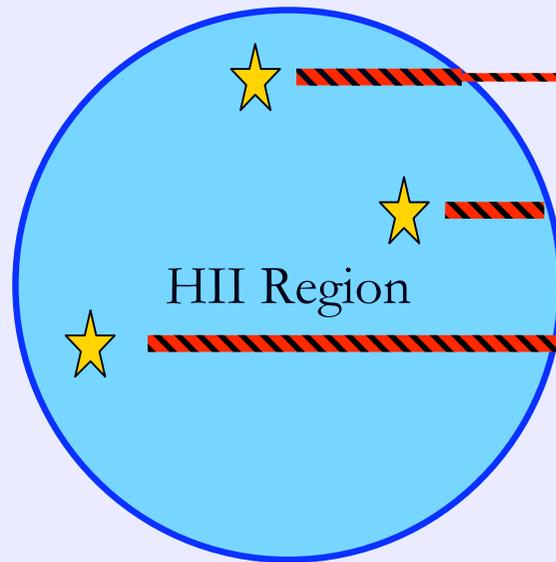


Studying Reionization with Ly α Emitters

Matt McQuinn

Lars Hernquist, Matias Zaldarriaga,
Suvendra Dutta

A neutral IGM attenuates Ly α line from galaxies



Your Telescope

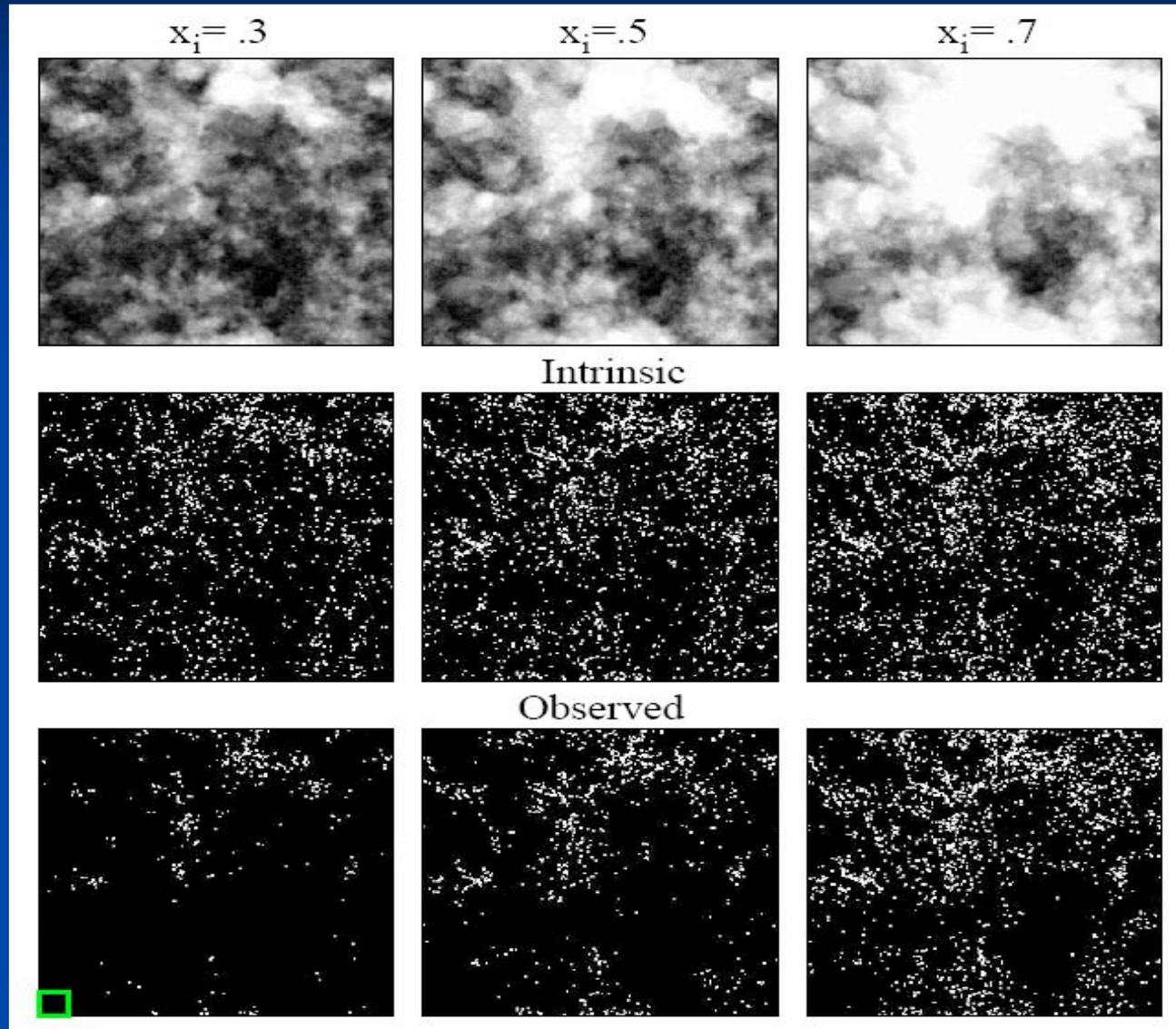
Neutral IGM



Size of HII region has to be $> \sim 1$ proper Mpc for emitter to be observed.

Miralda-Escude (1998)

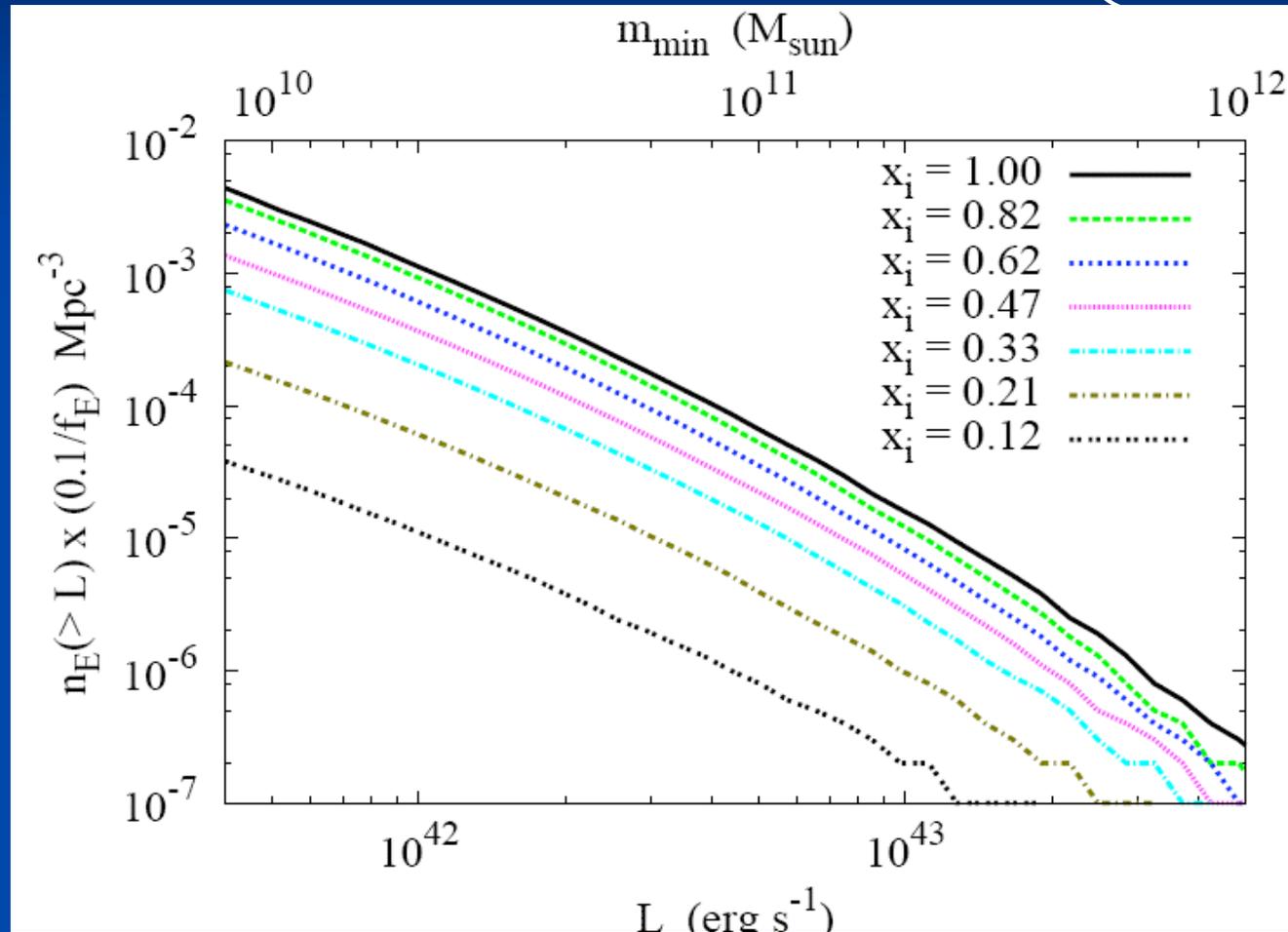
What does LAE field look like?



Each panel is $\sim .5$ deg. across with width 40 Mpc (same size as Subaru DF)

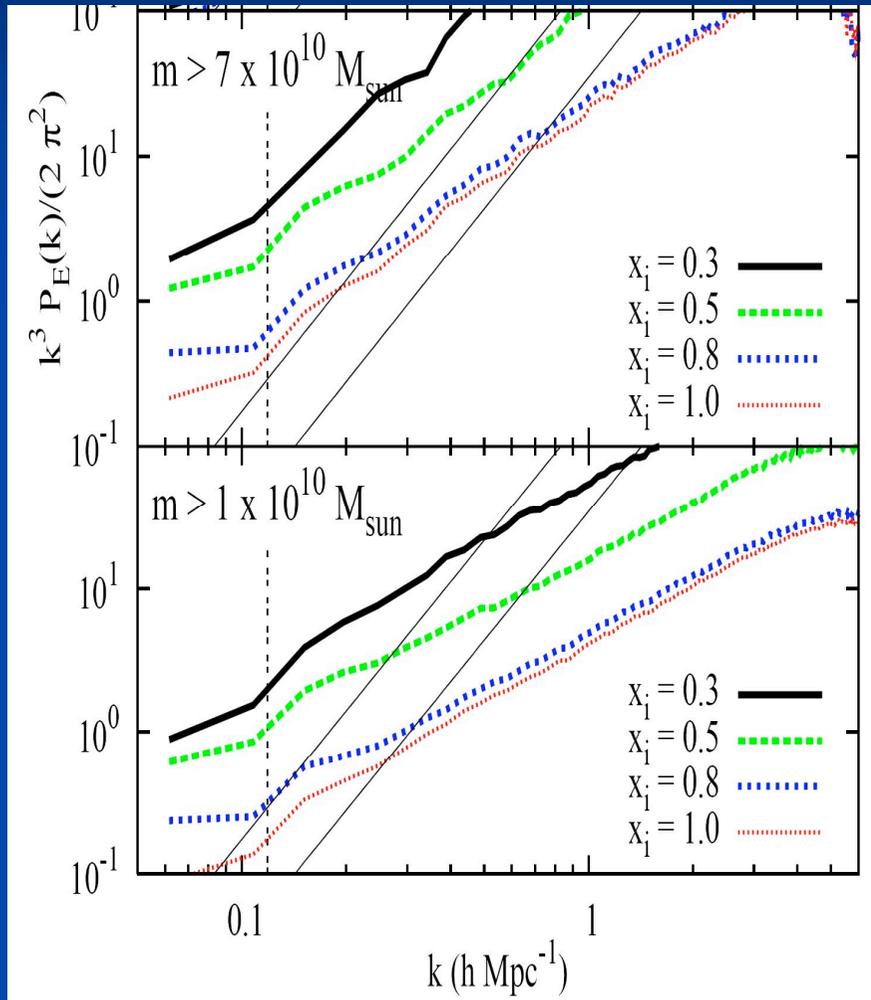
Effect on Luminosity Function

McQuinn et al (2007)



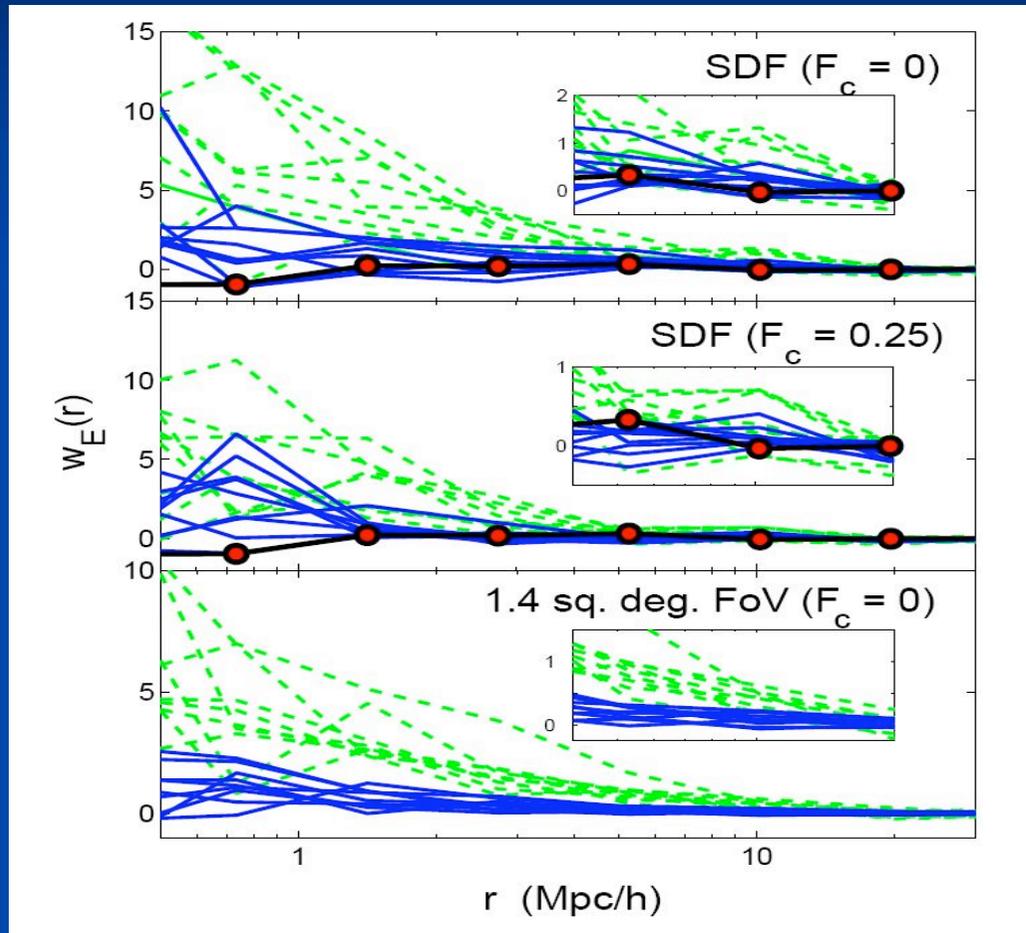
Interestingly, a sharp decrease in the amplitude of the luminosity function is observed between $z = 5.7$ and $z = 6.6$ in the Subaru Deep Field (Kashikawa et al, '06).

Clustering of Emitters



- For $x_i < .5$, increase in power during reionization is much larger than increase realistically achieved from changing unknown bias of LAEs
- SDF $z = 6.6$ LAE survey is sensitive to bubble-induced clustering

Constraints from $z = 6.6$ Subaru Deep Field (SDF)



58 emitters in survey
with size of SDF,
0 of which are
foreground galaxies

58 emitters in survey
with size of SDF,
14 of which are
foreground galaxies

250 emitters, 0
foreground galaxies

We find that the $z = 6.6$ SDF favors models with $x_i \sim 1$ to models with $x_i < .5$ at 2σ confidence level.

Final Points/Conclusions

- Reionization results in large HII regions such that emitters can be observed even when the Universe is mostly neutral
- Rapid increase with redshift in clustering at > 10 Mpc would be strong evidence for reionization
- Clustering increase can be much larger than can be accomplished with intrinsic evolution in the properties of Ly α emitters
- Comparing emitter field with galaxy survey with other selection criteria would confirm whether increased clustering is due to reionization
- Current SDF observations already place constraints on reionization at $z = 6.6$, and Subaru narrow-band observations in 2007 both increase the survey volume at $z = 6.6$ by a factor of 5 as well as increase the sample of emitters at higher redshifts