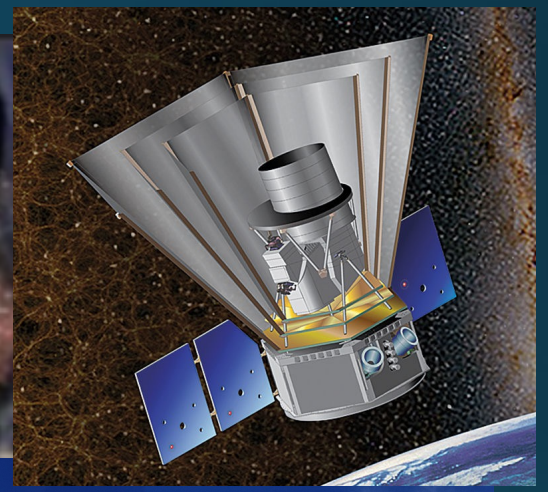
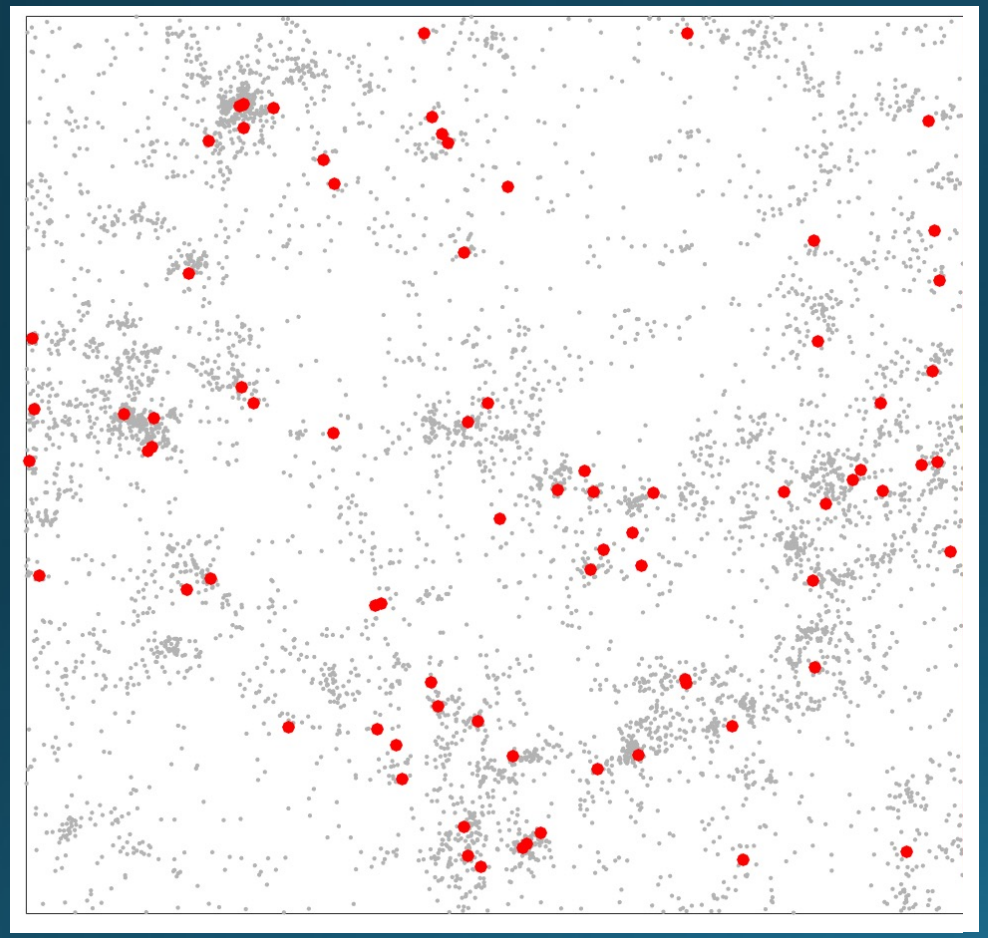
Line Intensity Mapping at Reionization

Patrick C. Breysse (NYU)

CMB-S4 2021 Summer Collaboration Meeting



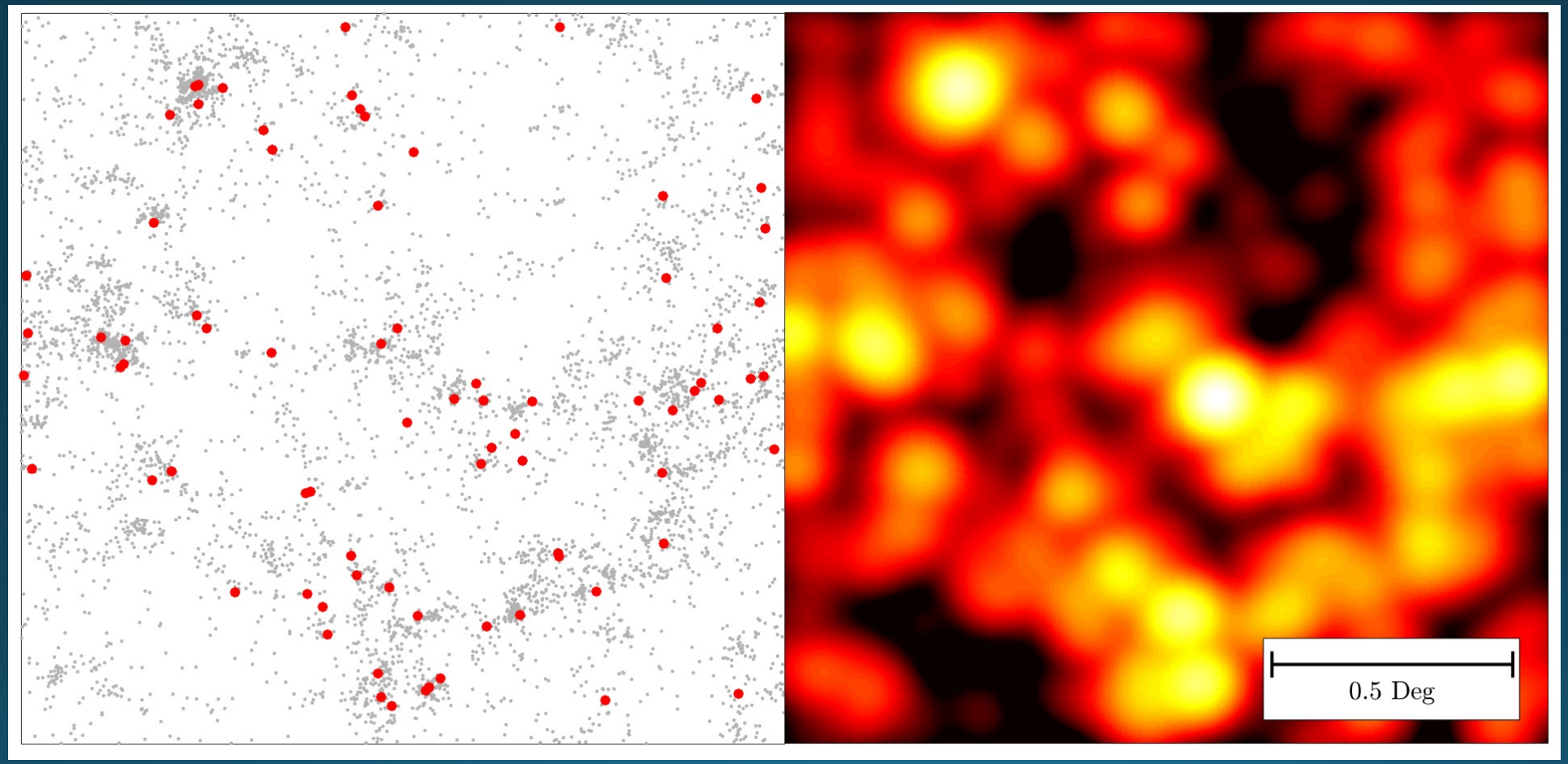
Line Intensity Mapping



Faint Galaxies Bright Galaxies

- Consider a blind spectroscopic survey of line emitters
- Example- CO(1-0) at z~3 over 2.5 deg^2 with VLA
- With ~4500 hours, can detect red points (<1% of all sources)

Line Intensity Mapping



Faint Galaxies Bright Galaxies Line Emission

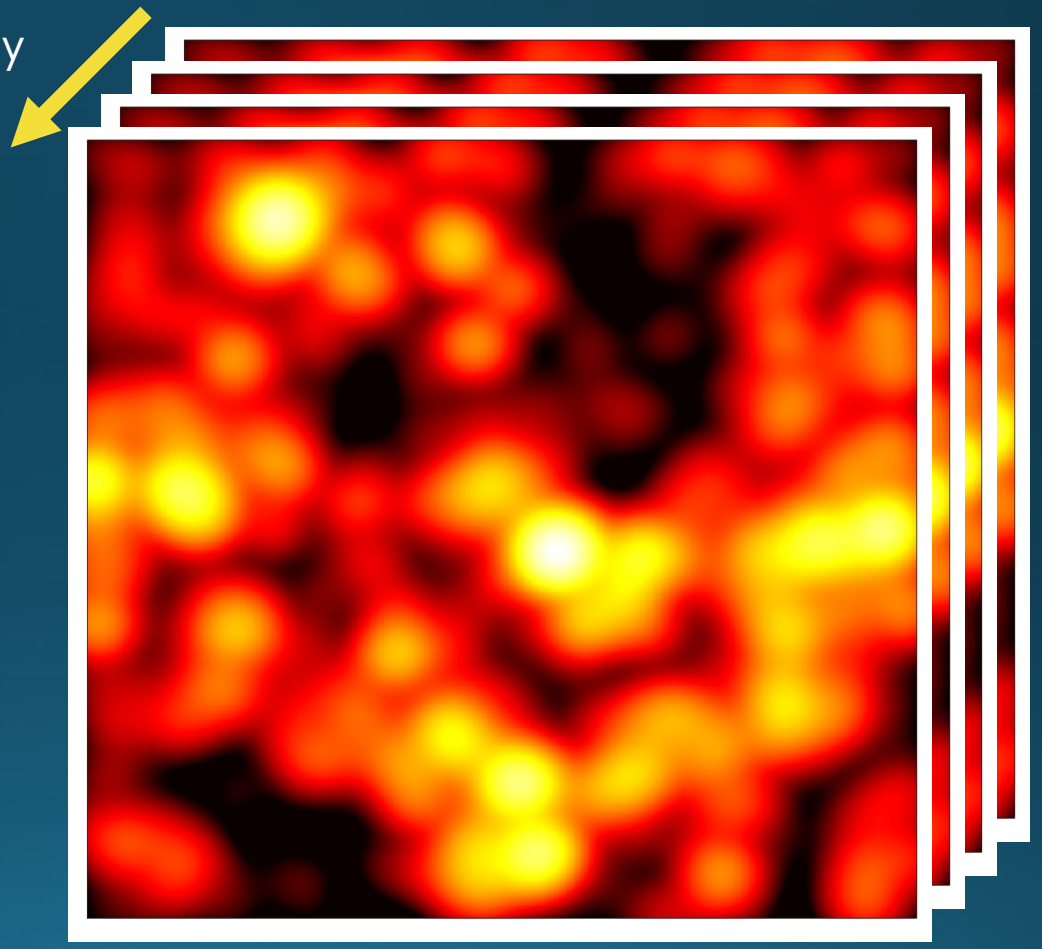
Line Intensity Mapping

Observing Frequency

↕

Redshift

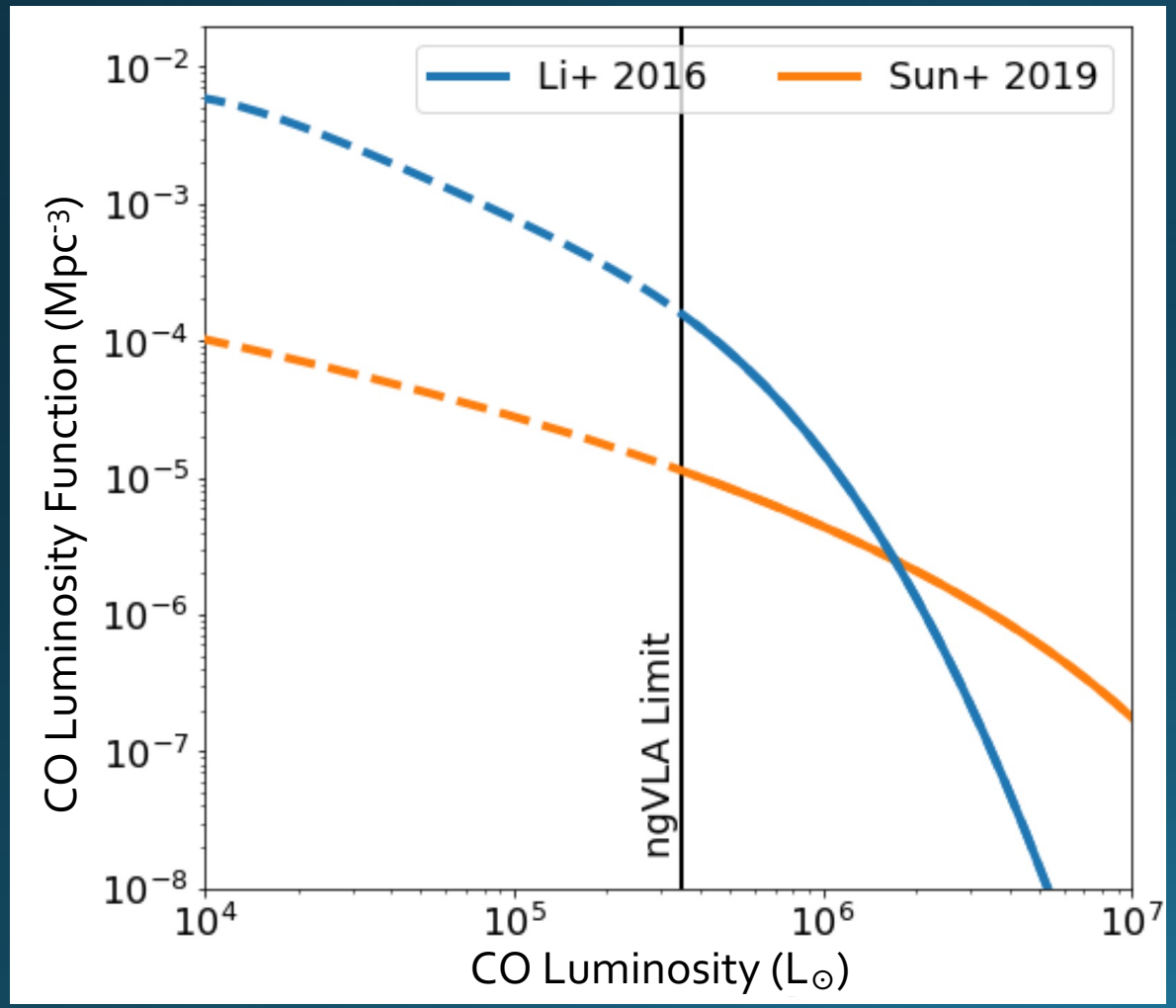
Can make 3D measurements by observing at many, closely-spaced frequencies

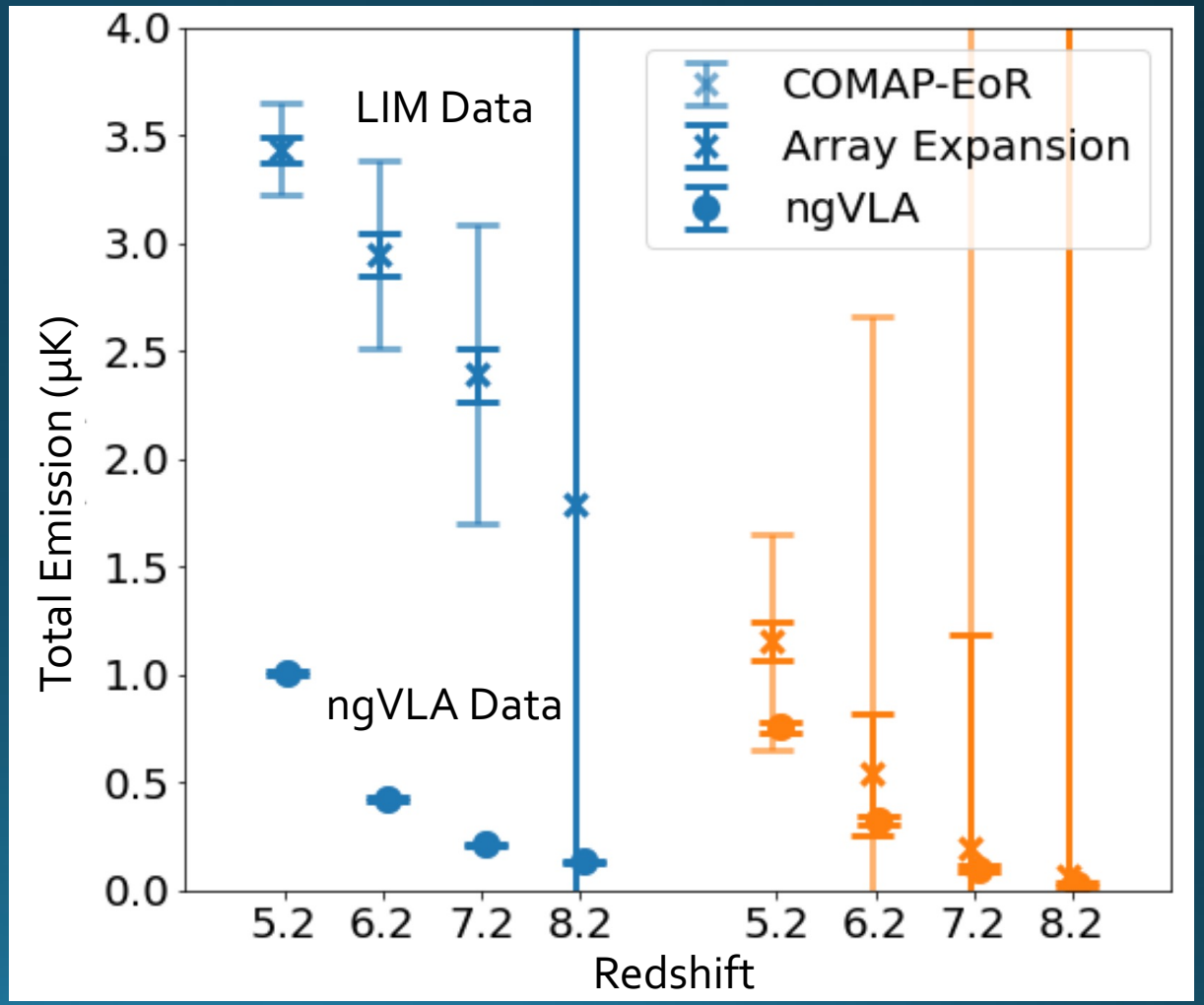


Galaxy surveys give detailed properties of brightest galaxies

Intensity maps give statistical properties of all galaxies

Faint Galaxies at EoR



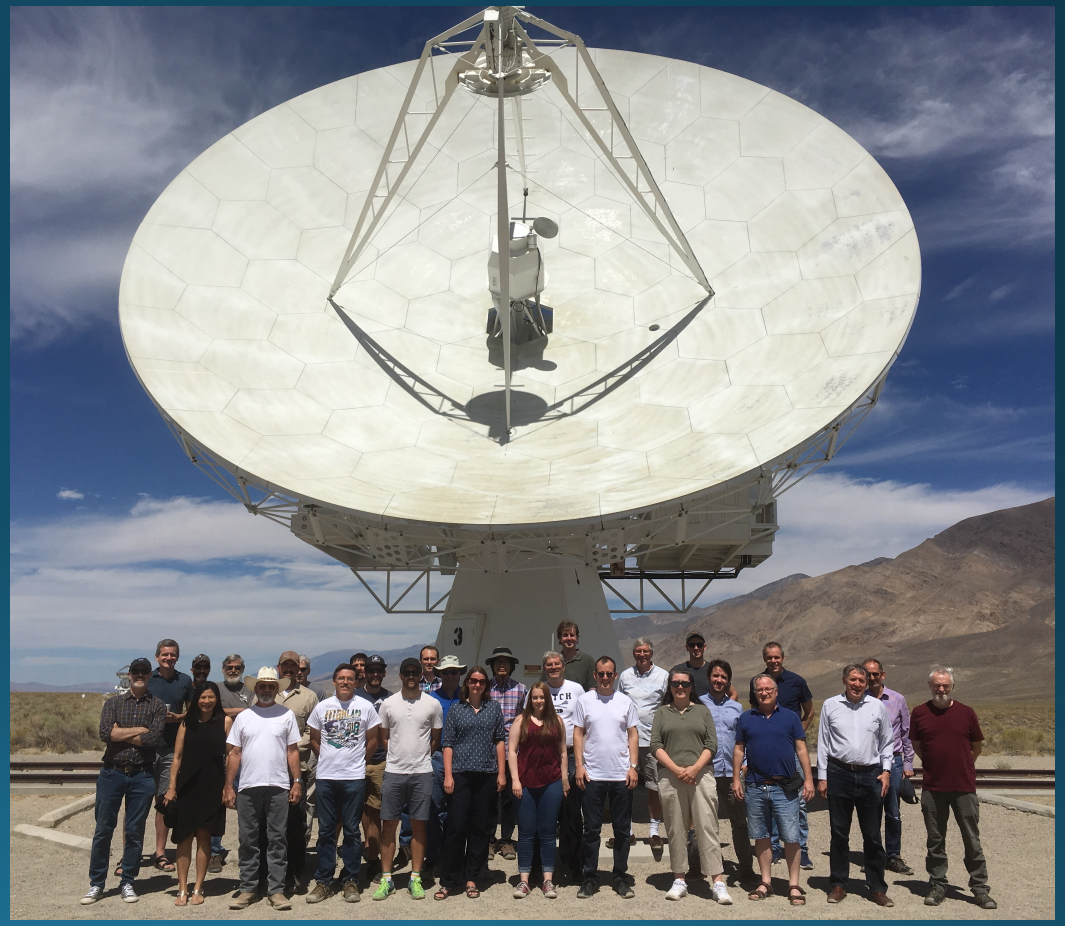


LIM Experiments at EoR

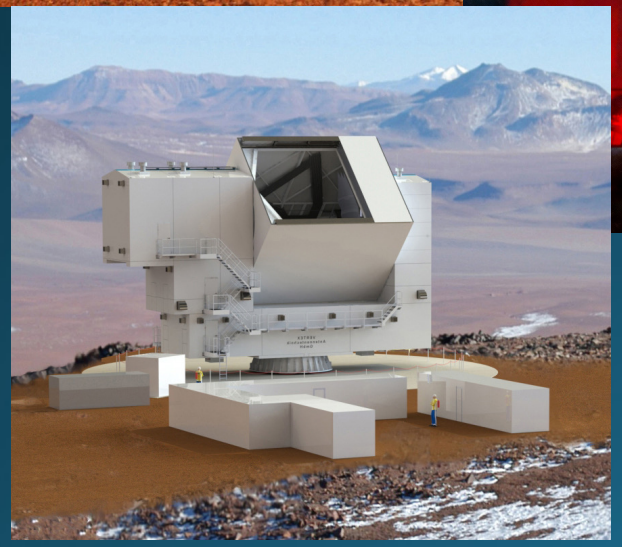
CO Intensity Mapping

Carbon Monoxide Mapping Array Project (COMAP)

- Currently mapping CO at z~3
- Partially funded extension to z~7 upcoming
- Maps molecular gas, star formation



CII Intensity Mapping



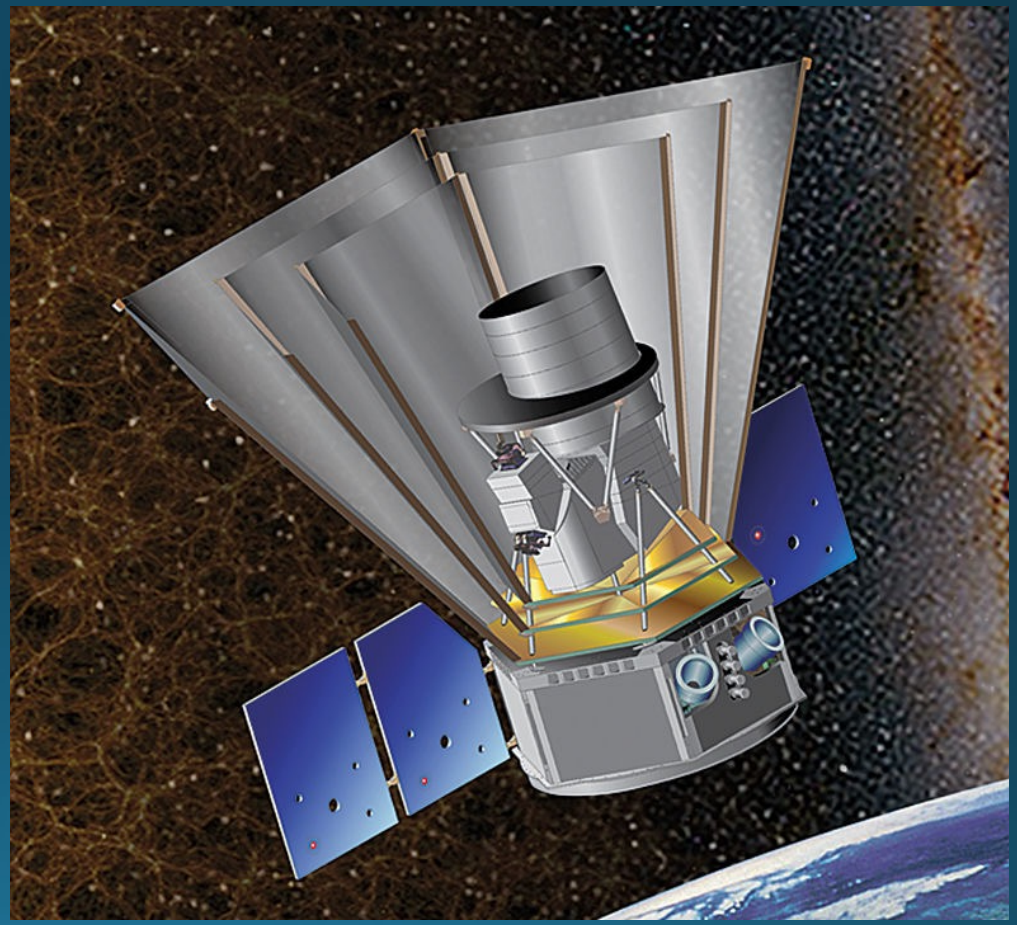
CONCERTO, TIME, and FYST

- All targeting CII 158 μm at z~7
- Widely different spectrograph technologies
- Brighter than CO, but has several foreground lines

Lyman-α Intensity Mapping

SPHEREx midEx Mission

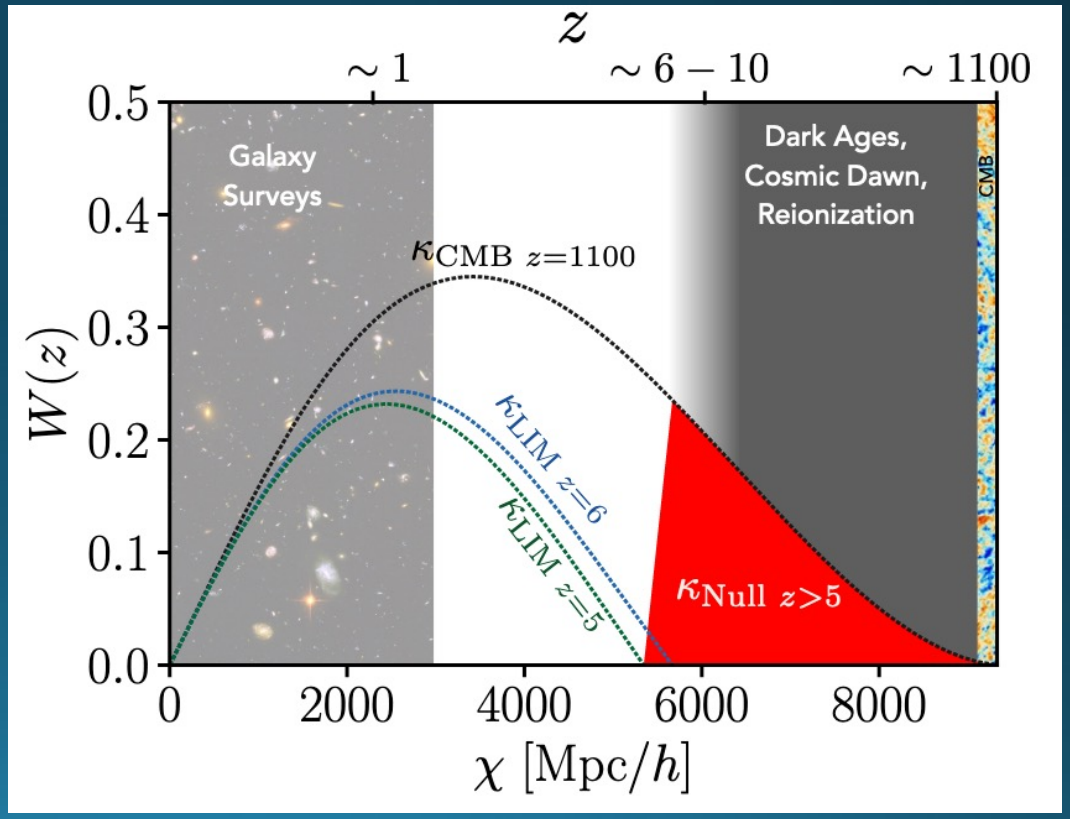
- IR spectrum at every point on the sky, deep fields at poles well-suited for LIM
- Accesses several different lines, inc. EoR-era Lyα



Modeling Limitations

Huge need for theory/modeling effort to understand cross-experiment synergies!

- Example- Dark ages lensing with LIMxCMB
  - Maniyar+ 2021, arXiv:2106.09005
- What other synergies are there?
  - CIB? kSZ? 21cm? ???



Lots of intensity mapping
data are coming soon!