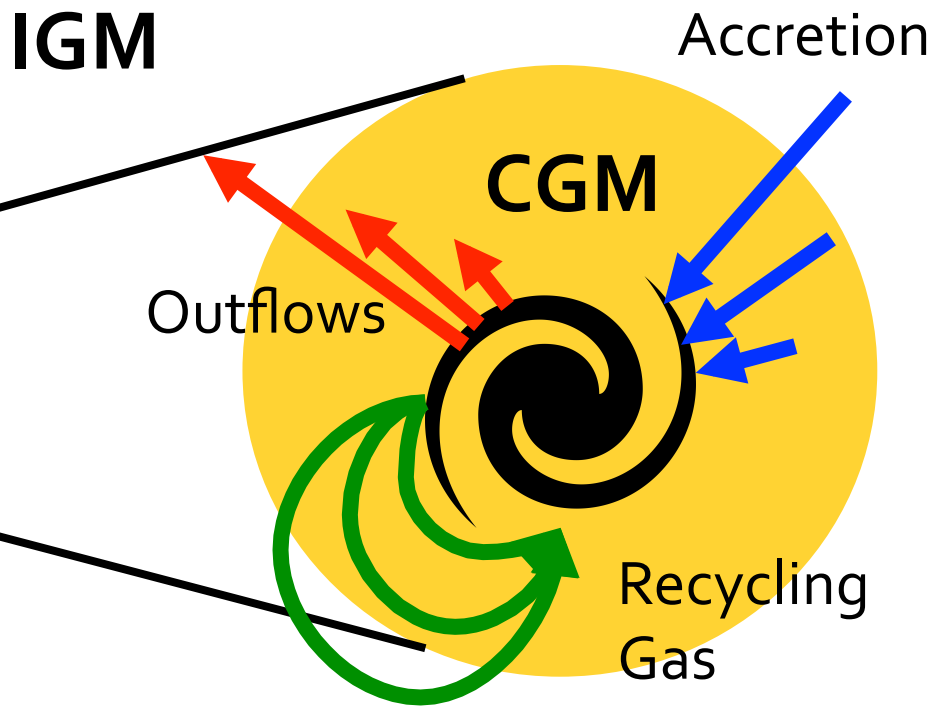

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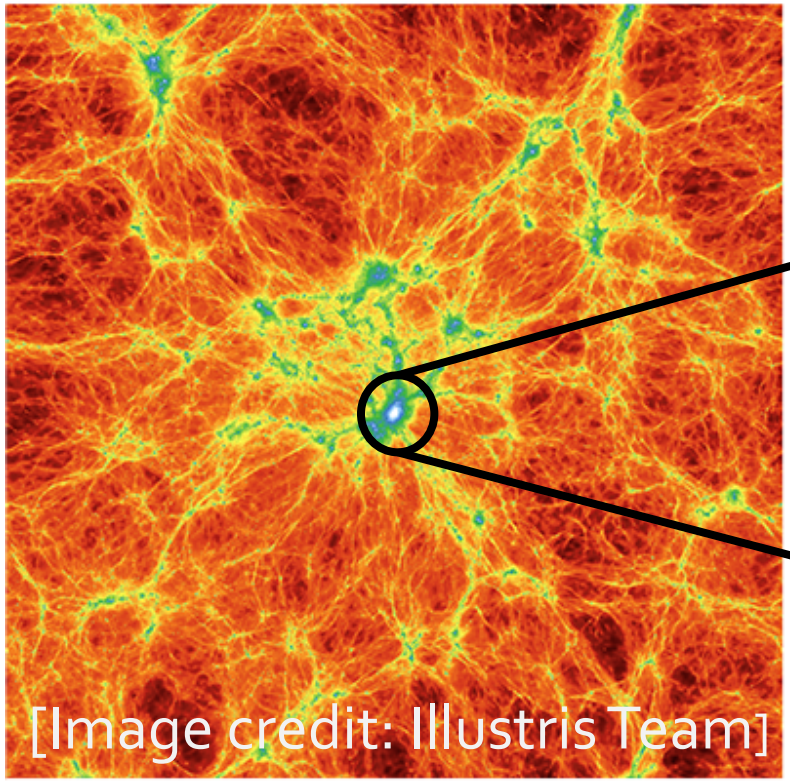

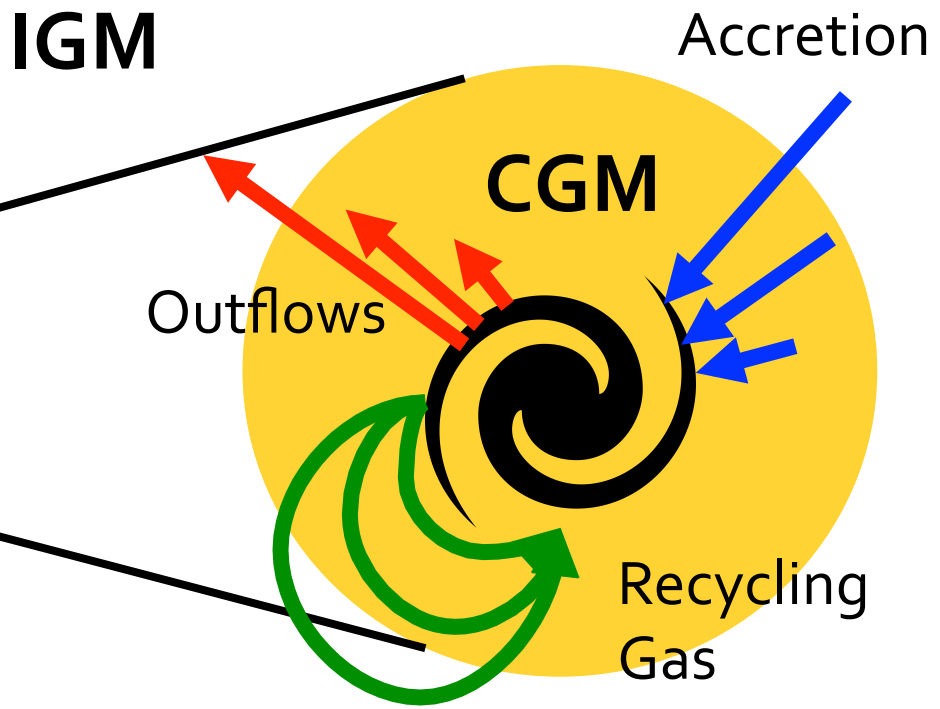

Modeling physics from LSS down to galaxies

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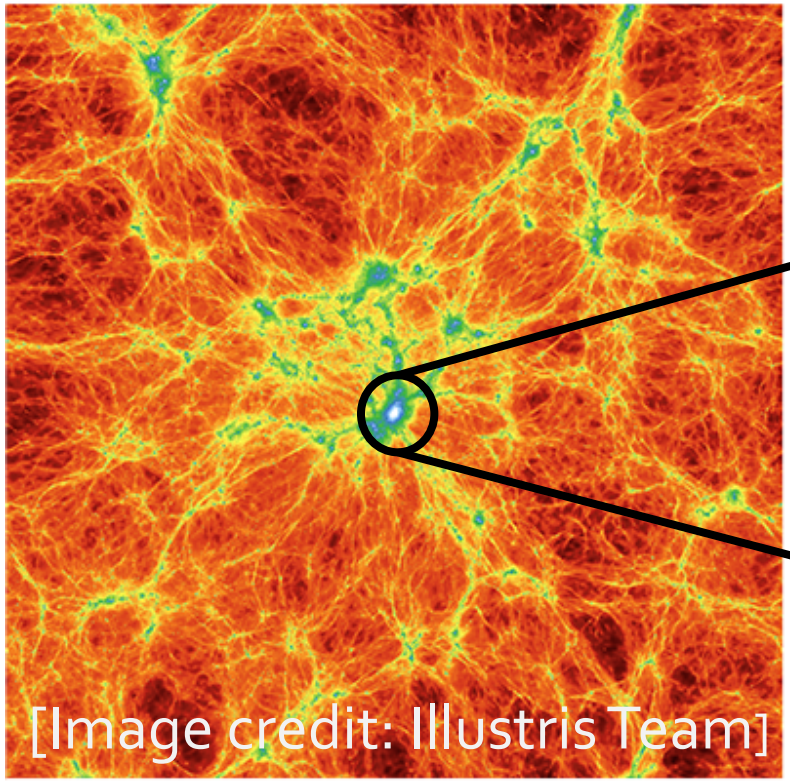
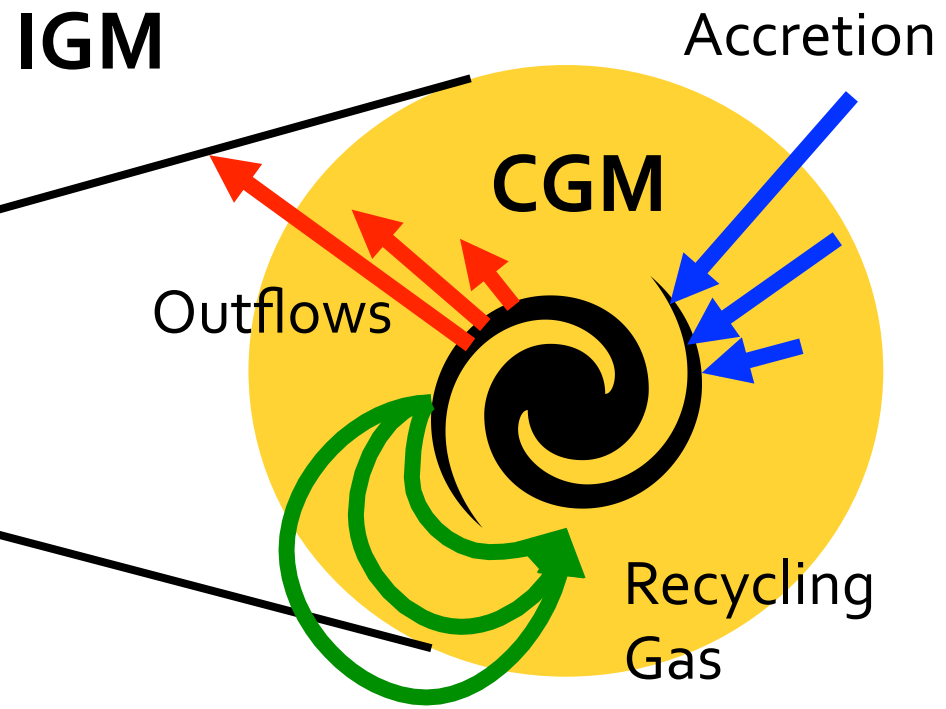
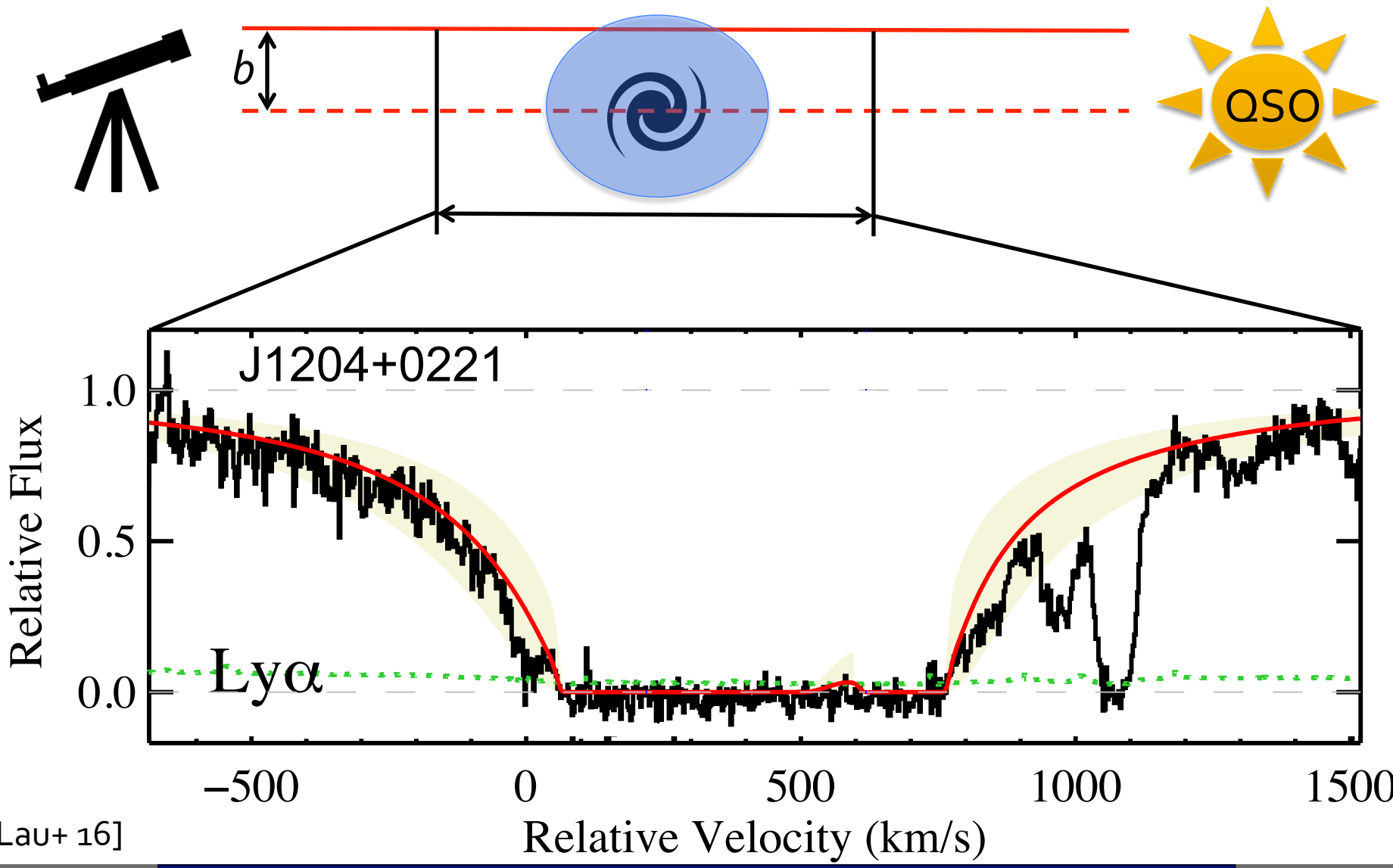




Modeling physics from LSS down to galaxies → Unresolved physics @ galactic scales → Feedback Prescriptions

Probing the CGM with Quasar Spectra



[Lau+ 16]

Probing the CGM with Quasar Spectra

- Lyα absorption at small *b*
  [e.g. Rudie+ 12, 13, Rakic+ 12, Tumlinson+ 13, Werk+ 14, Turner+ 14]
- Lyα absorption at large *b* from BOSS
  [Font-Ribera+ 12, 13]
- Simulations at small *b*
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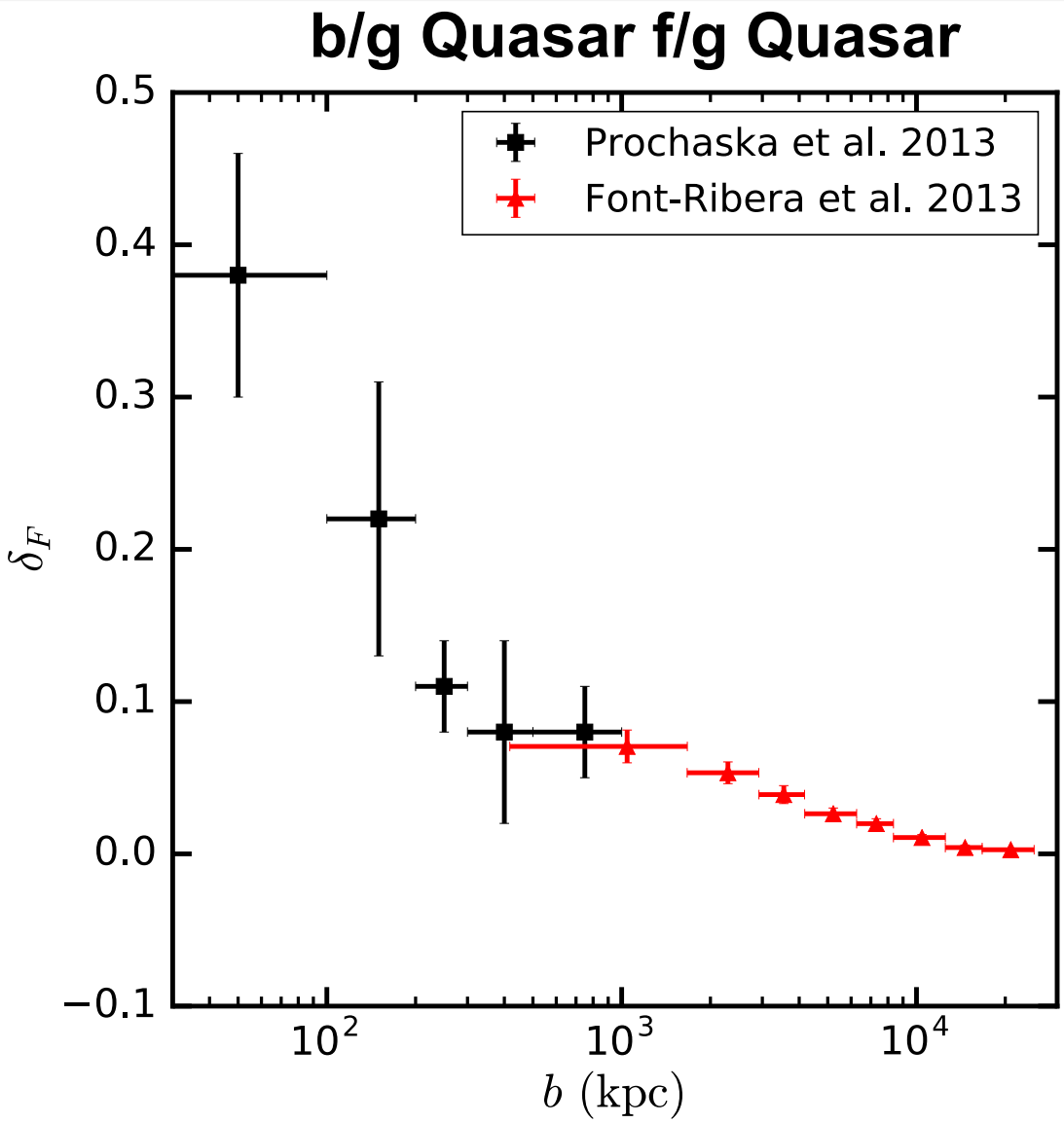

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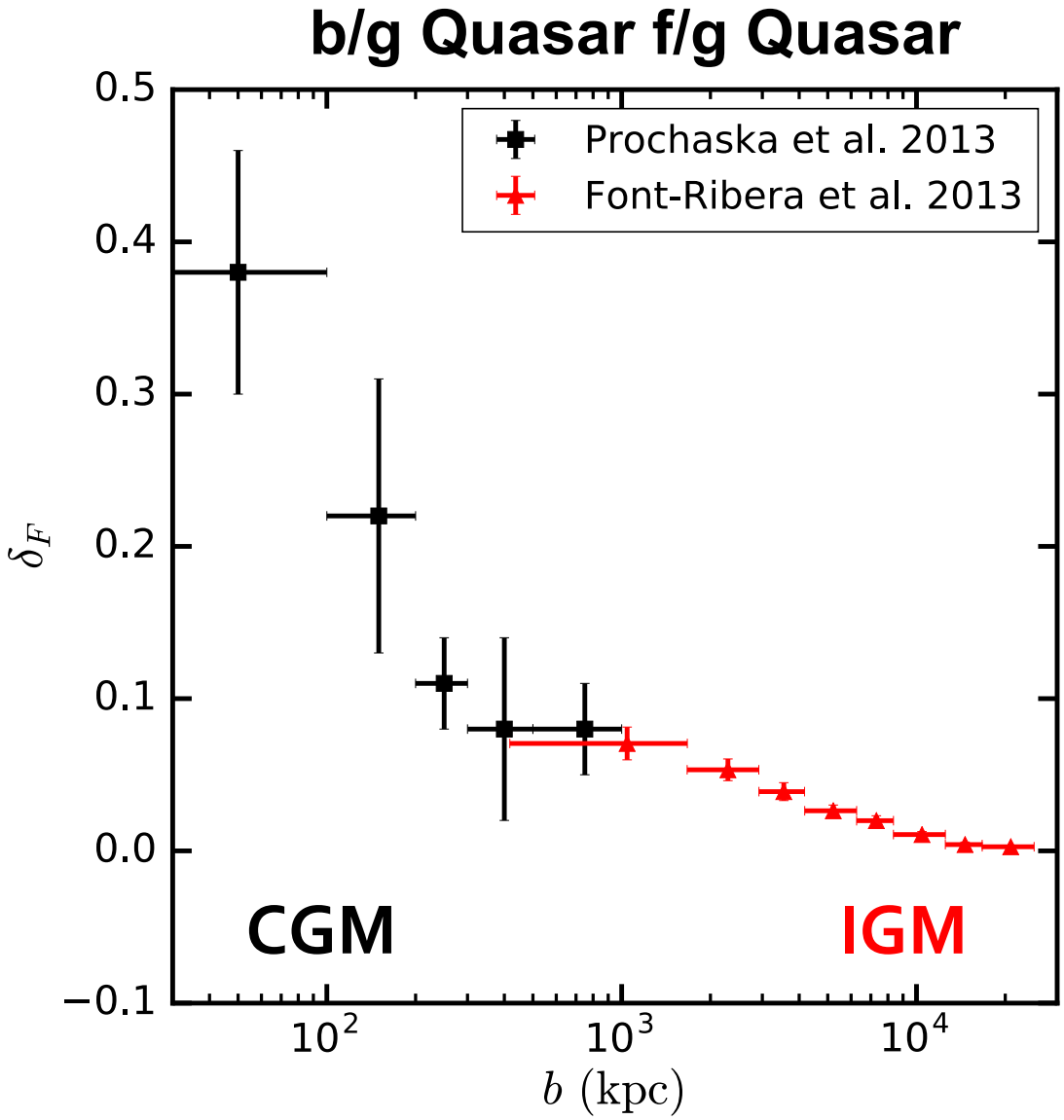
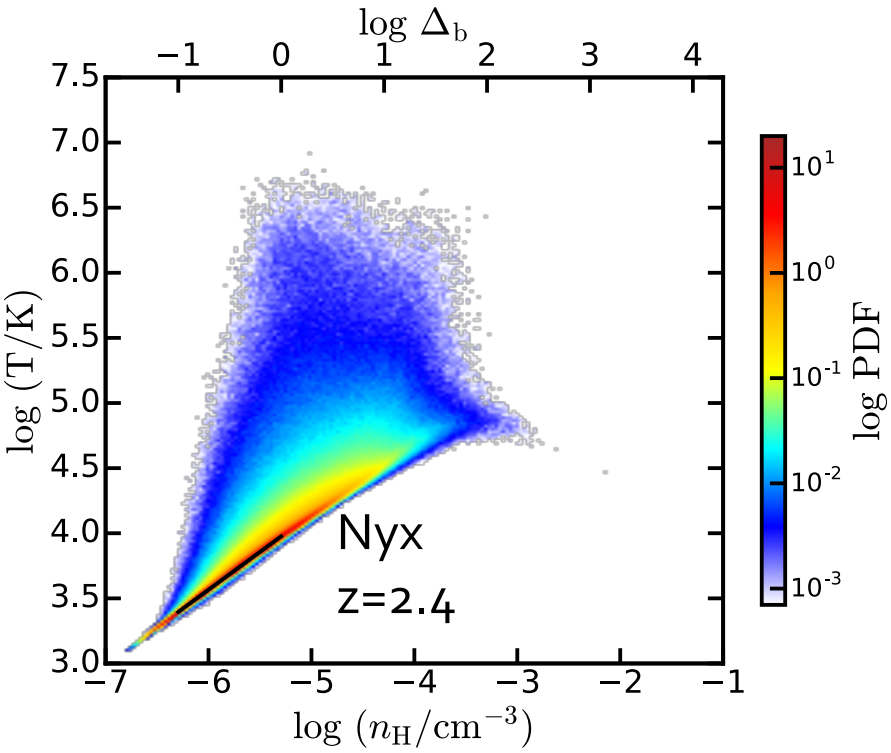
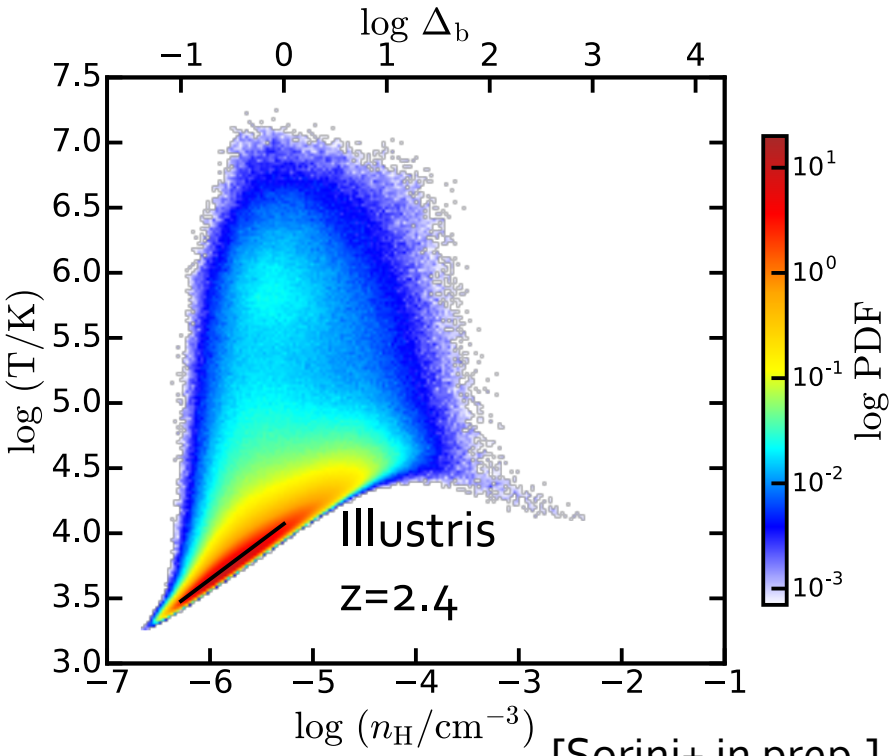
1st-time extension to large *b*



Feedback and CGM Temperature

- **ILLUSTRIS**: L=106.5 cMpc, star formation, stellar and AGN feedback [Vogelsberger+ 14]
- **NYX**: L=142.5 cMpc, no feedback, no star formation, no metals [Almgren+ 13, Lukić+ 15]





[Sorini+ in prep.]

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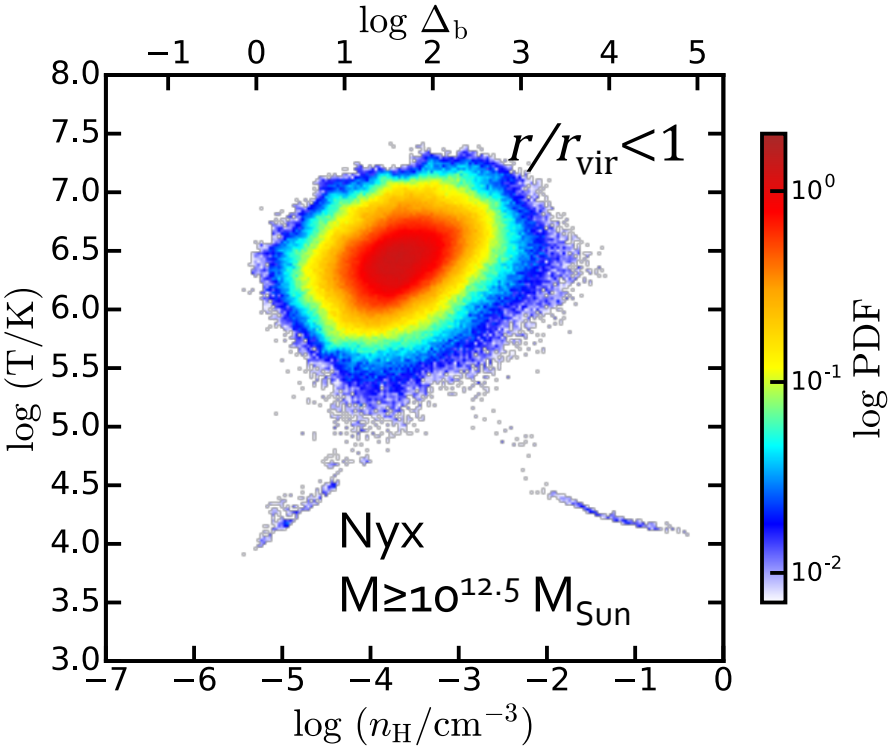

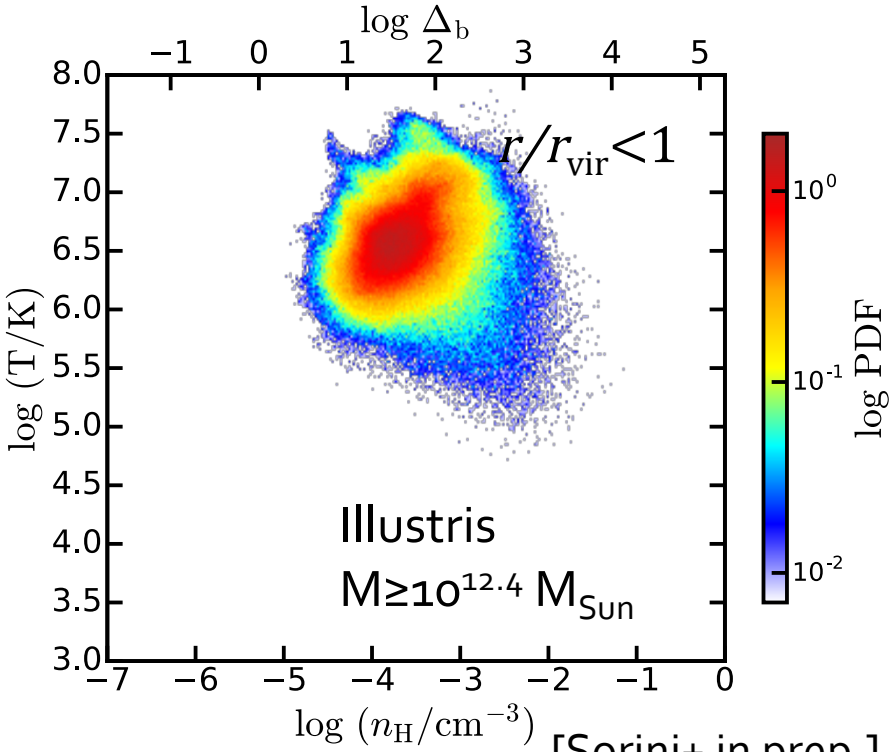

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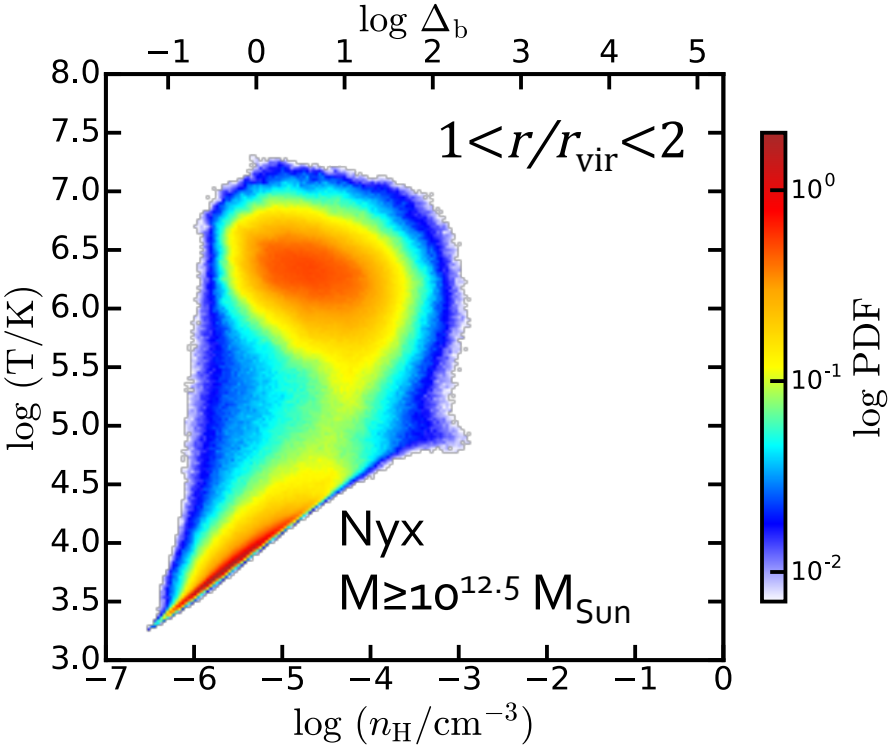

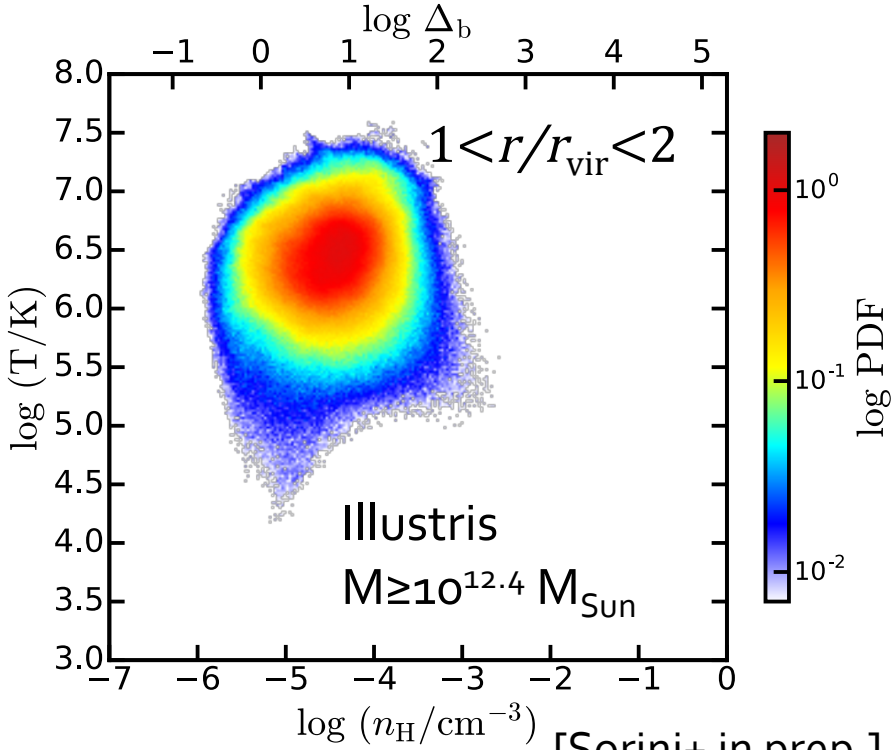

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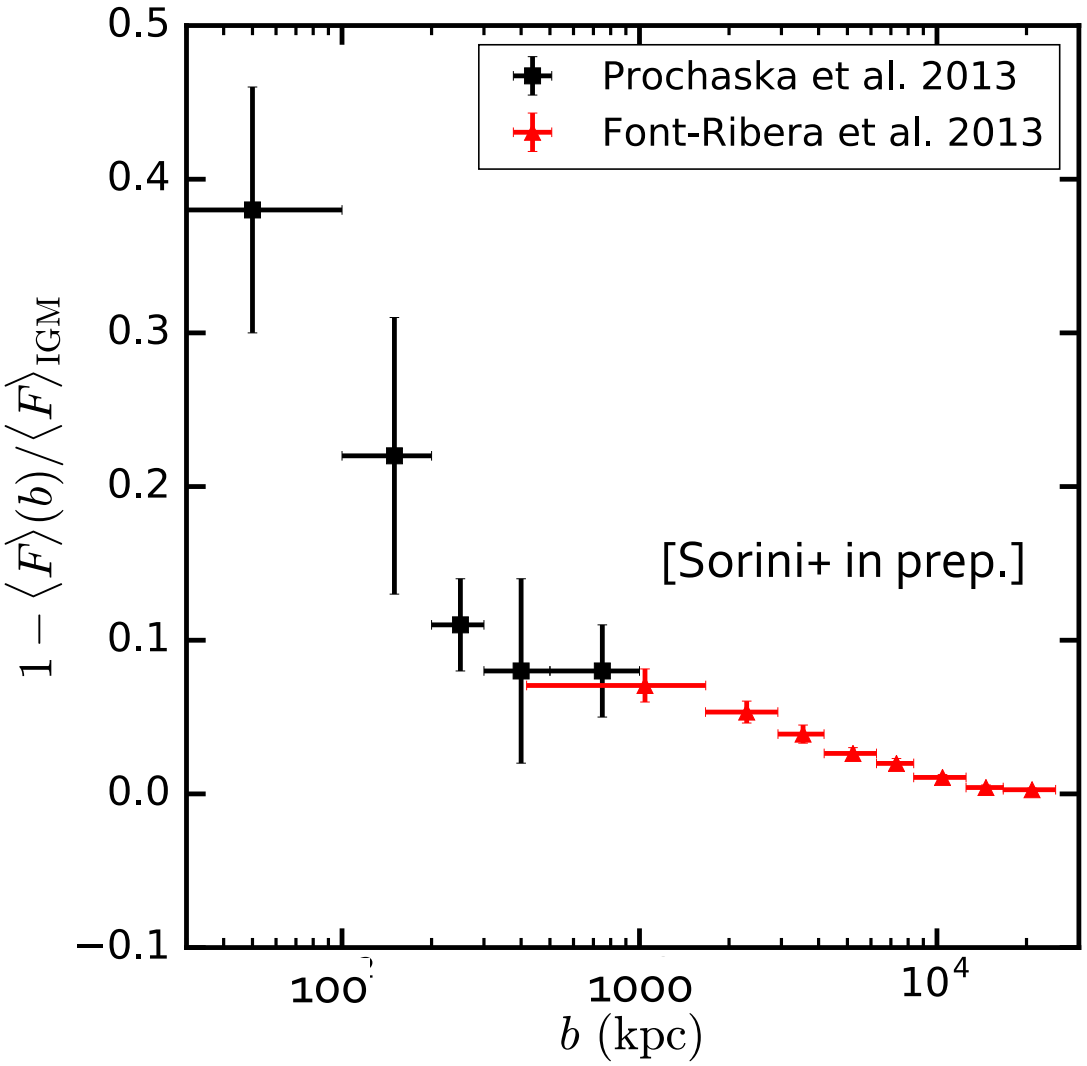
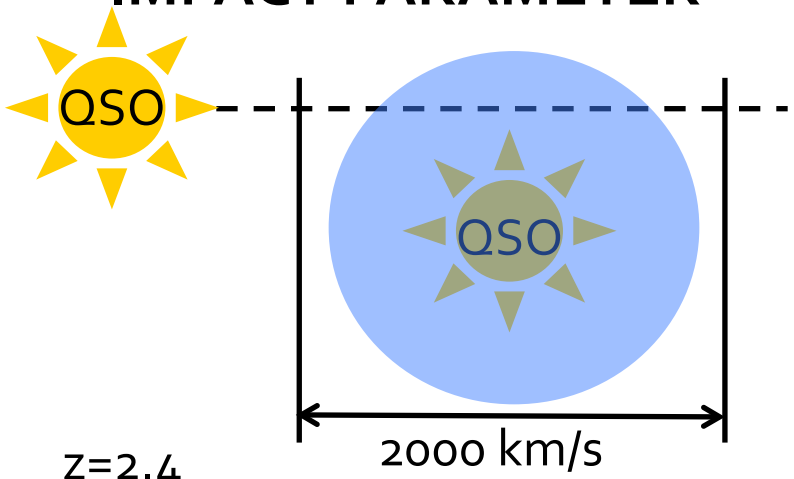
Lyα Absorption around Quasar Hosts



FLUX FLUCTUATIONS

vs

IMPACT PARAMETER



z=2.4

$\log(M_{halo}/M_{\odot})\geq 12.5$

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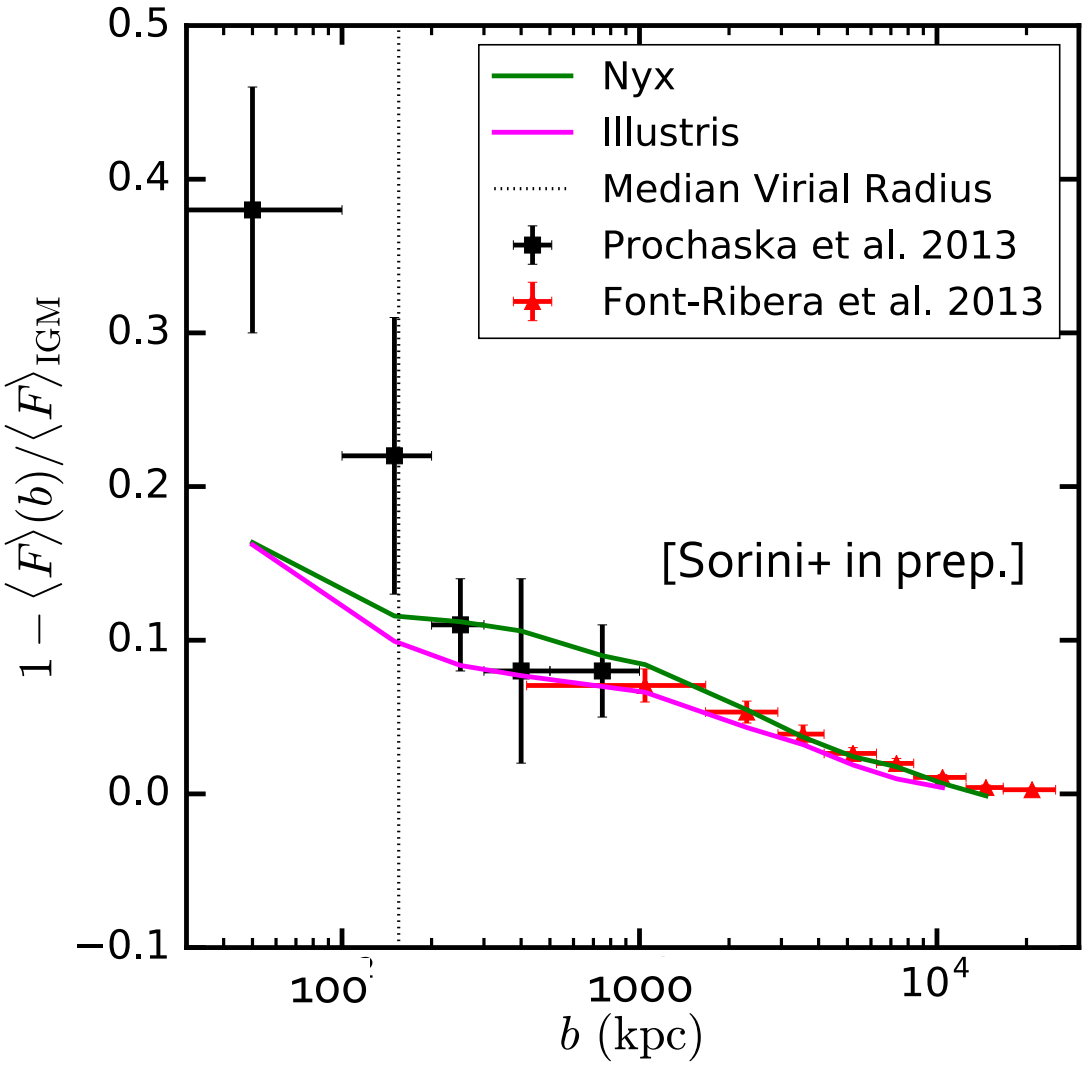

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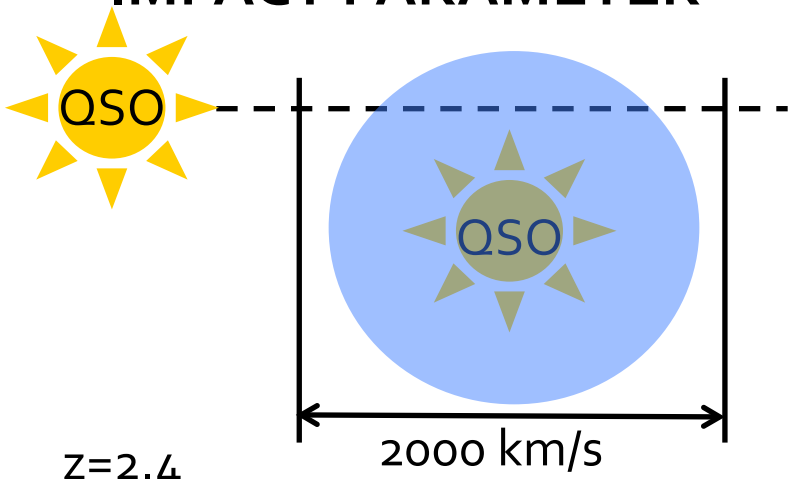

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LARGE SEPARATIONS

Sims reproduce precise measurements

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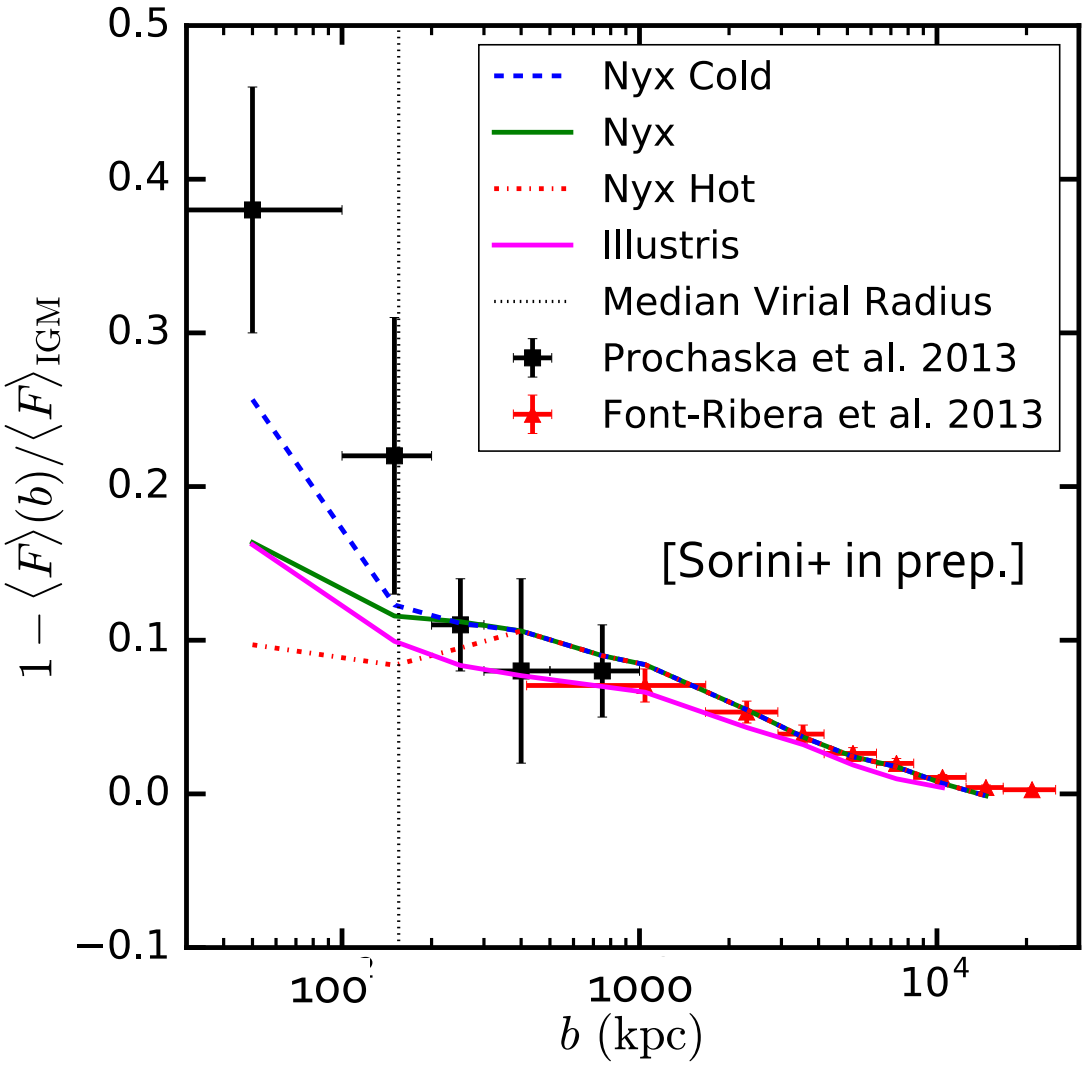

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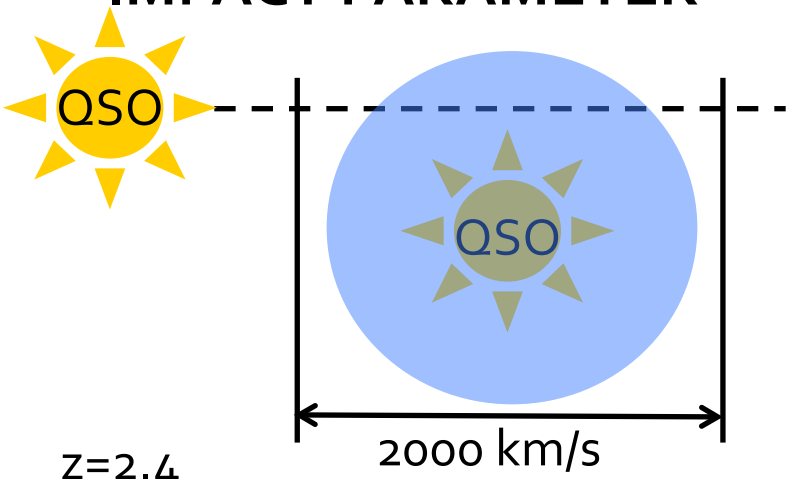

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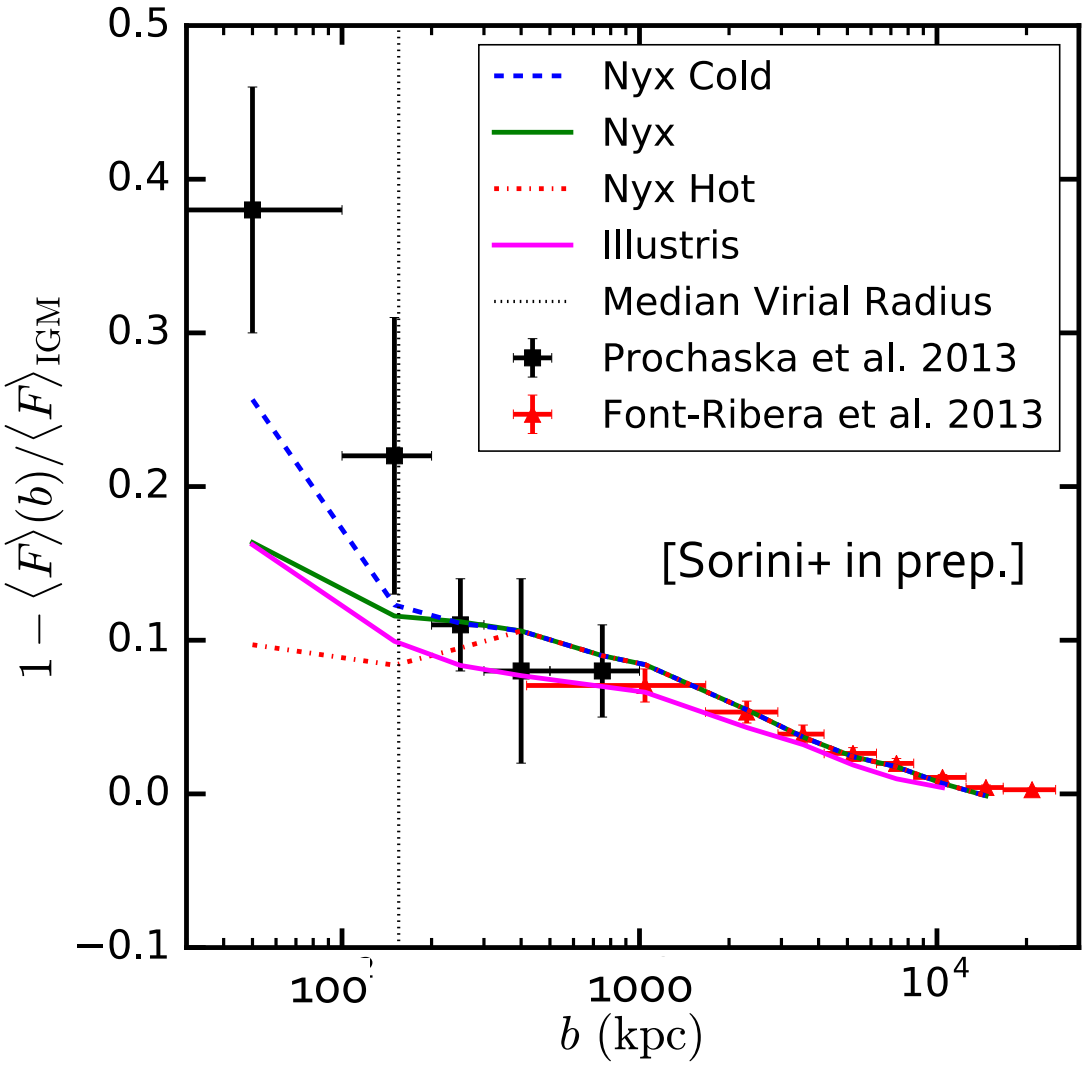

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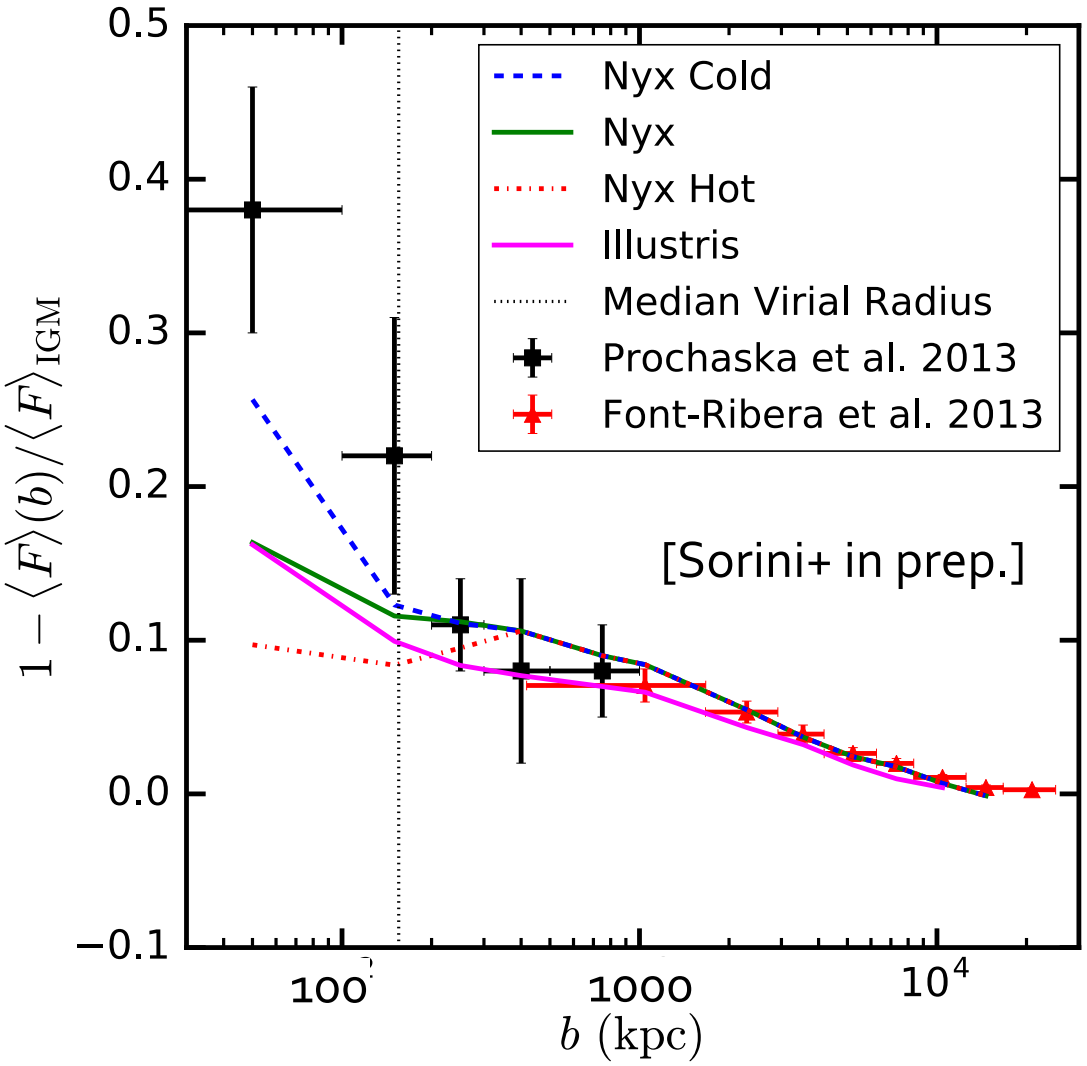

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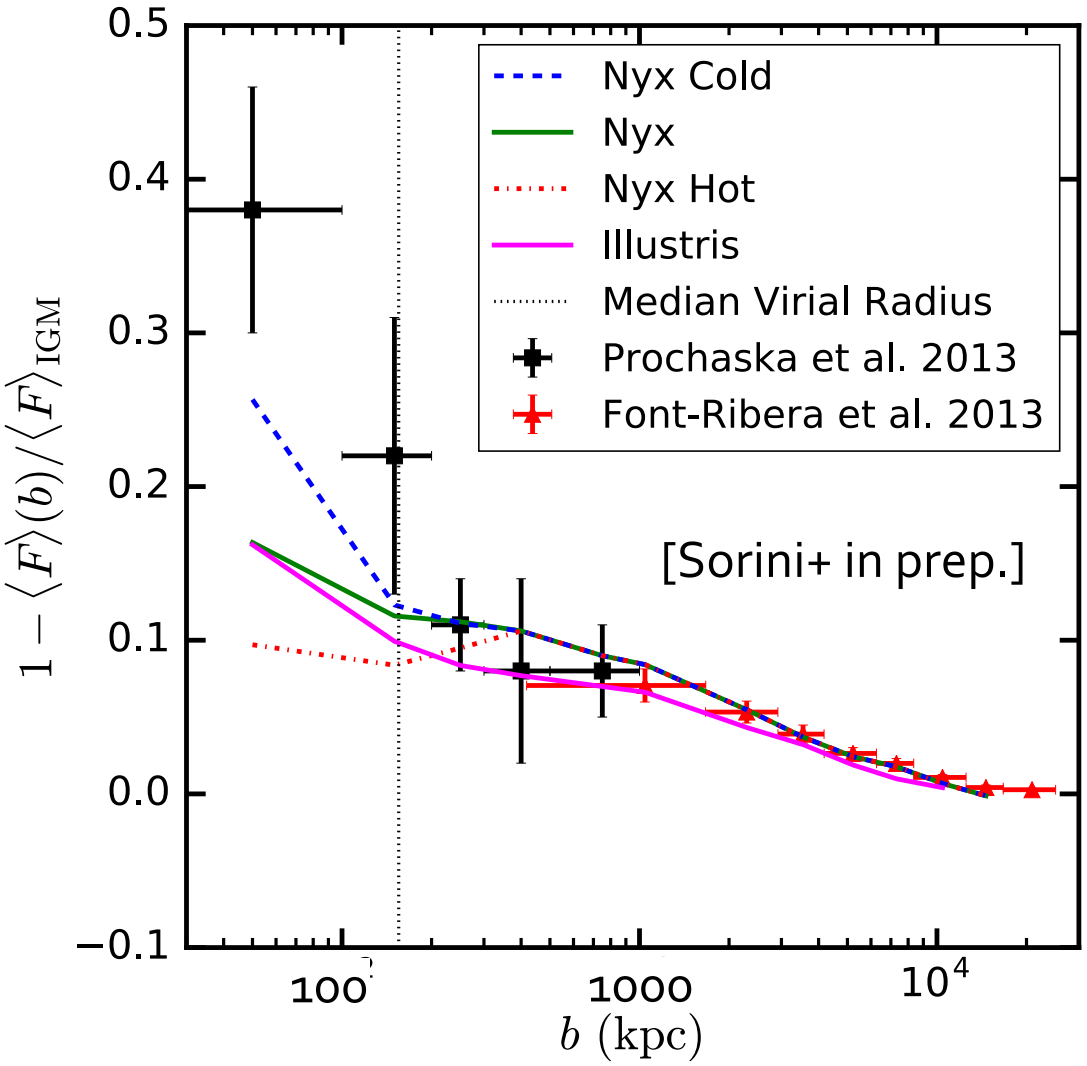

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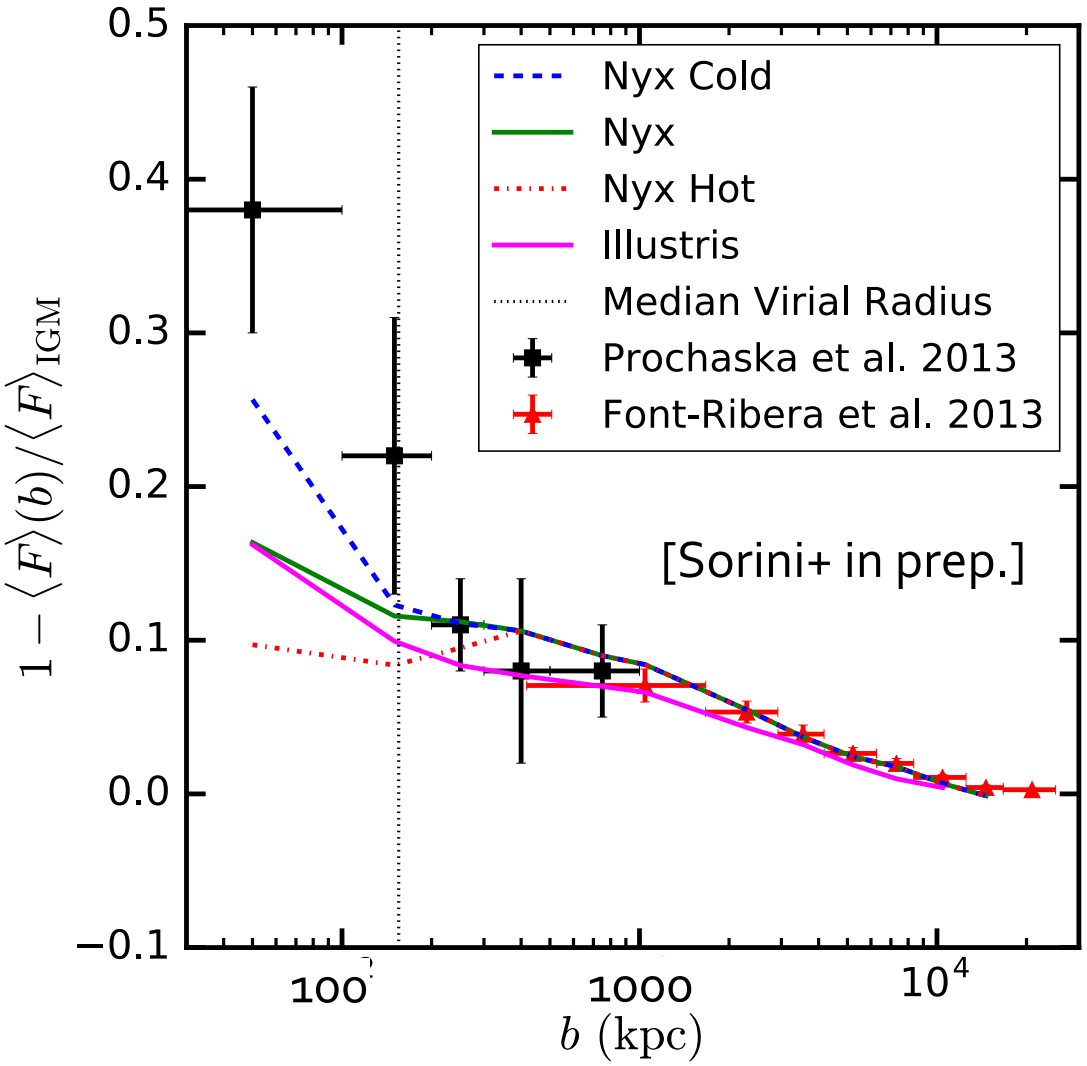

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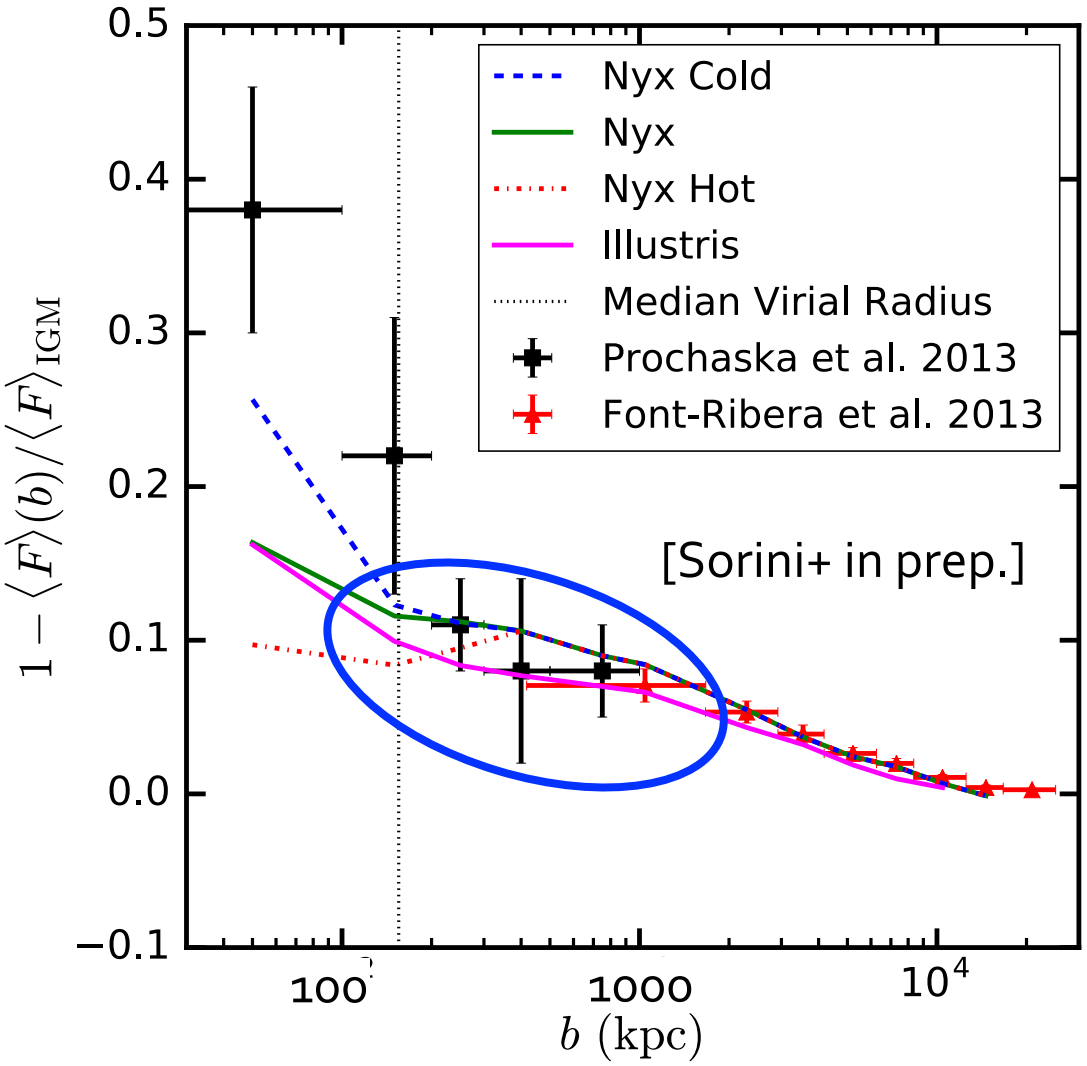

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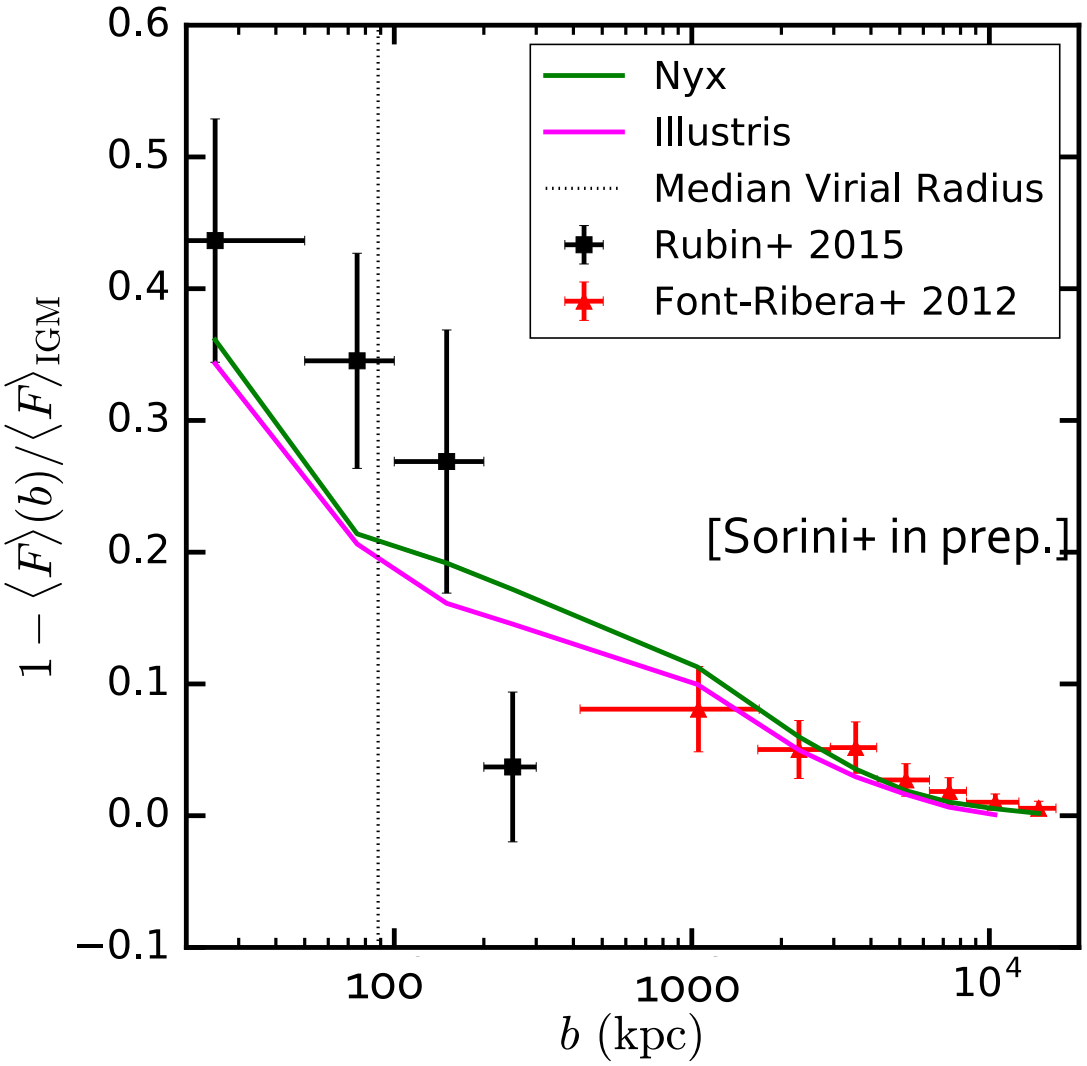
Lyα Absorption around DLAs



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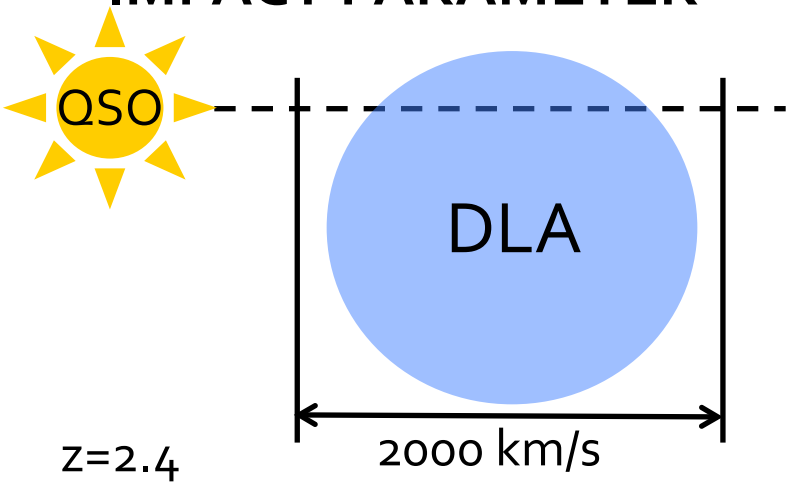

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$\log(M_{halo}/M_\odot)\geq 12$
$\log(N_{HI}/cm^{-2})\geq 20.3$

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Sims reproduce precise measurements

Conclusions & Outlook

- Precise Lyα absorption data at large separations reproduced well by simulations
- Matching Lyα absorption at small separations challenging for cosmological simulations
- Increase precision of measurements up to b~1 Mpc ➔ discriminate among different feedback implementations