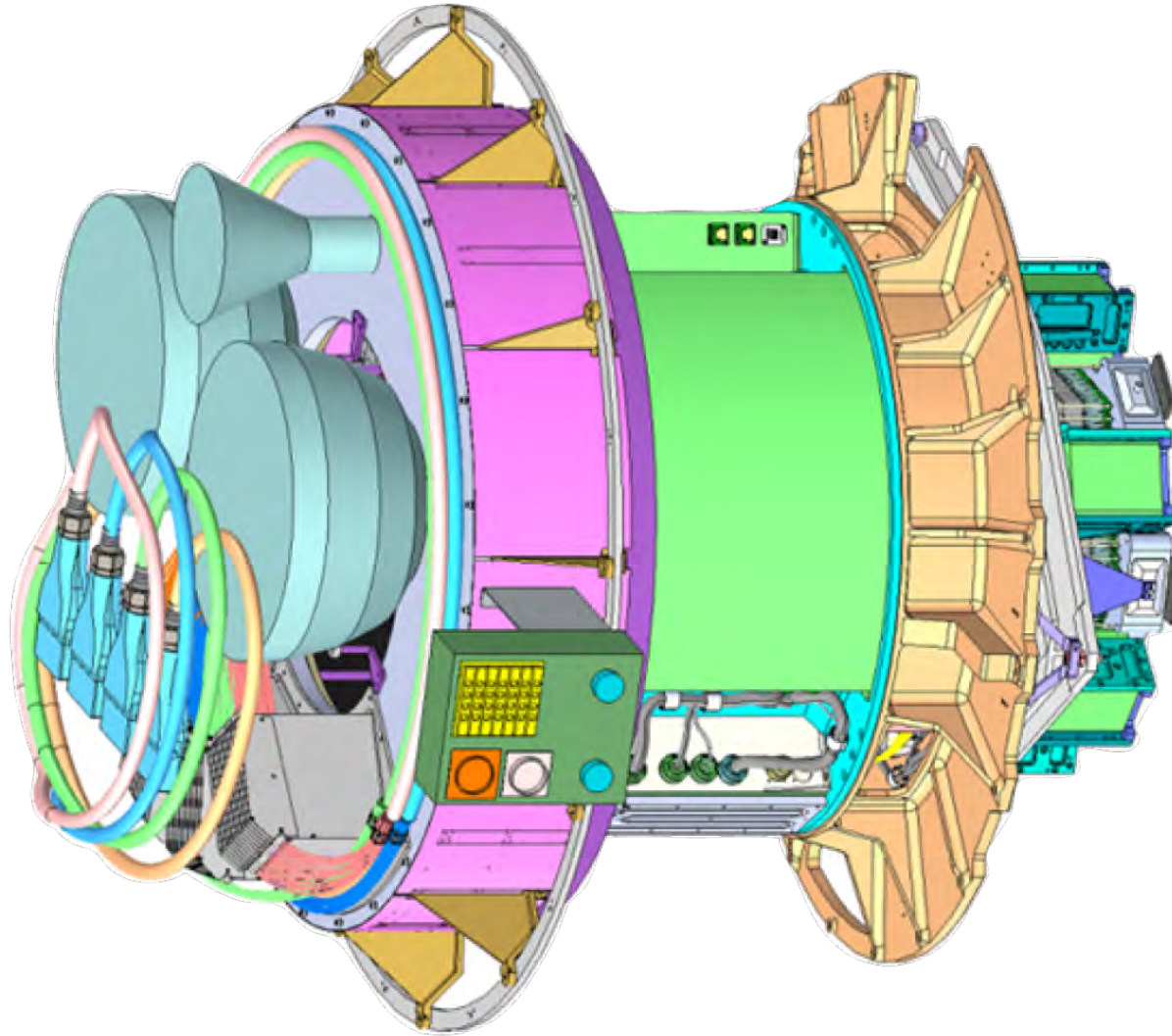


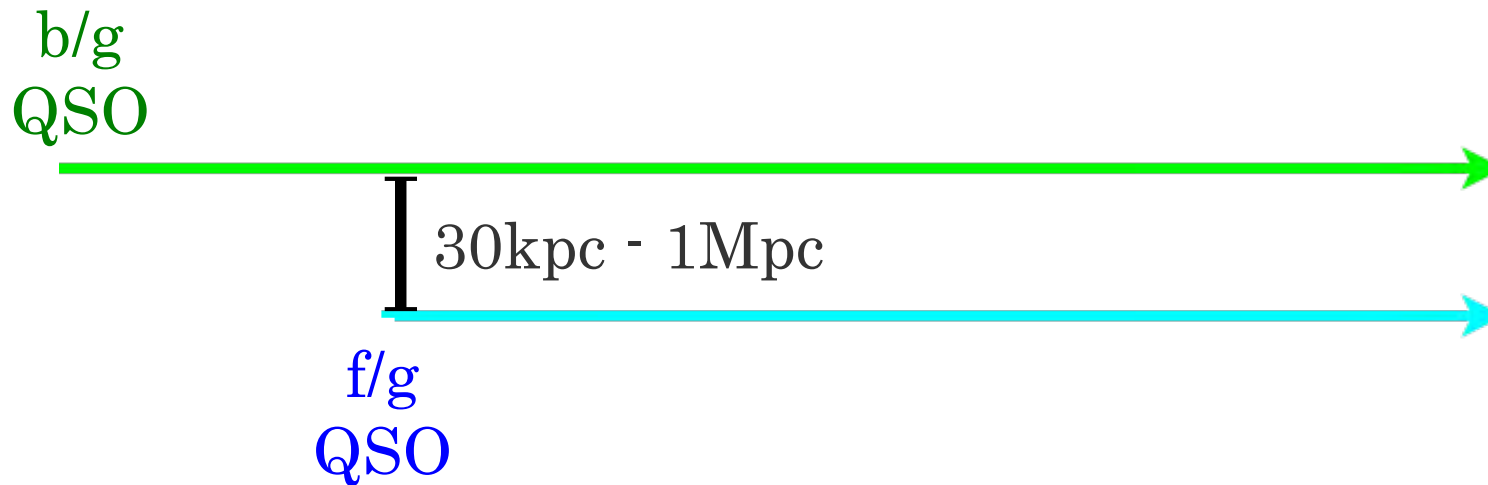
Open Questions on the CGM at $z > 2$ (that PFS could/will attack)



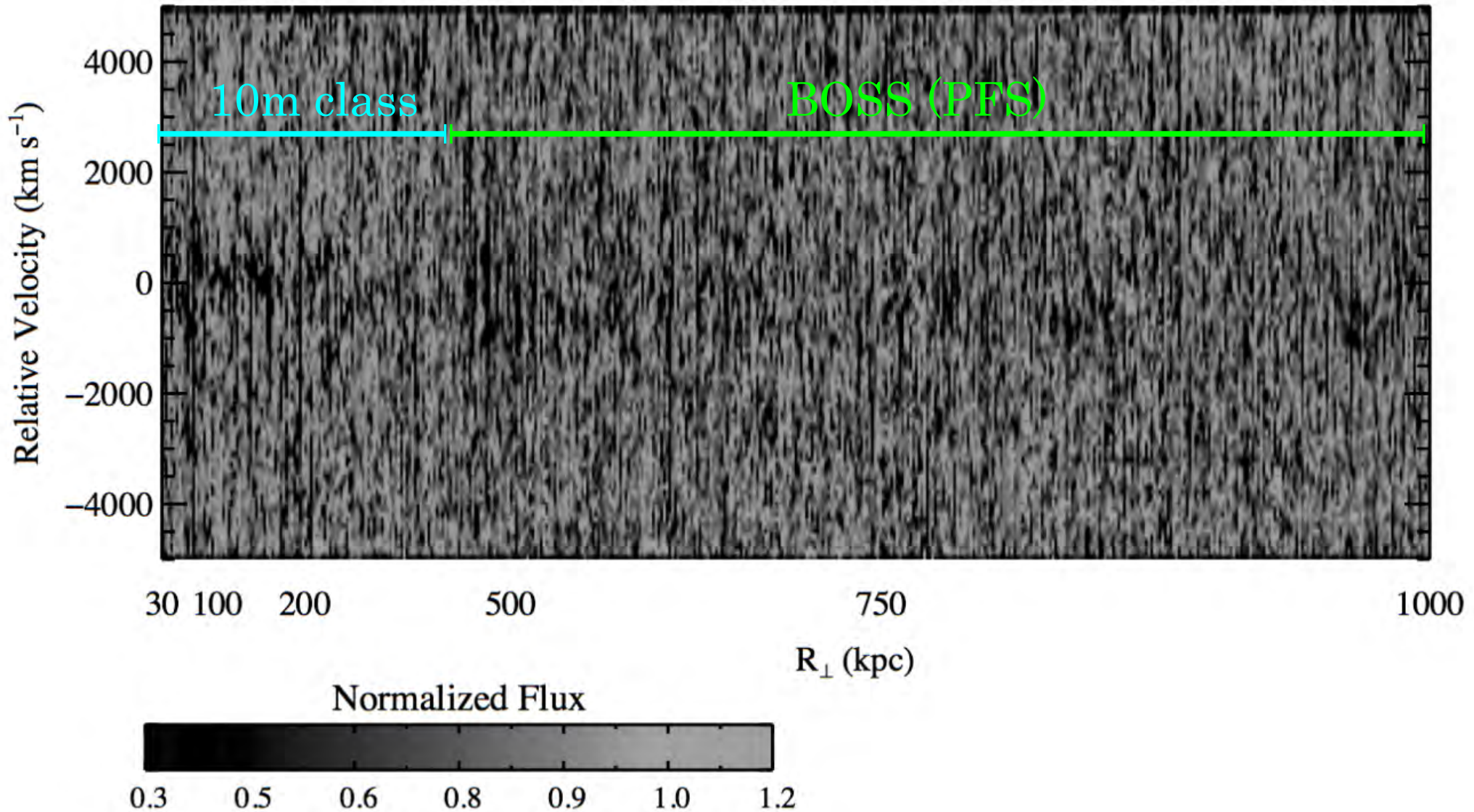
J. Xavier Prochaska
@ IMPS @ UCSC

How does the CGM trace Dark Matter Halo Mass?

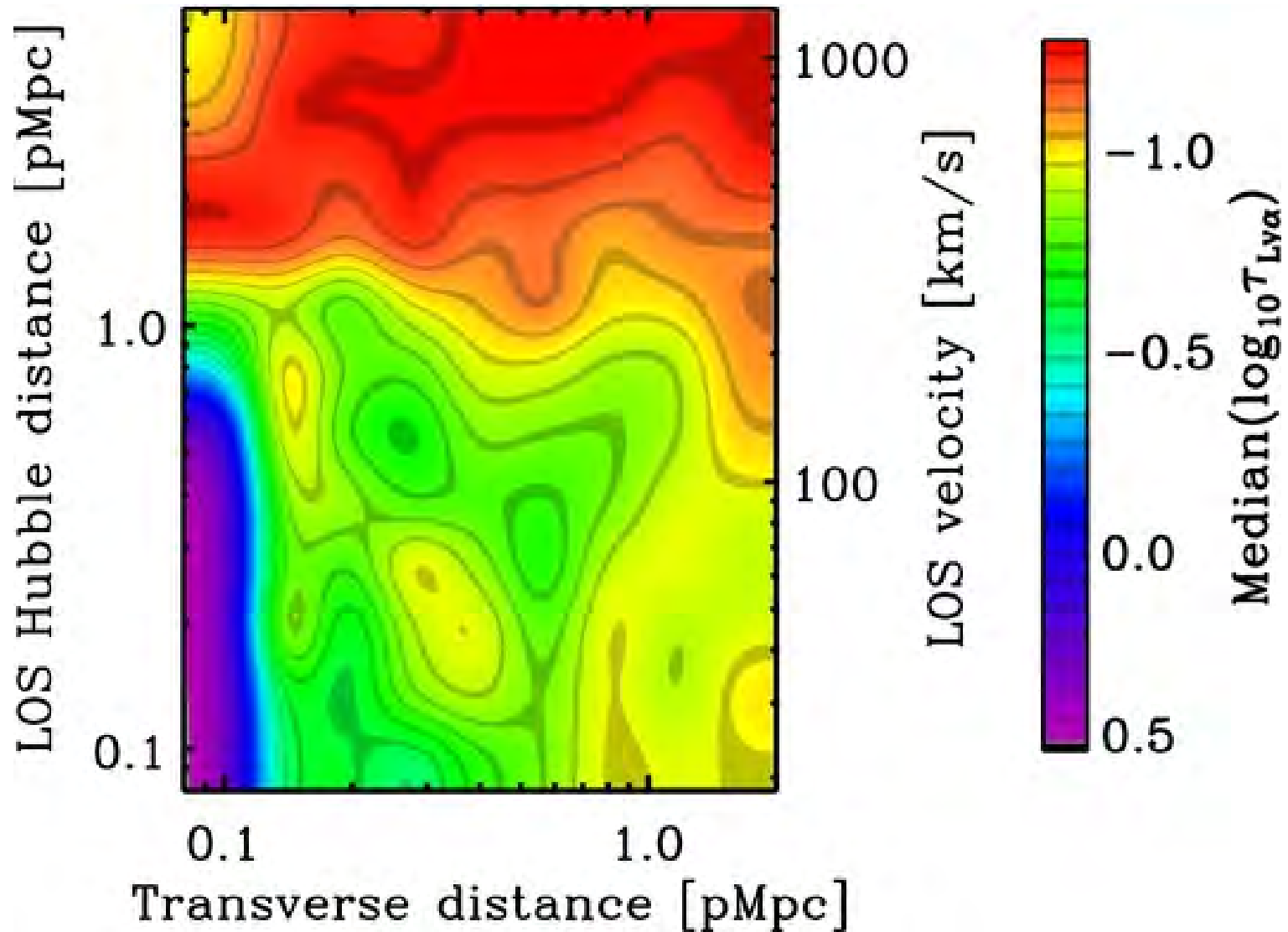
Quasars Probing Quasars (QPQ)
Hennawi, Prochaska, +others



QPP: Strong, Excess HI Absorption

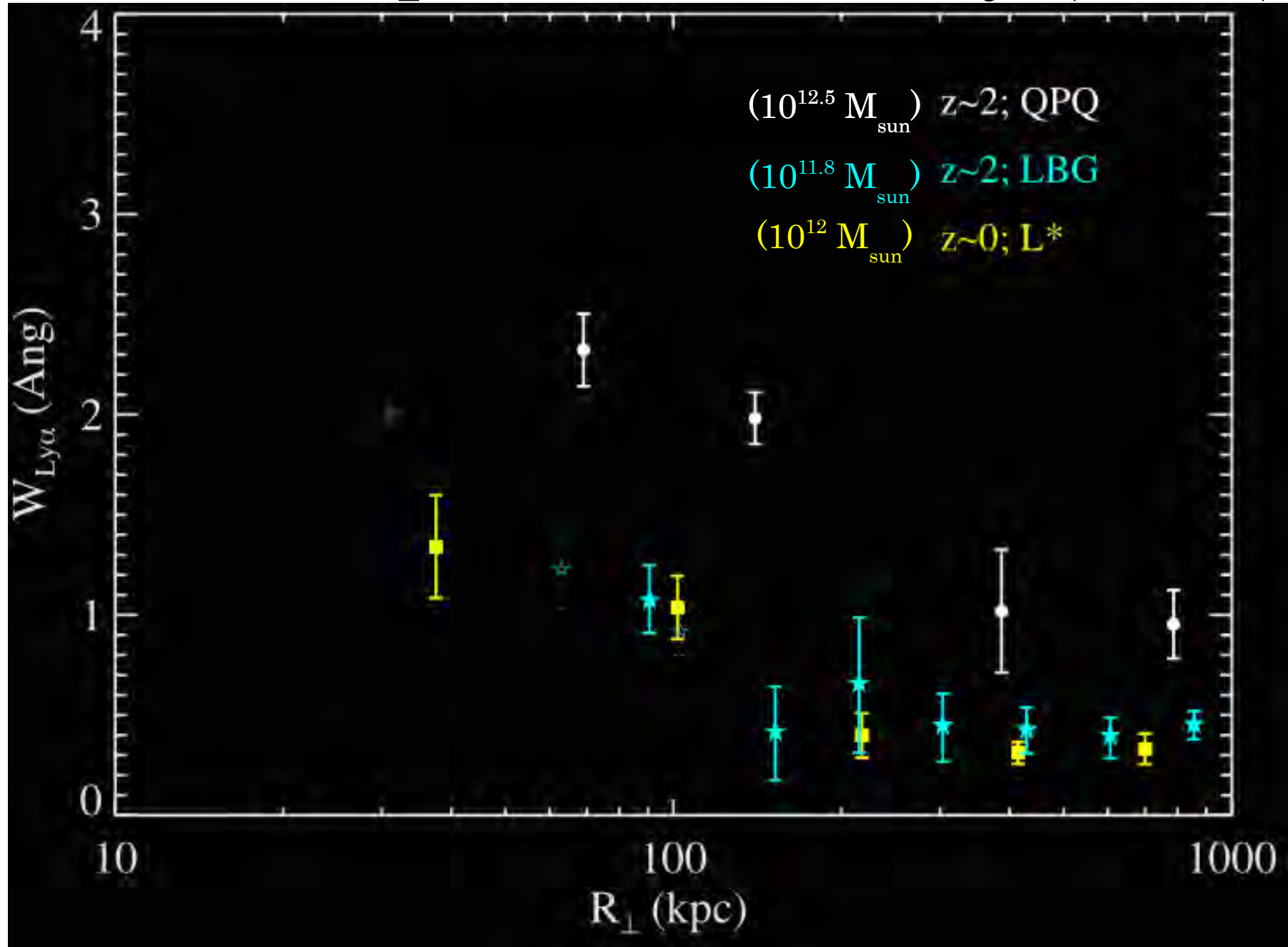


Lyman Break Galaxies

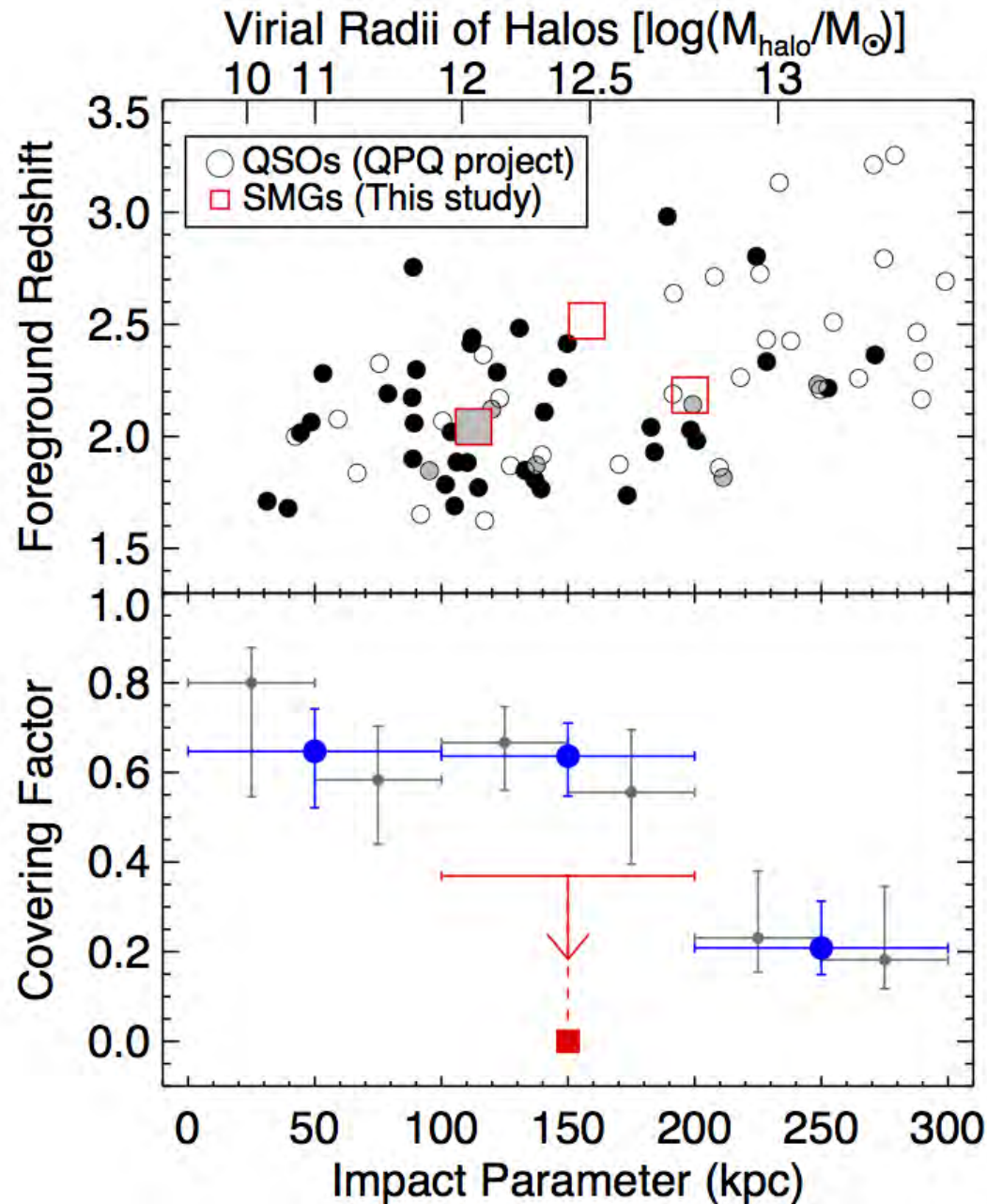


Rakic+12

HI Absorption vs. Galaxy (Halo)

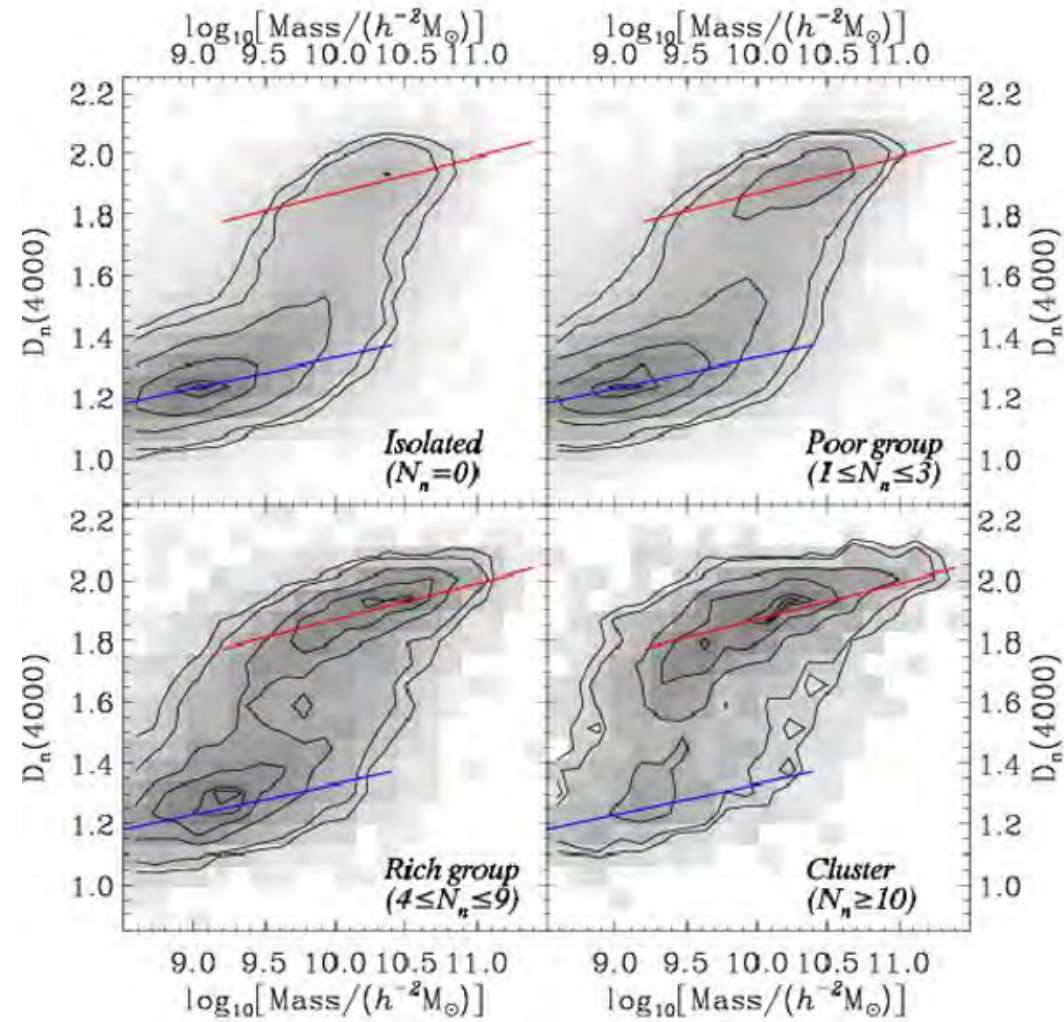
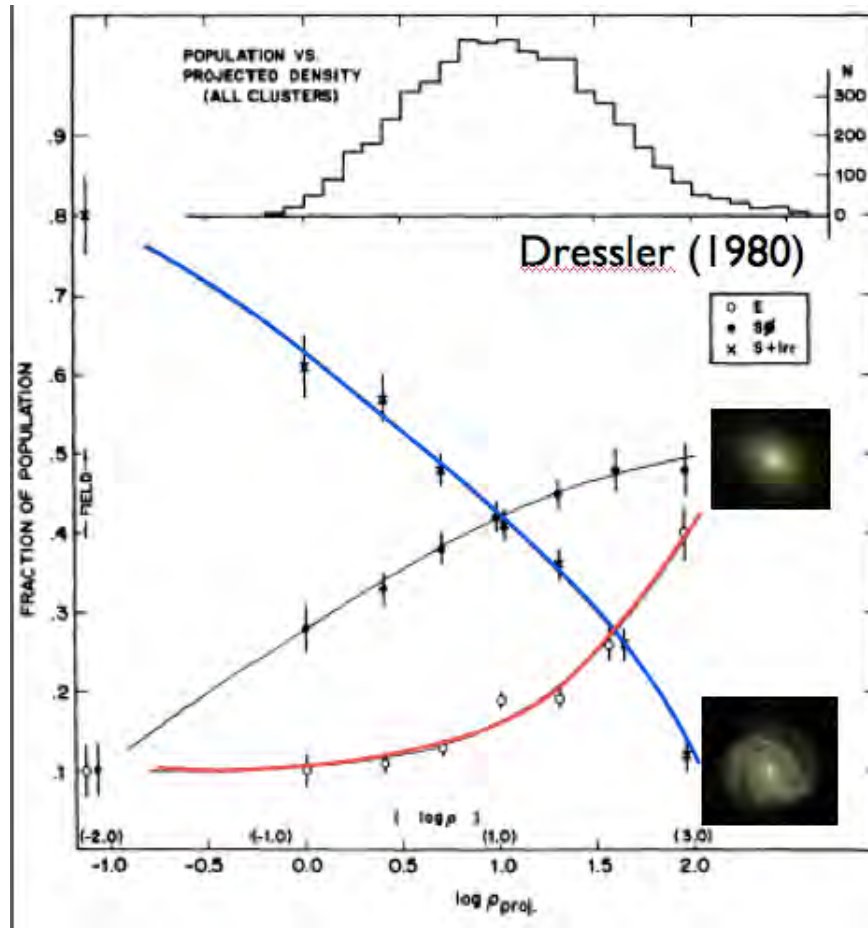


PFS (LAEs, SMGs, faint AGN, etc.)

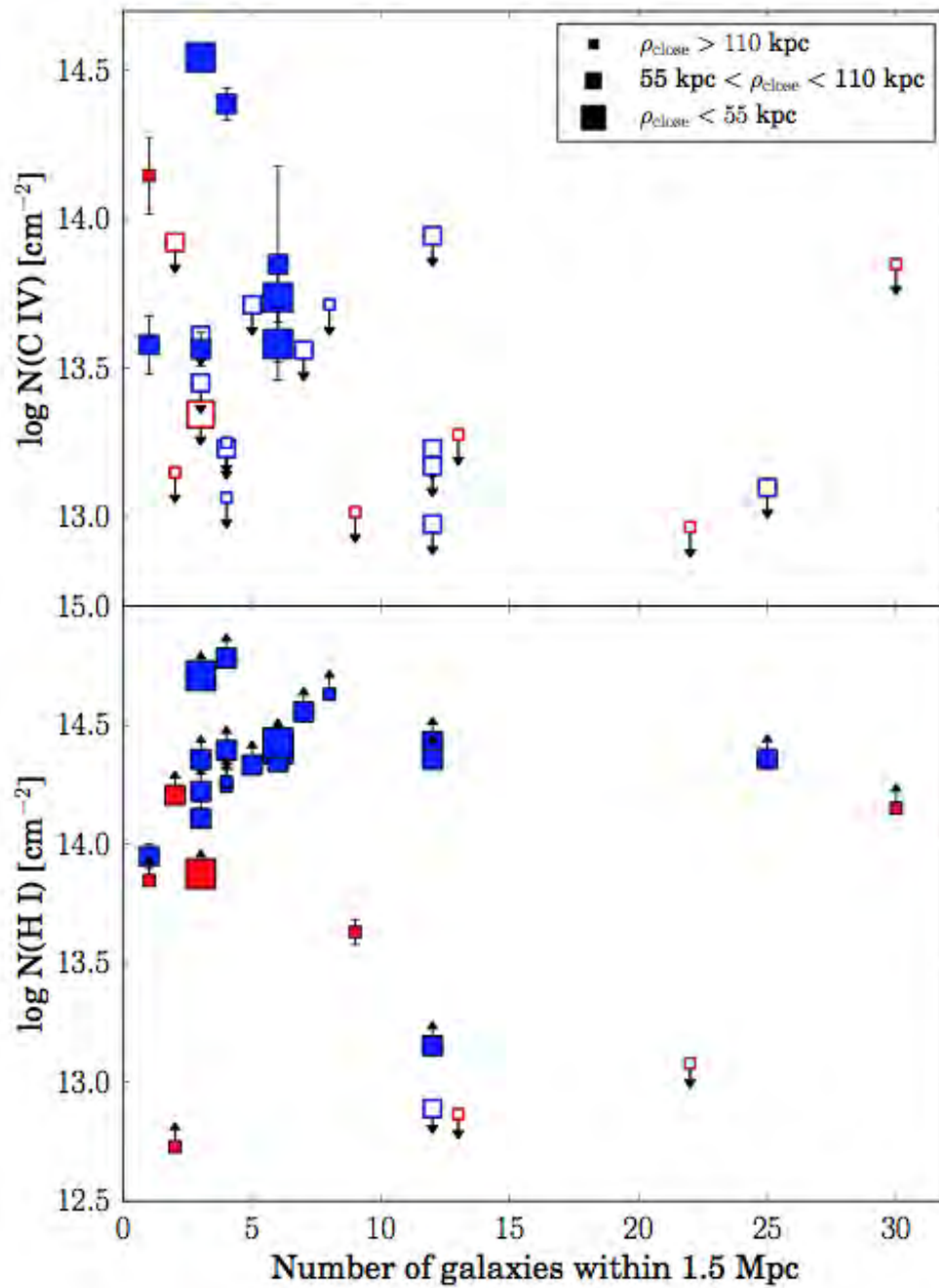


Fu+16

2. How is the CGM influencing (or influenced by) its extended environment?

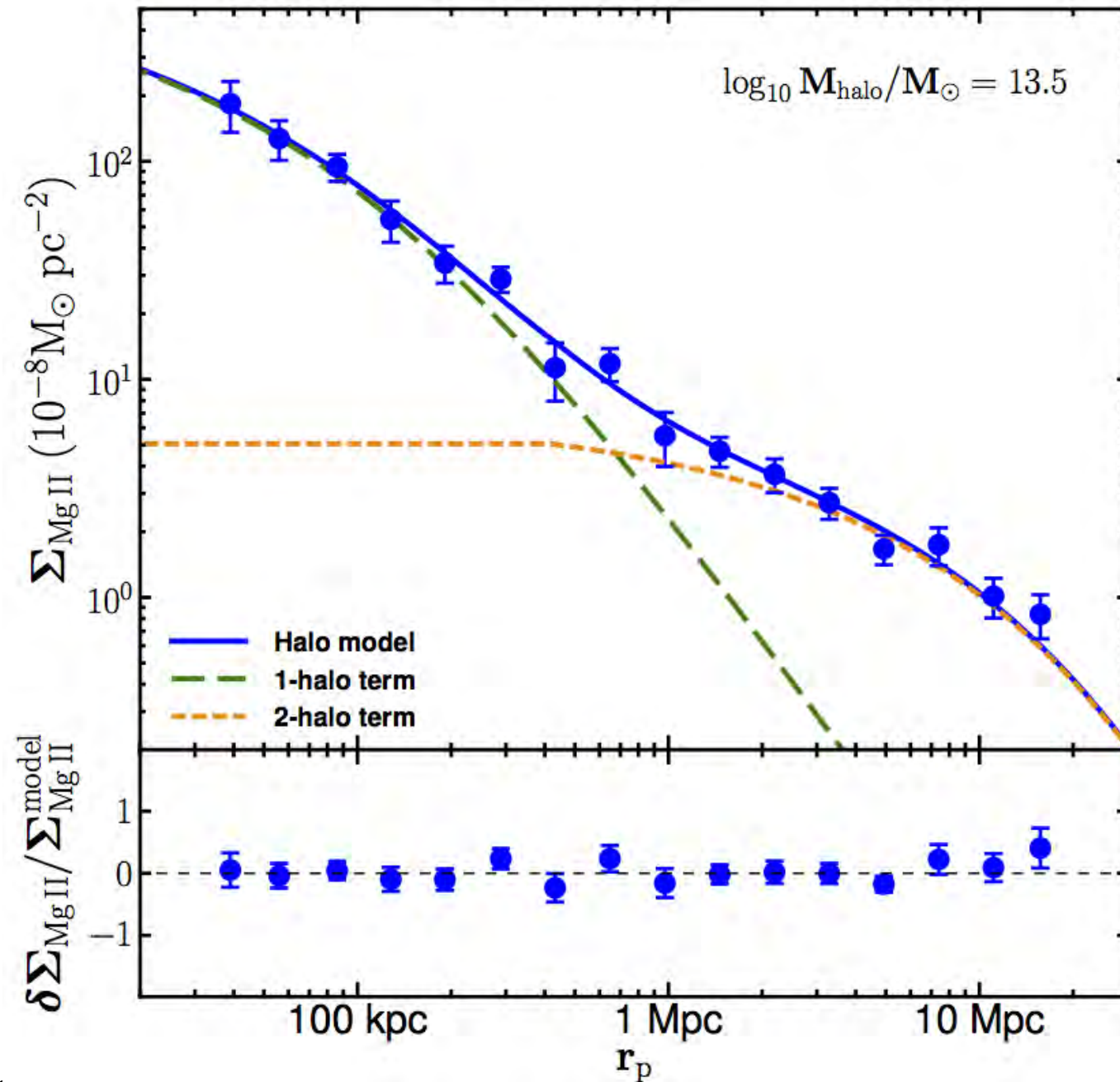


Low-z Metals (CIV)



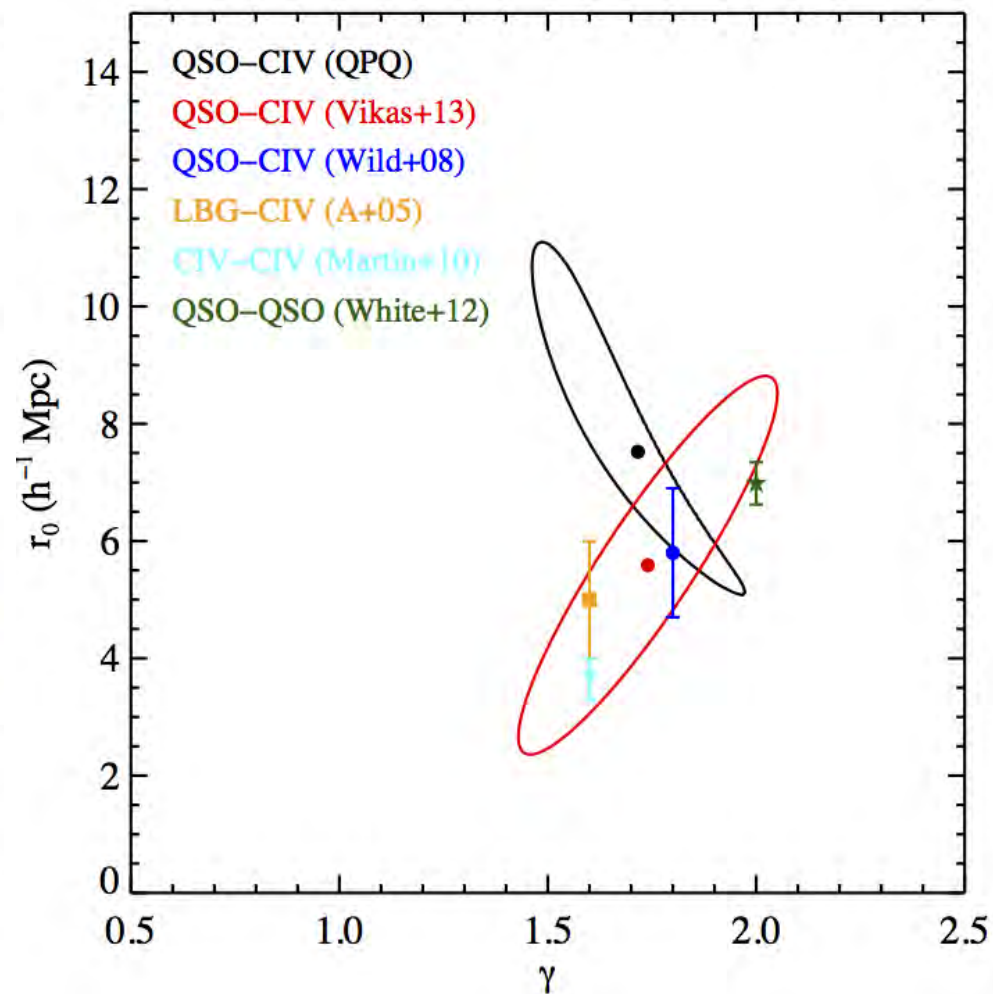
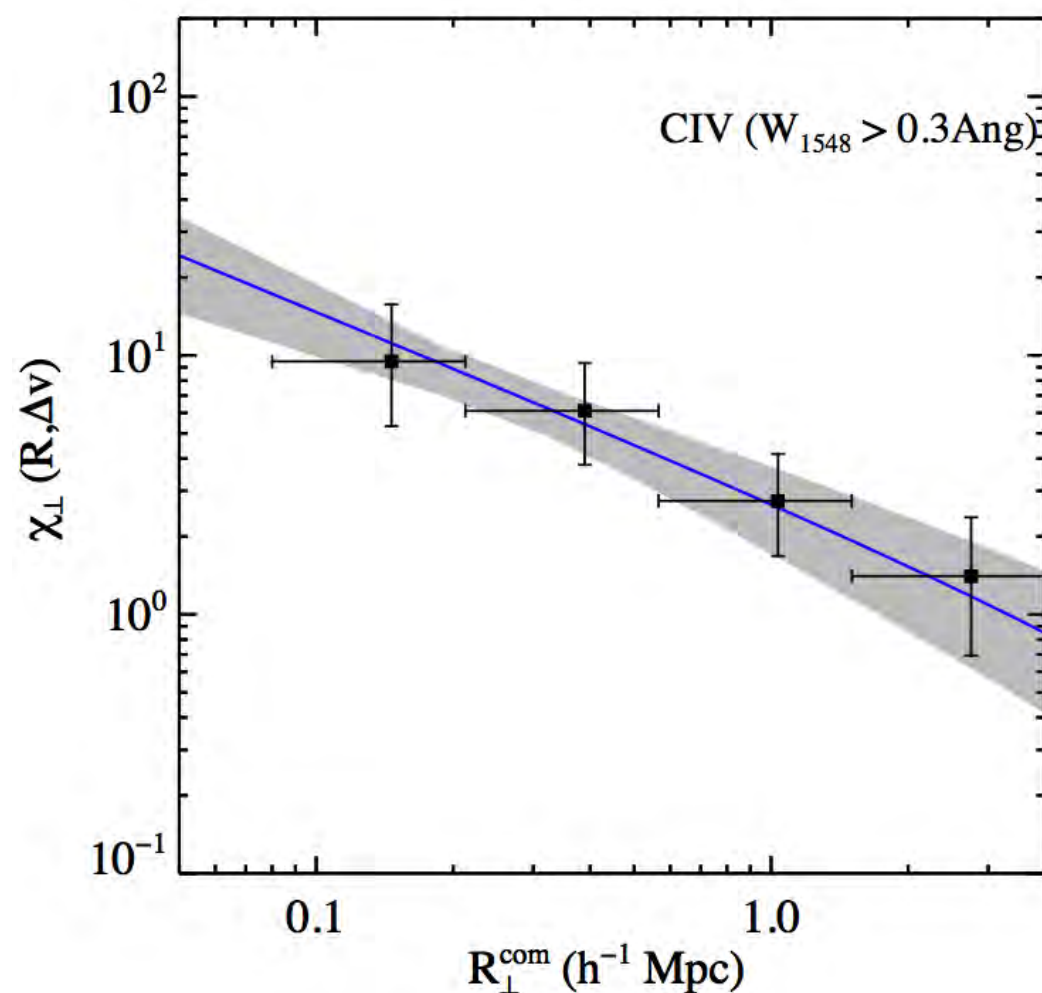
Burchett+16

LRGs-MgII Cross-Correlation



Zhu+14

QPQ/BOSS: Quasar-CIV clustering

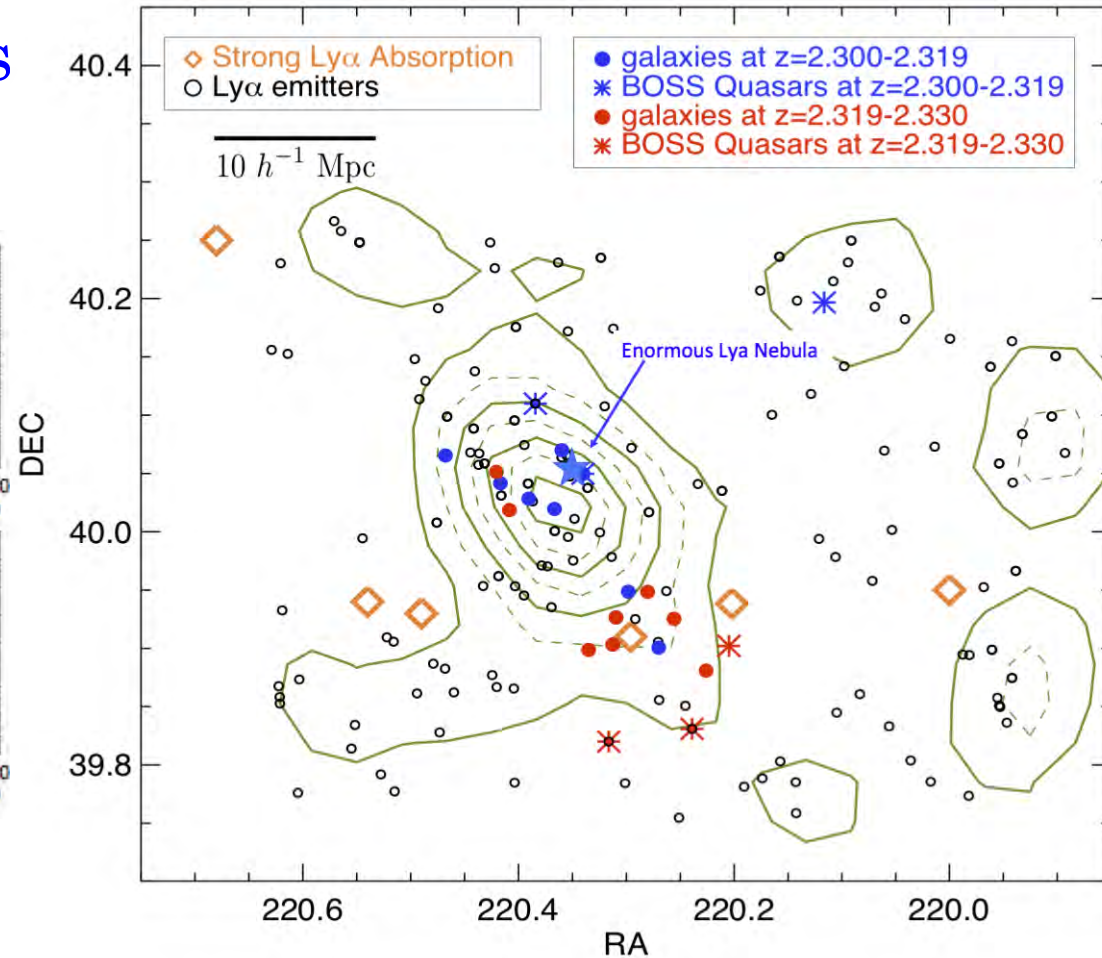
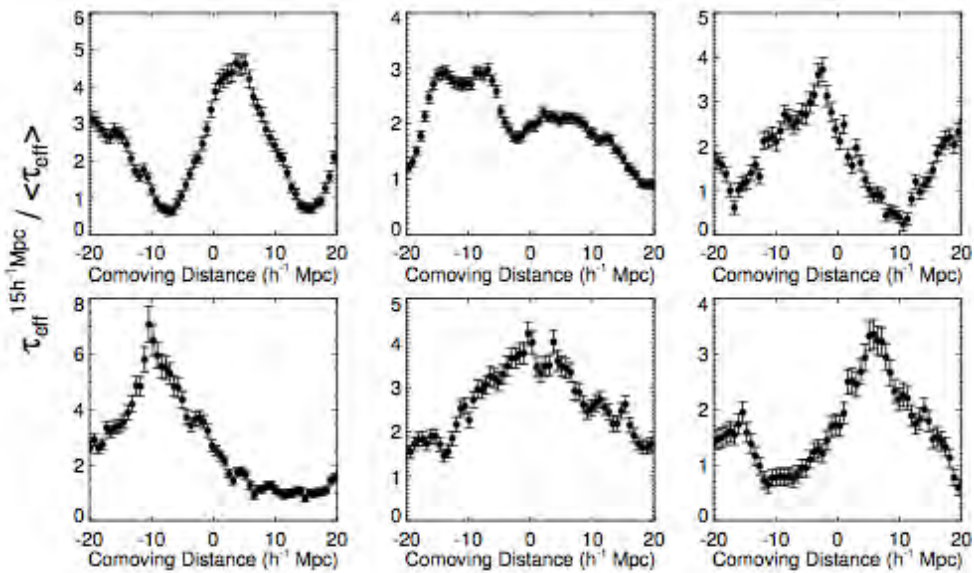


P+14

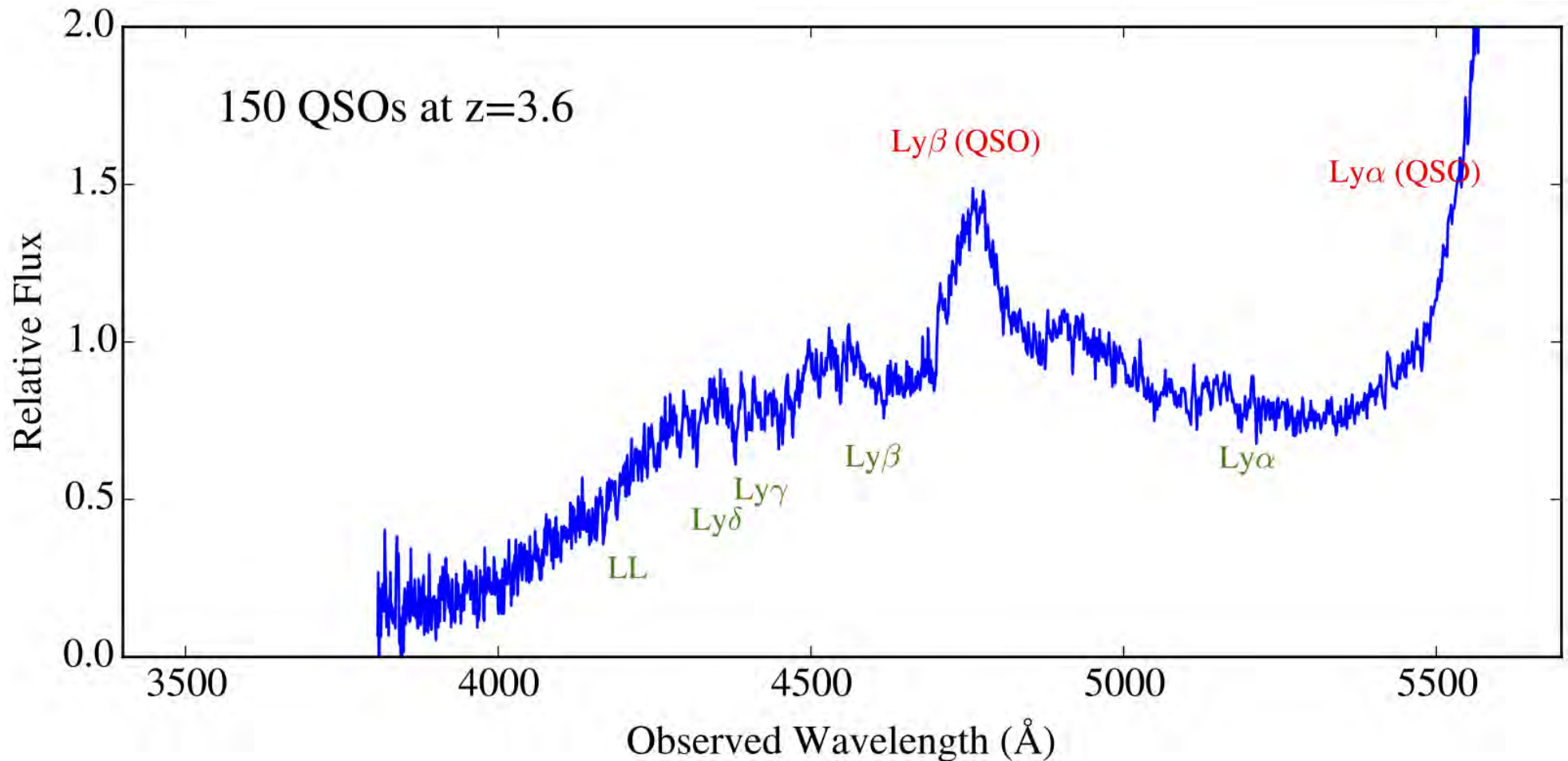
PFS: Extrema (e.g protoclusters), LBGs on large scales??

Cai+16b

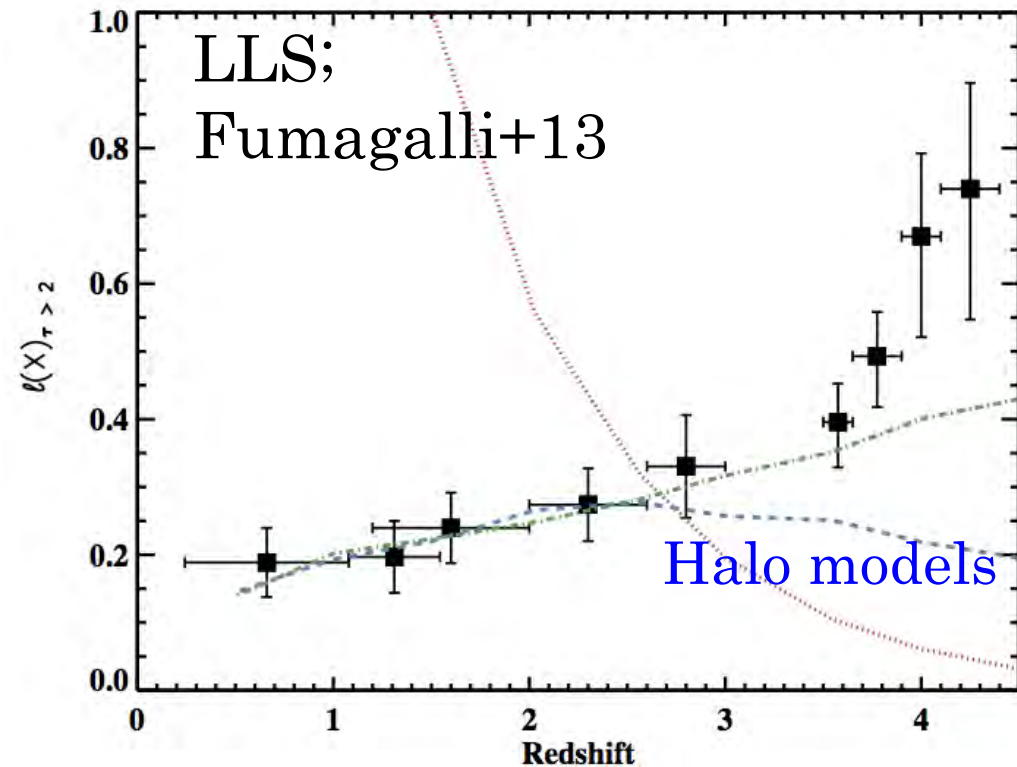
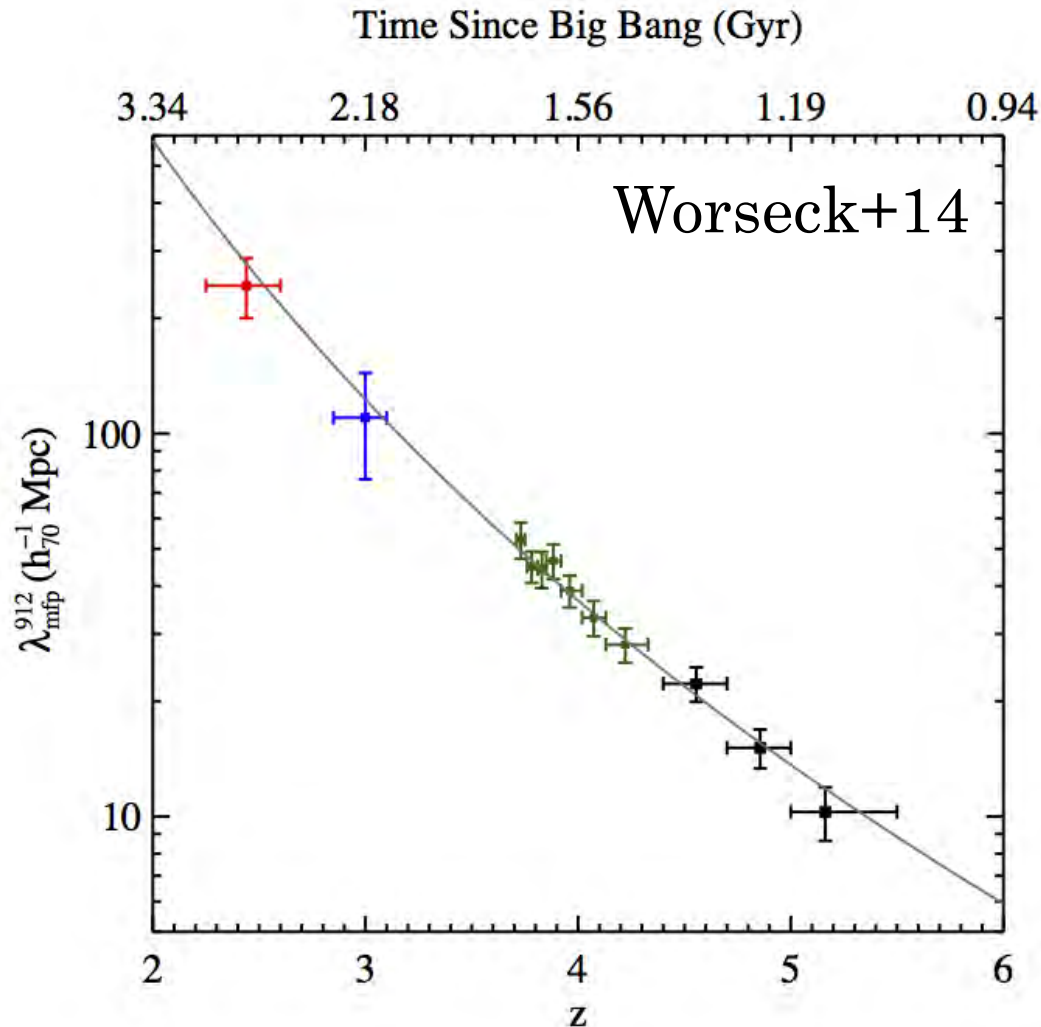
IGM-selected protoclusters (MAMMOTH; Cai+16a)



3. Is optically thick gas preferentially surrounding massive galaxies??

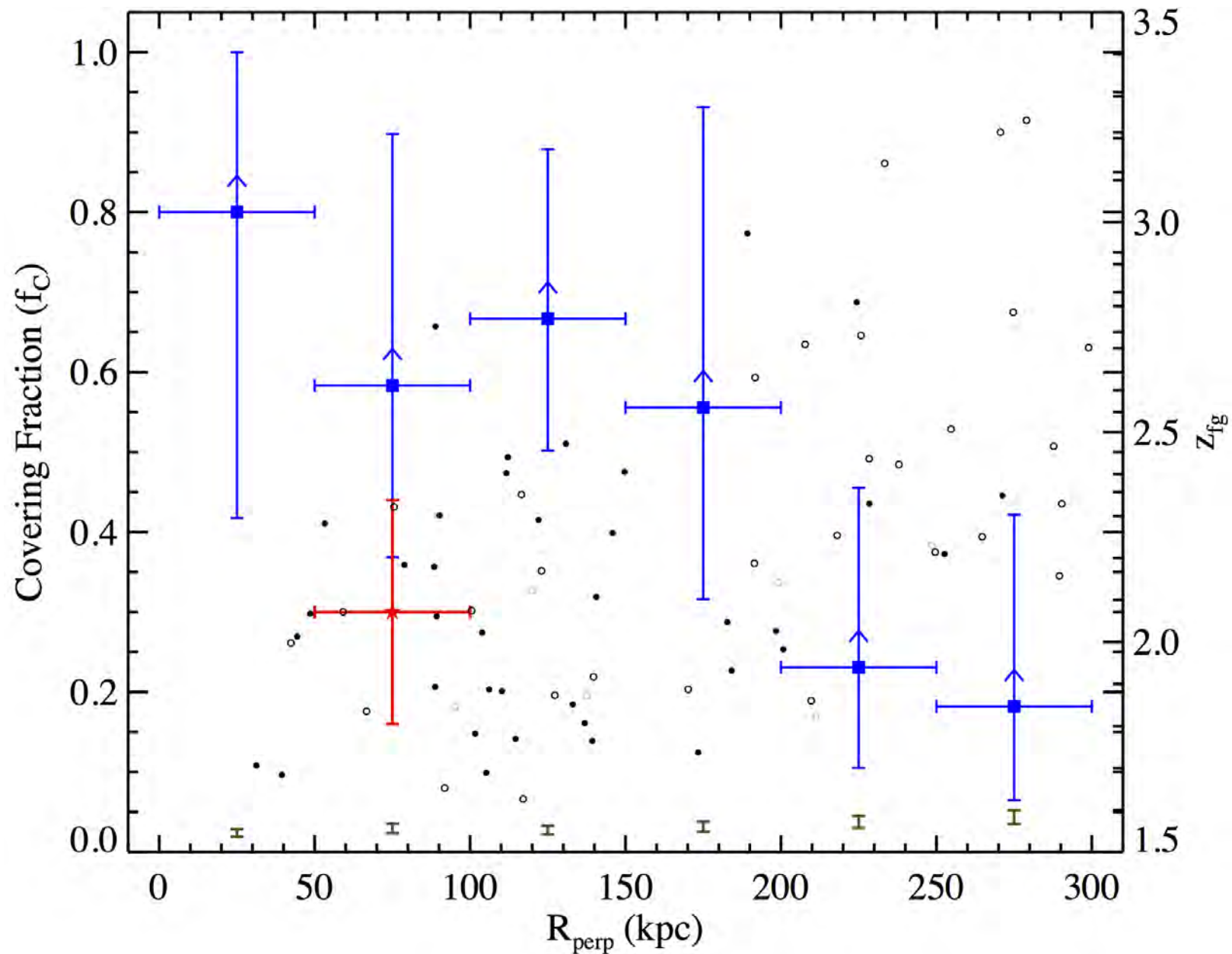


Mean Free Path (MFP) and LLS

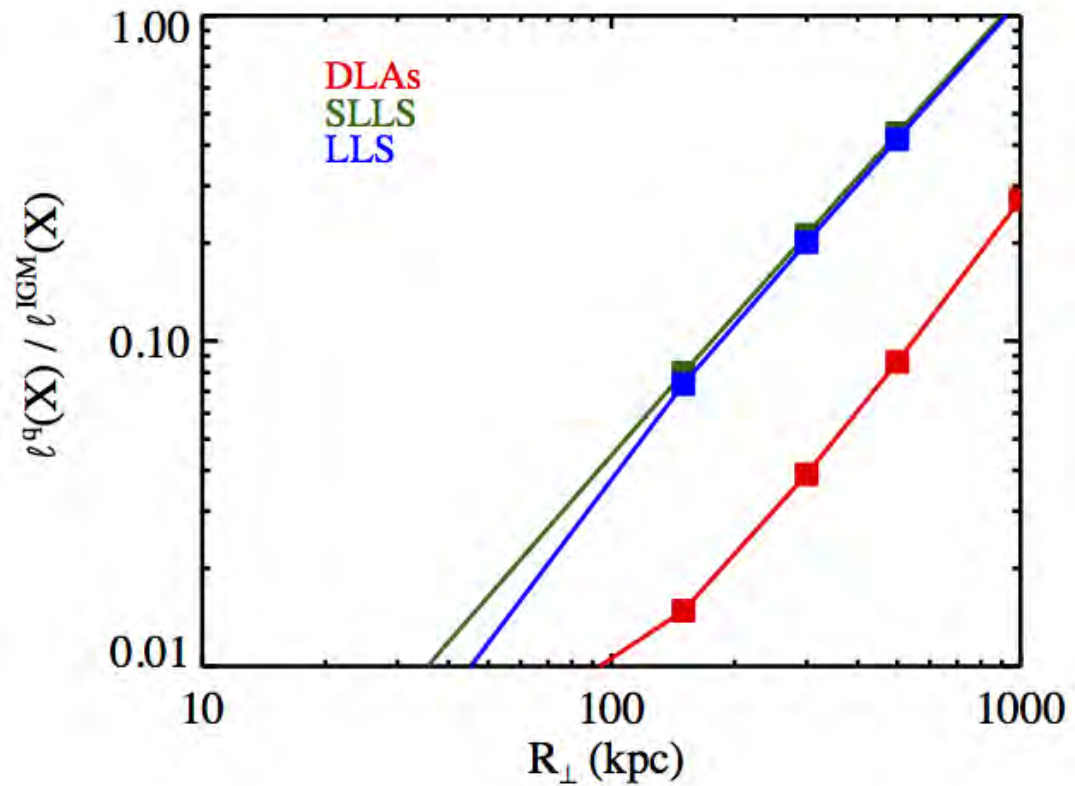
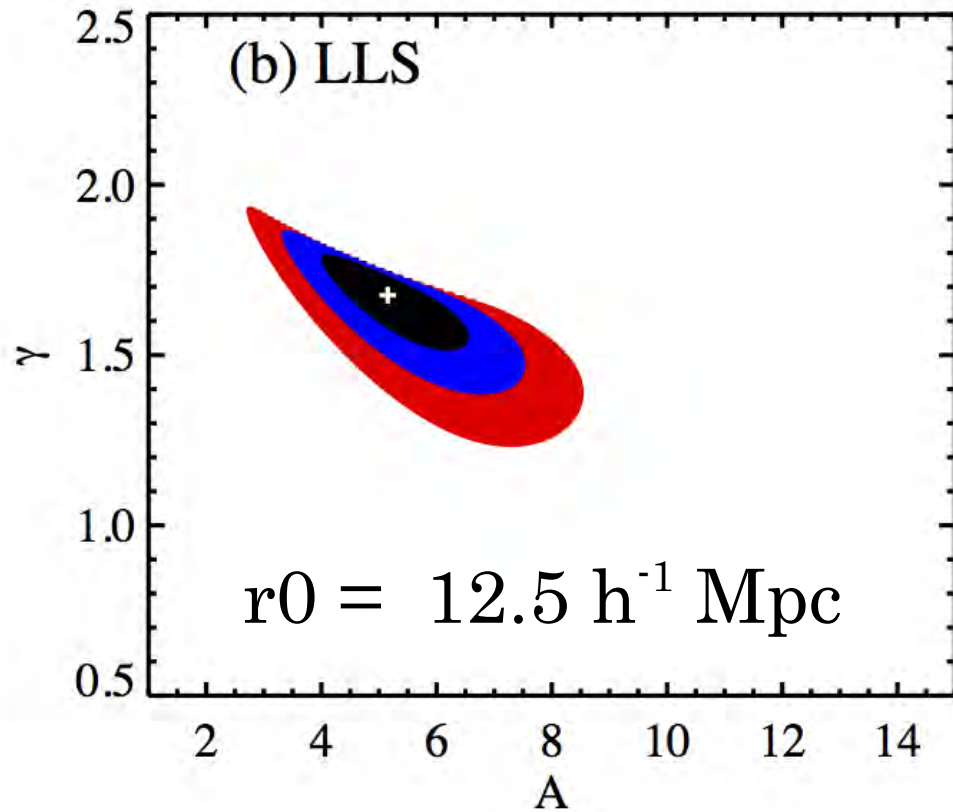


What sources and structures
dominate this opacity (vs. time)?

QPQ5 and Optically thick gas



QPQ6 and Optically thick gas

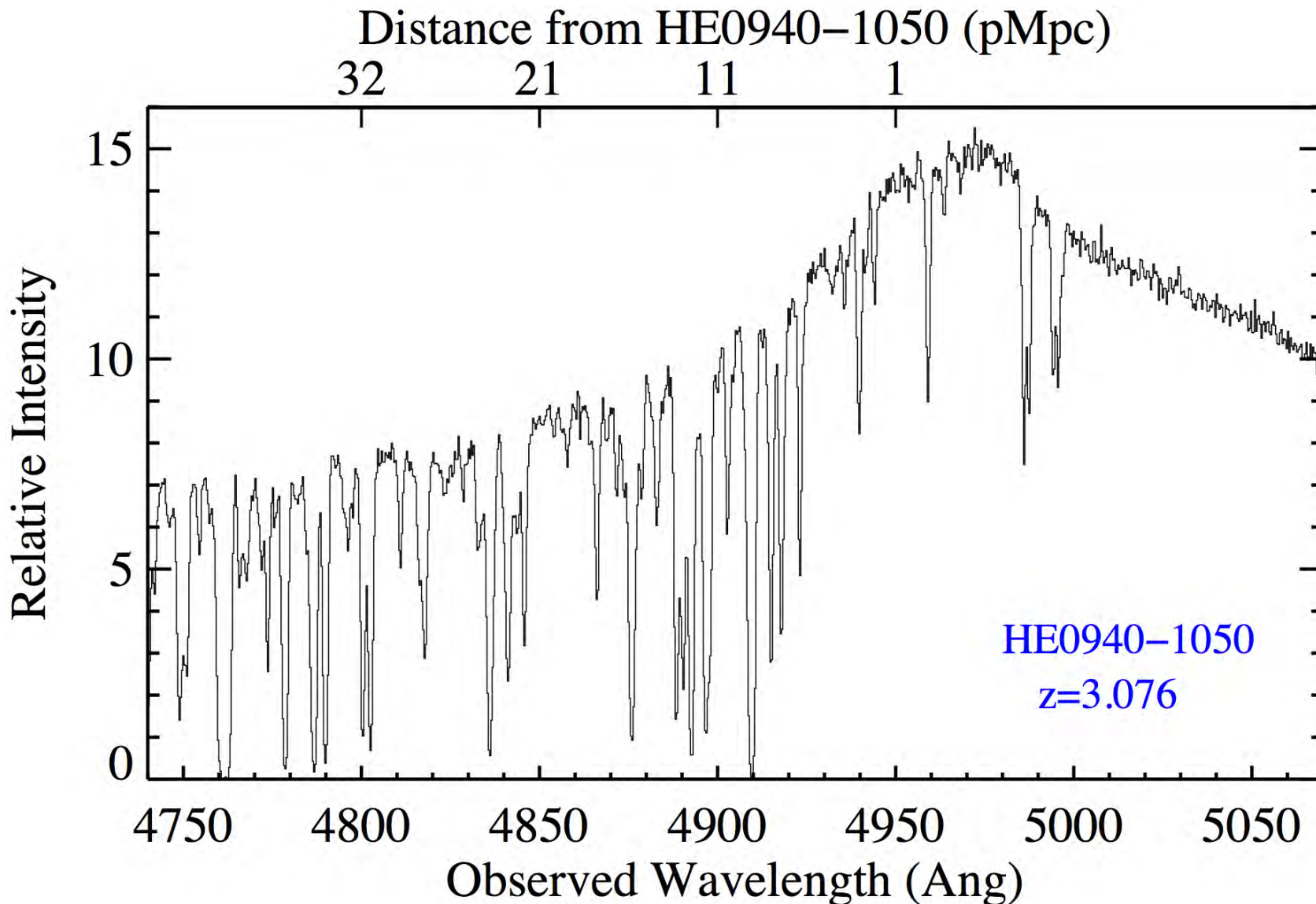


PFS: Optically Thick Gas

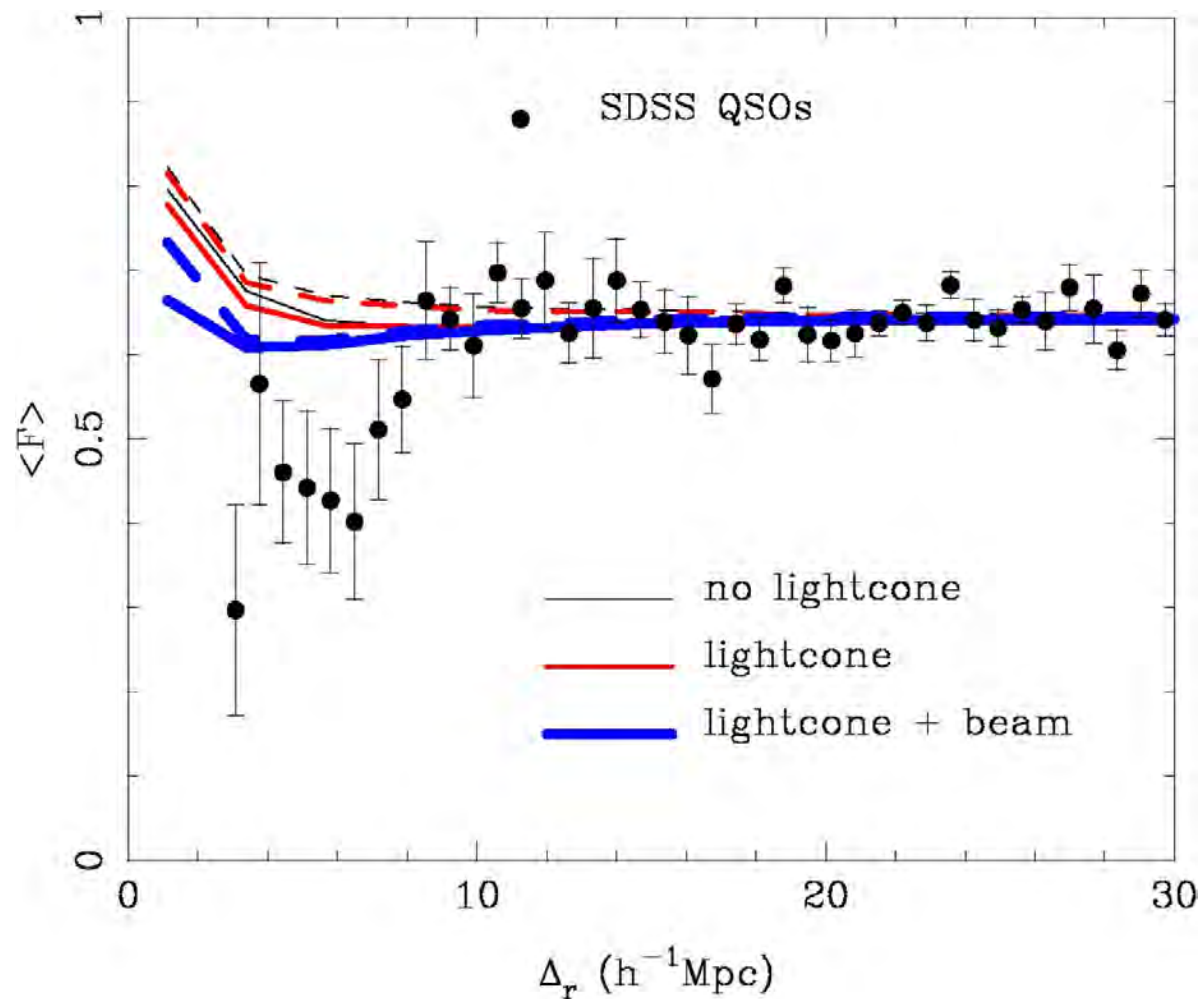
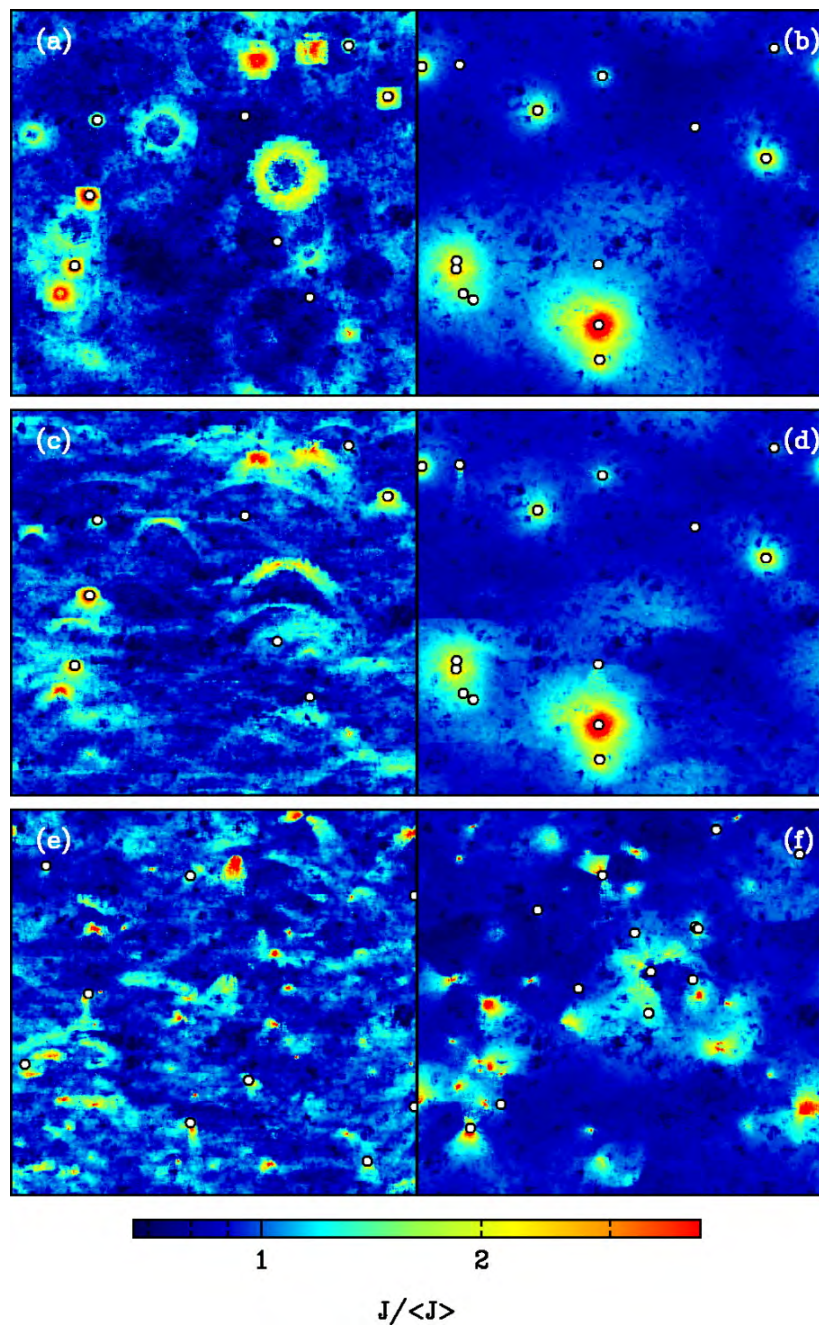
Cross-correlation with LAEs, LBGs,
voids, etc. Area is critical..

(Tomography has too low S/N)

Is there a Transverse Proximity Effect (TPE) [for HI or HeII] ??

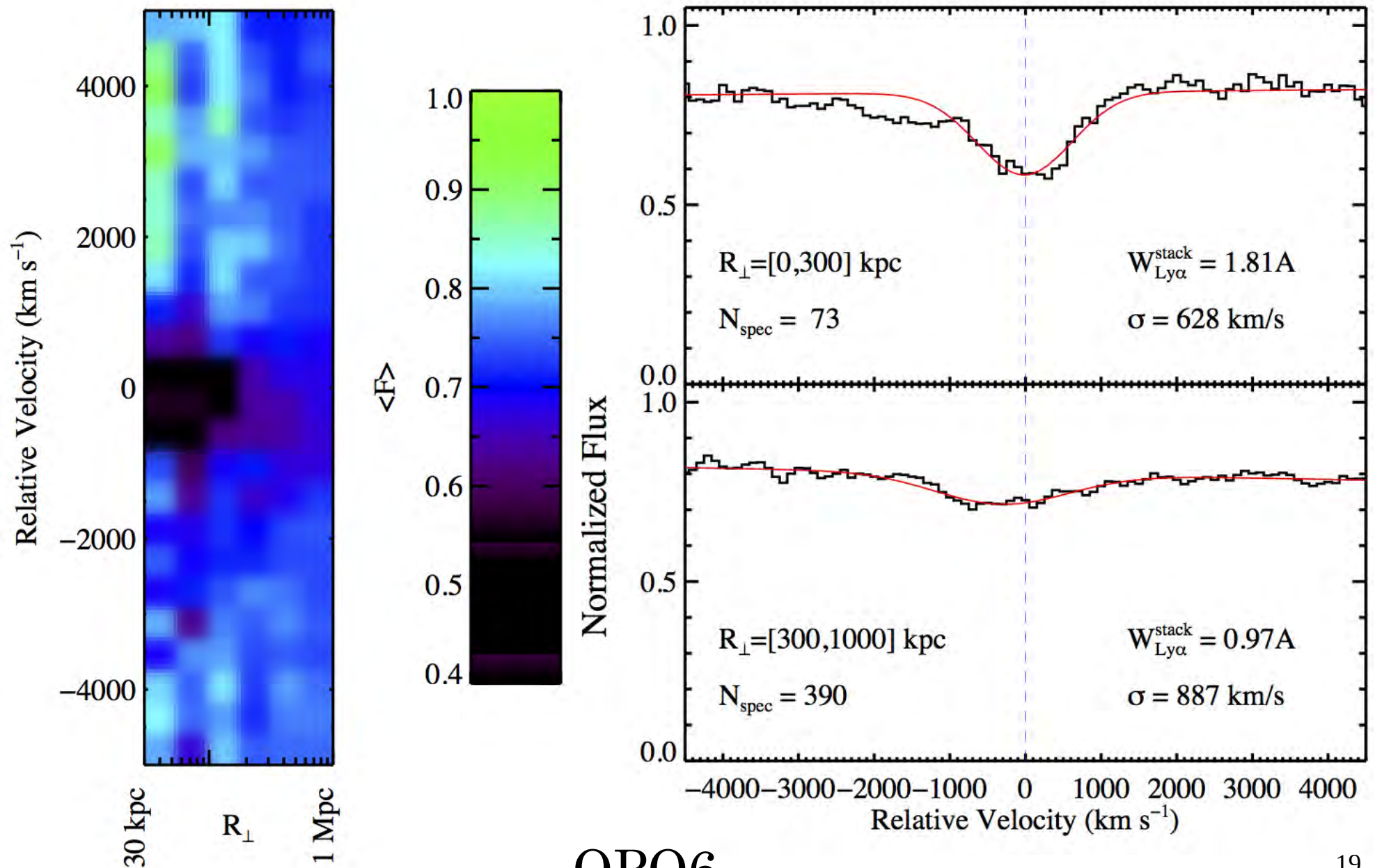


(Failed) Searches for the TPE



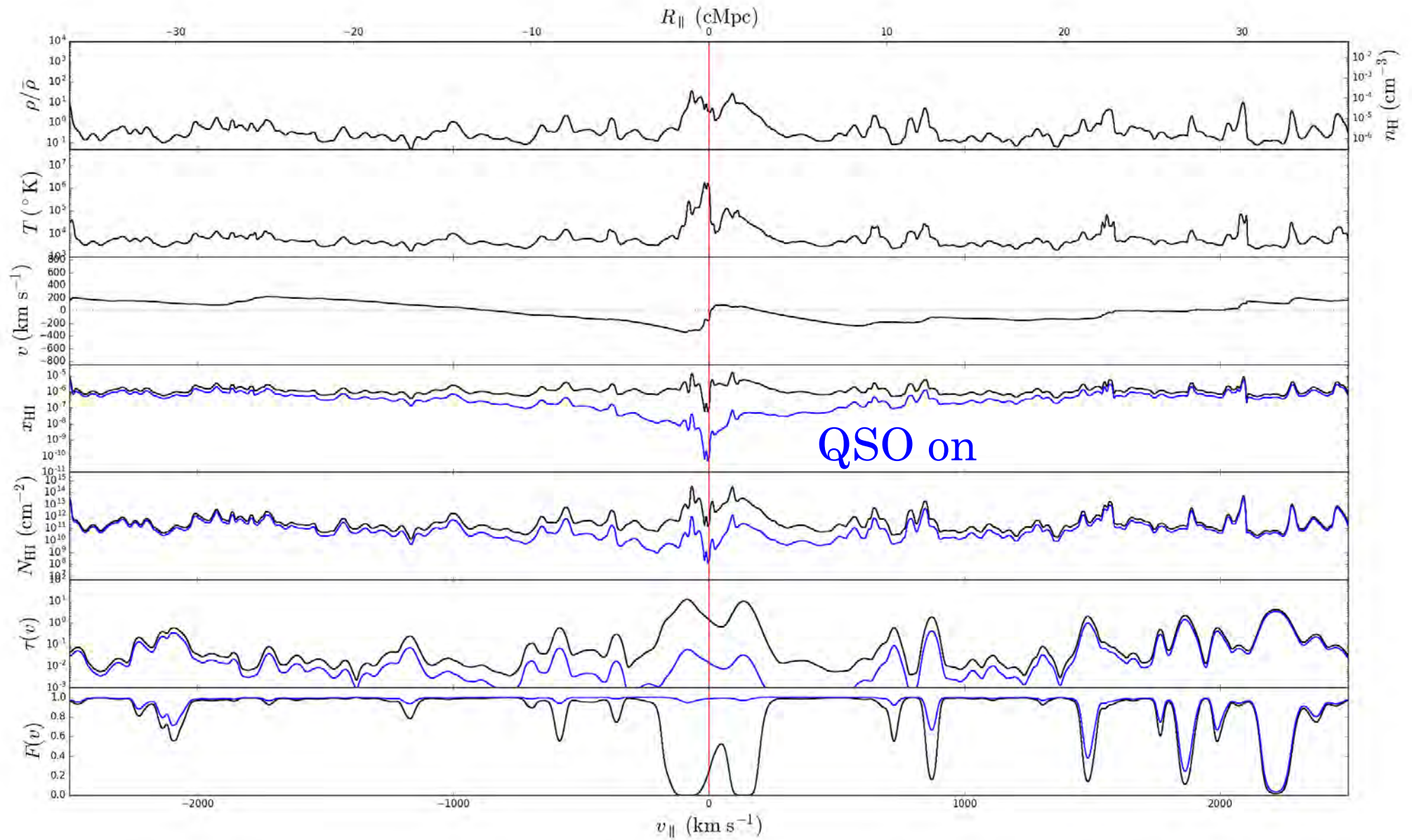
Croft 2004

(Failed) Searches for the TPE



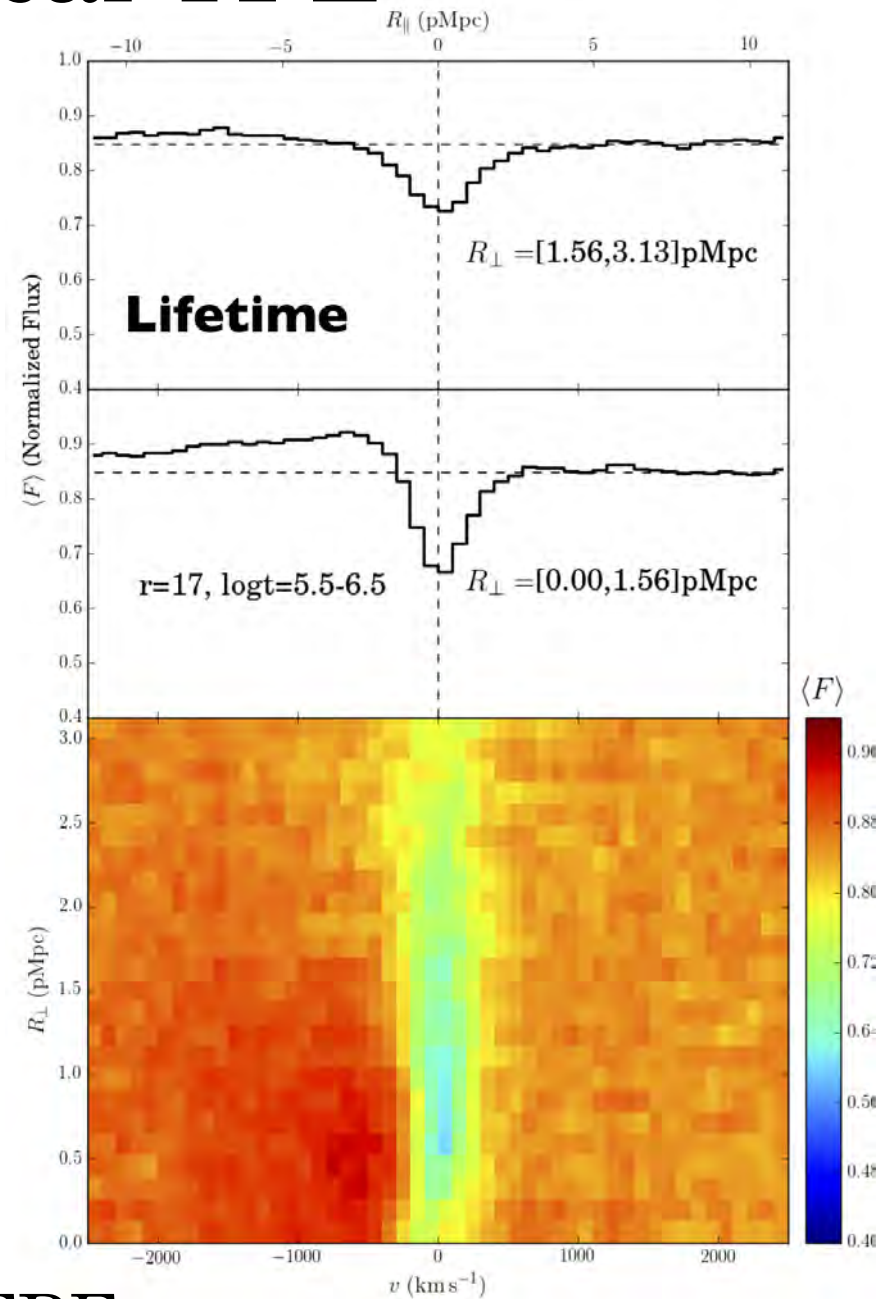
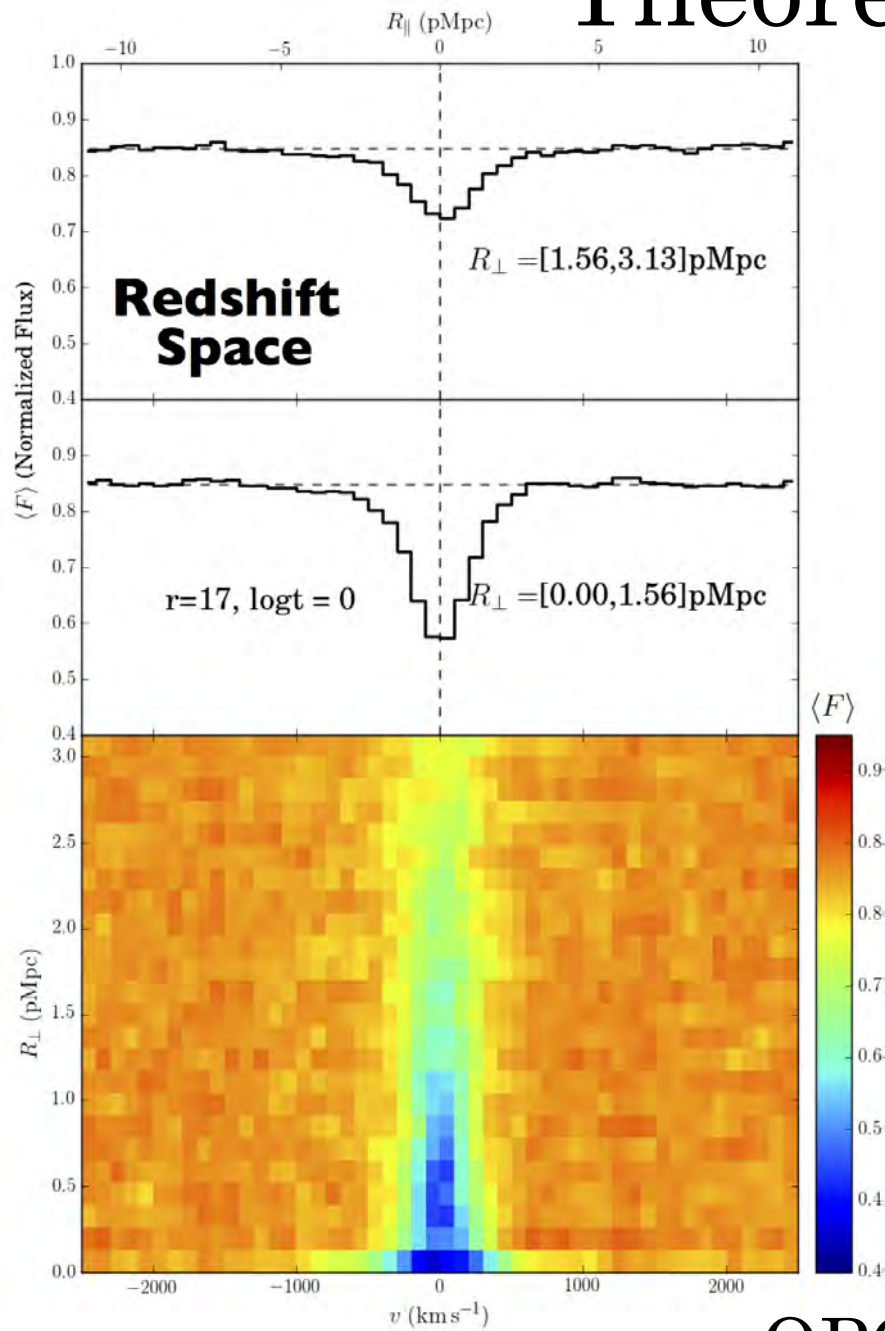
QPP6

Theoretical TPE



QPQ-TPE

Theoretical TPE



QPQ-TPE

Summary – PFS and the Extended CGM

1. How does the CGM trace Dark Matter Halo Mass?

- ◆ Analyze LAEs, faint AGN, sub-mm galaxies

2. How is the CGM influencing (or influenced by) its extended environment?

- ◆ Extend analysis to voids and protoclusters at $z \sim 2$

3. Is optically thick gas preferentially surrounding massive galaxies?

- ◆ Cross-correlate LLS with themselves, LBGs

4. Is there a Transverse Proximity Effect (TPE)?

- ◆ Probe wide range of AGN