

# Molecules in “DLAs”



Marcel Neeleman  
(IMPS; UCSD)

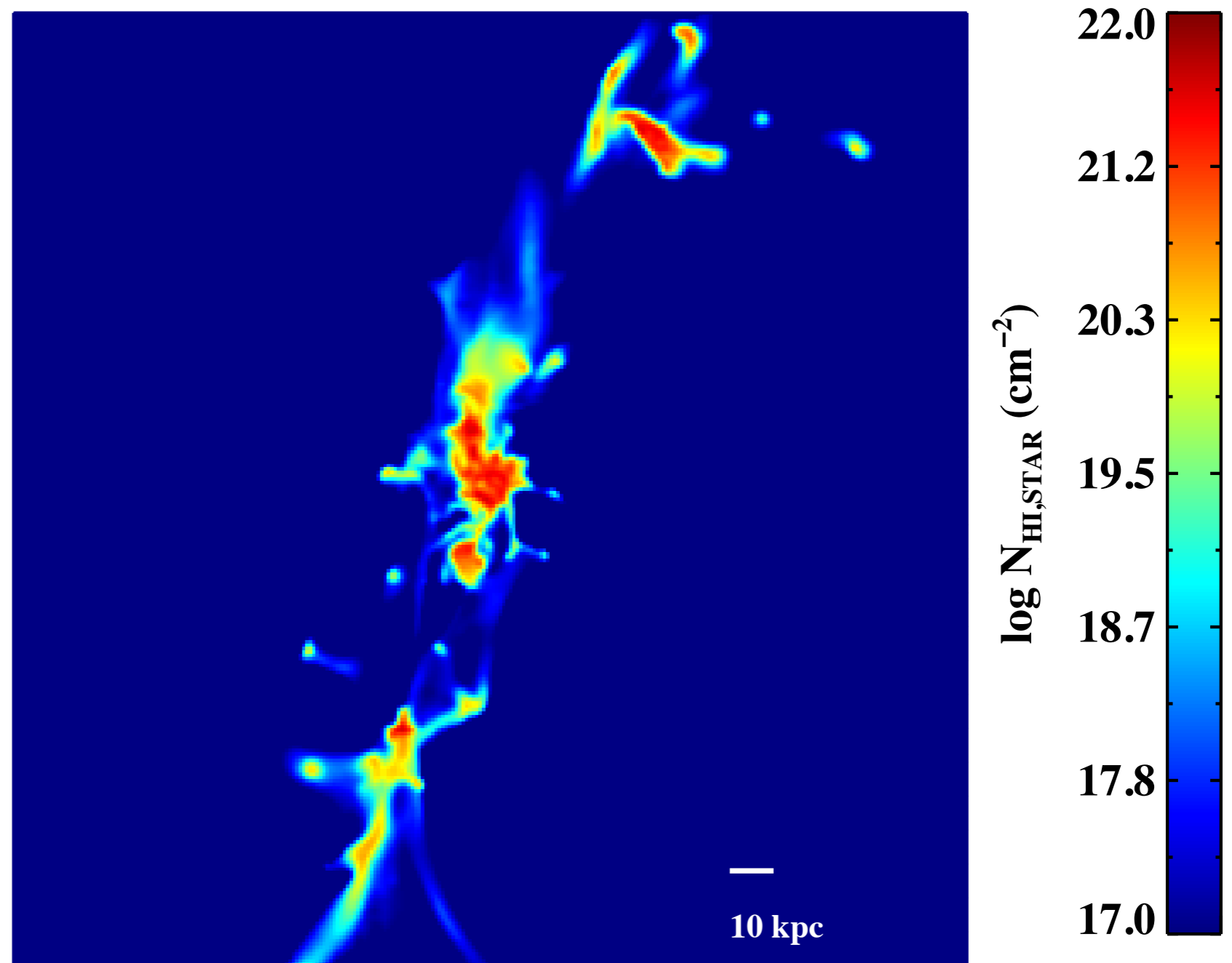
JXP, N. Kanekar, M. Zwaan, P. Moller, T. Zafar,  
J. Fynbo, L. Christensen, E. van Kampen

# DLA ~~IGM~~ / Galaxy Connection

# DLA ~~IGM~~ / Galaxy Connection

Fumagalli+11

see also Rahmati+14,  
Bird+14, etc.



DLAs trace HI gas the ISM of galaxies  
and the surrounding region

# Imaging DLAs (or not)

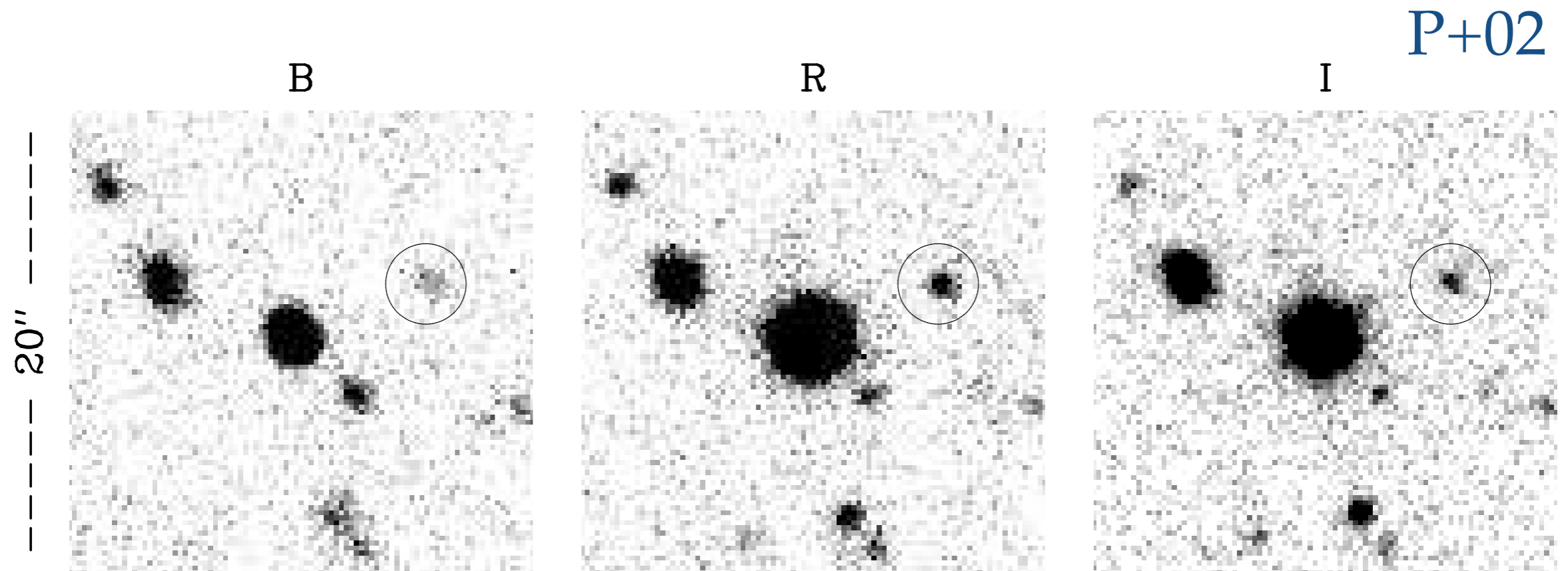
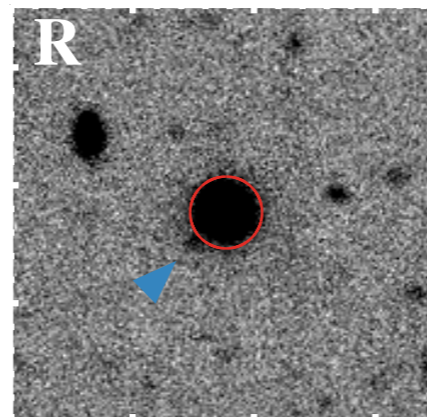
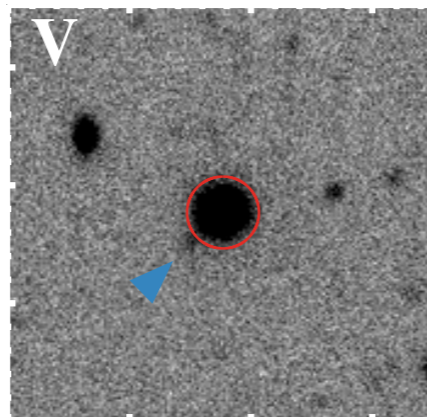
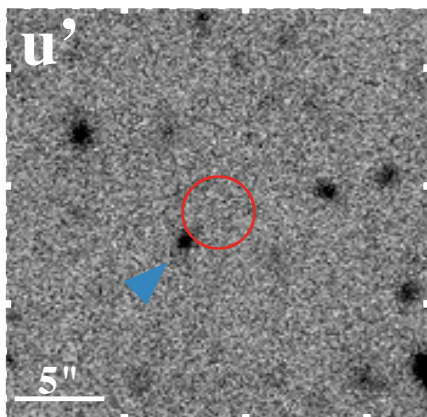
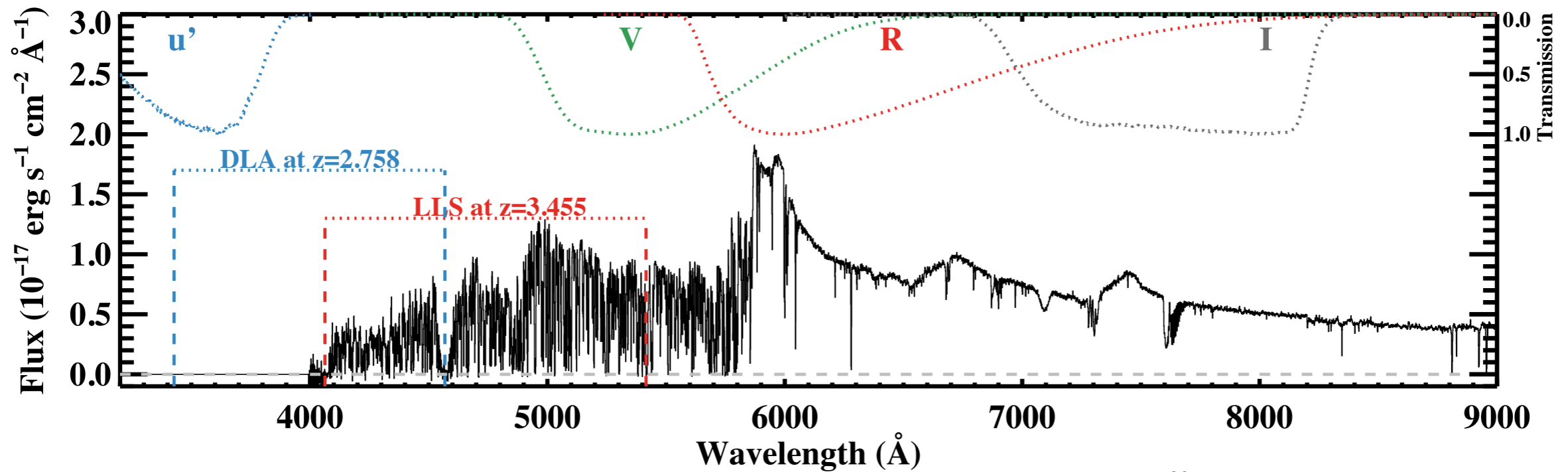
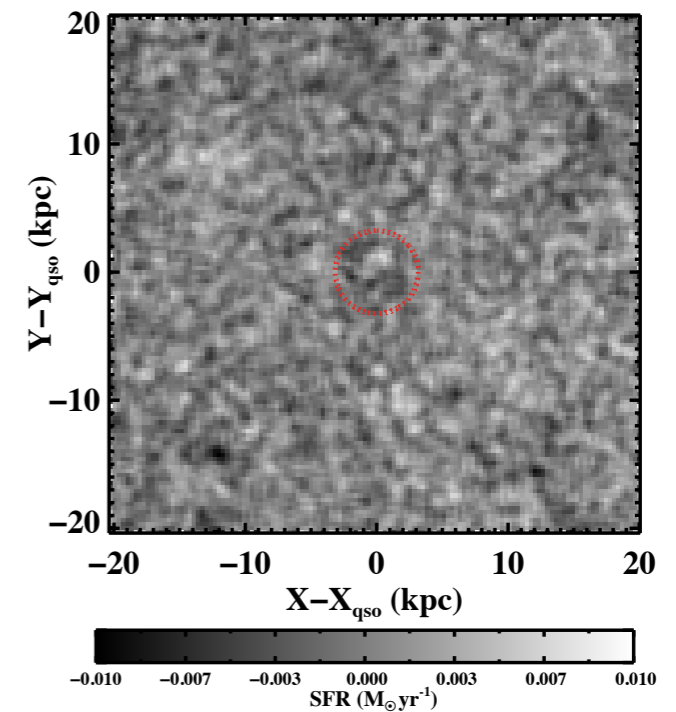


FIG. 7.— Close-up *BRI* images ( $20'' \times 20''$ ) centered on the quasar PSS0132+13. The object identified to the right of the quasar is the only significant *B*-band dropout in this region and has a photometric redshift  $z_{phot} = 3.6$ .

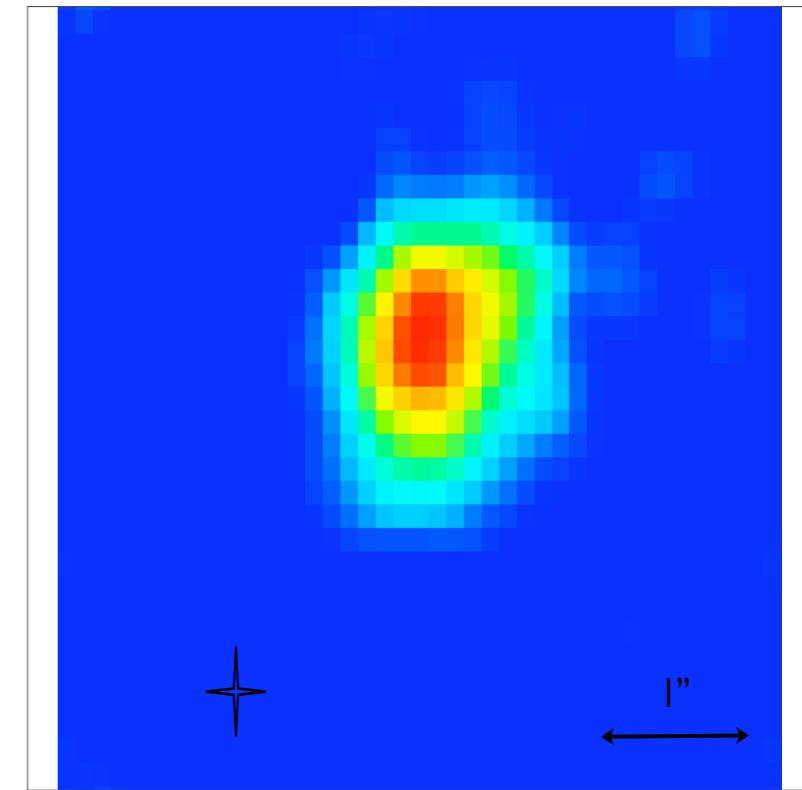
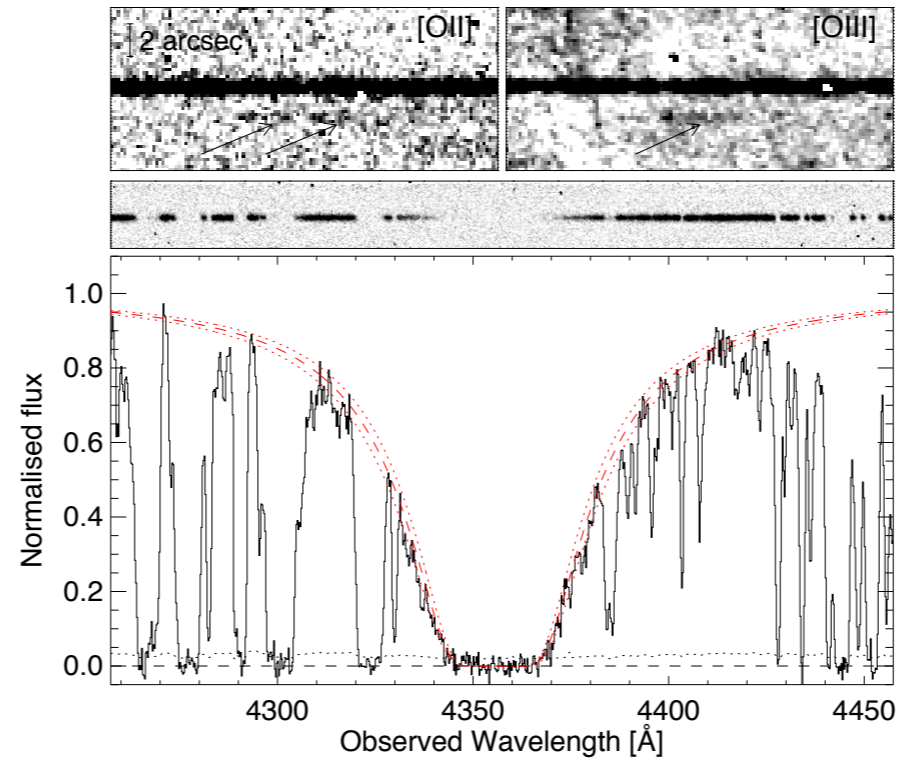
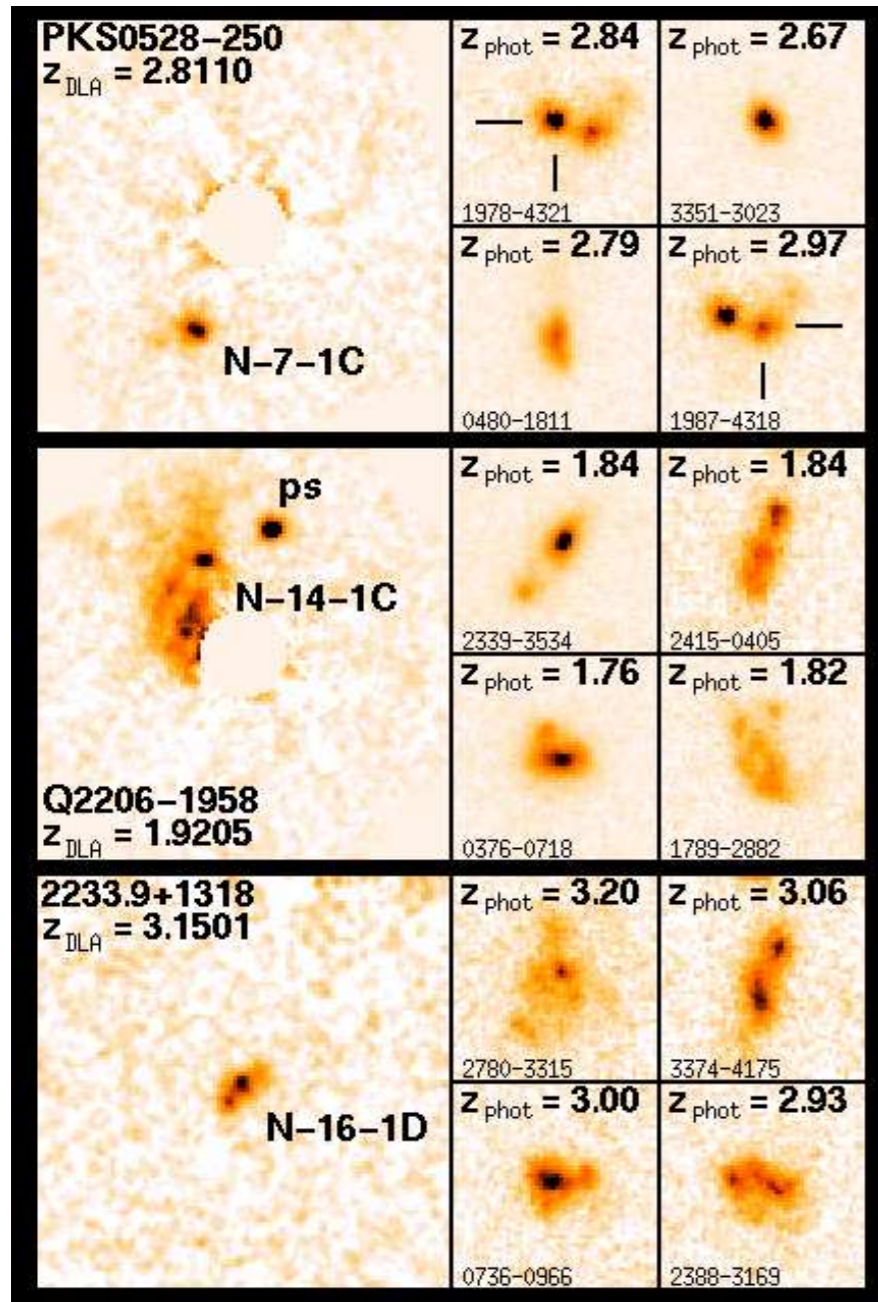
# Imaging DLAs (or not)



Fumagalli+14wx



# Imaging DLAs (successes)



## Higher metallicity DLAs

Moller+02

Fynbo+11

Peroux+12

# What is the path forward? (to maximize detections)

High Metallicity

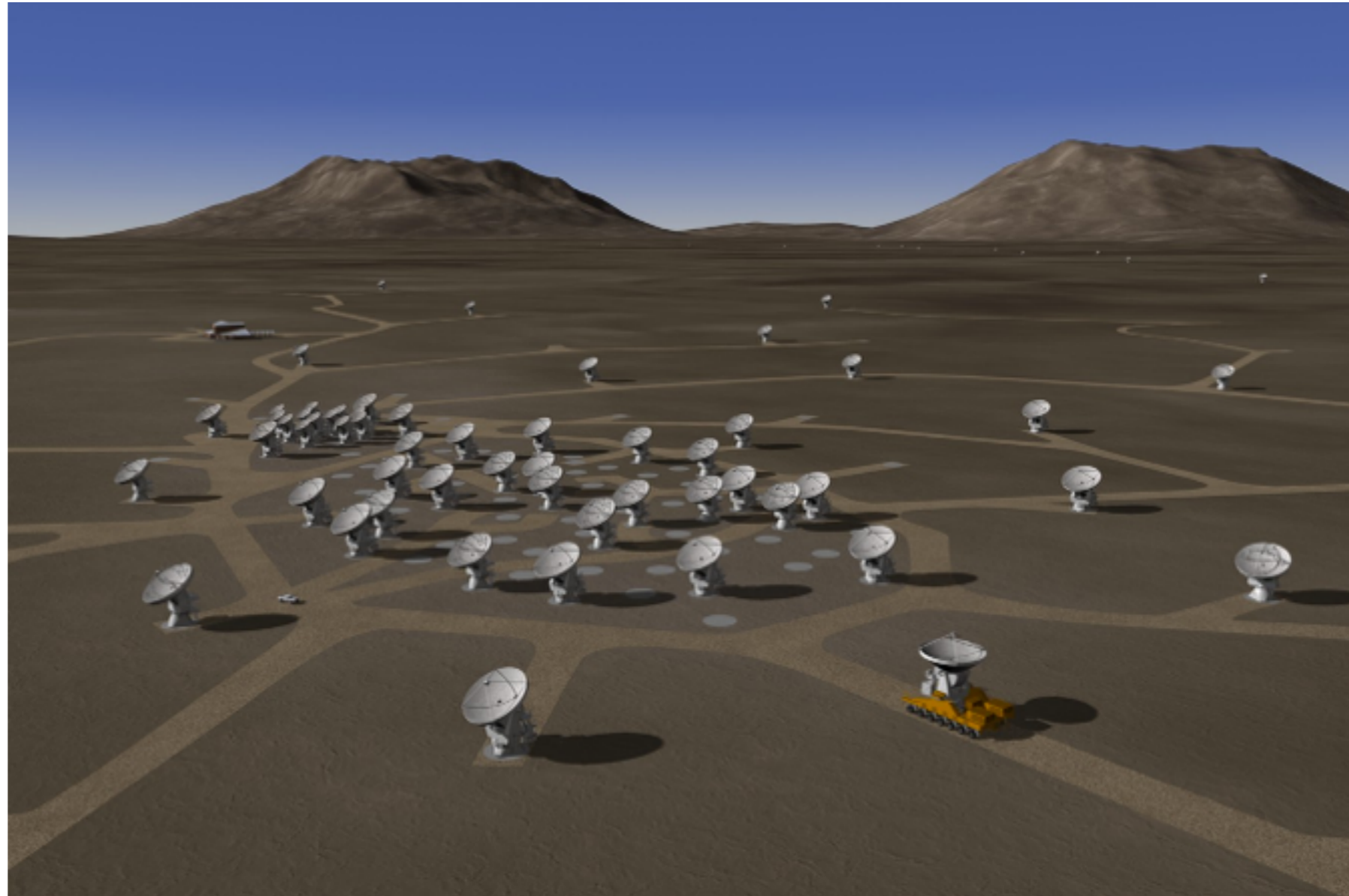
Lower  $z$

Line Emission

New Tool


# What is the path forward? (to maximize detections)

High Metallicity  
Lower  $z$   
Line Emission  
New Tool



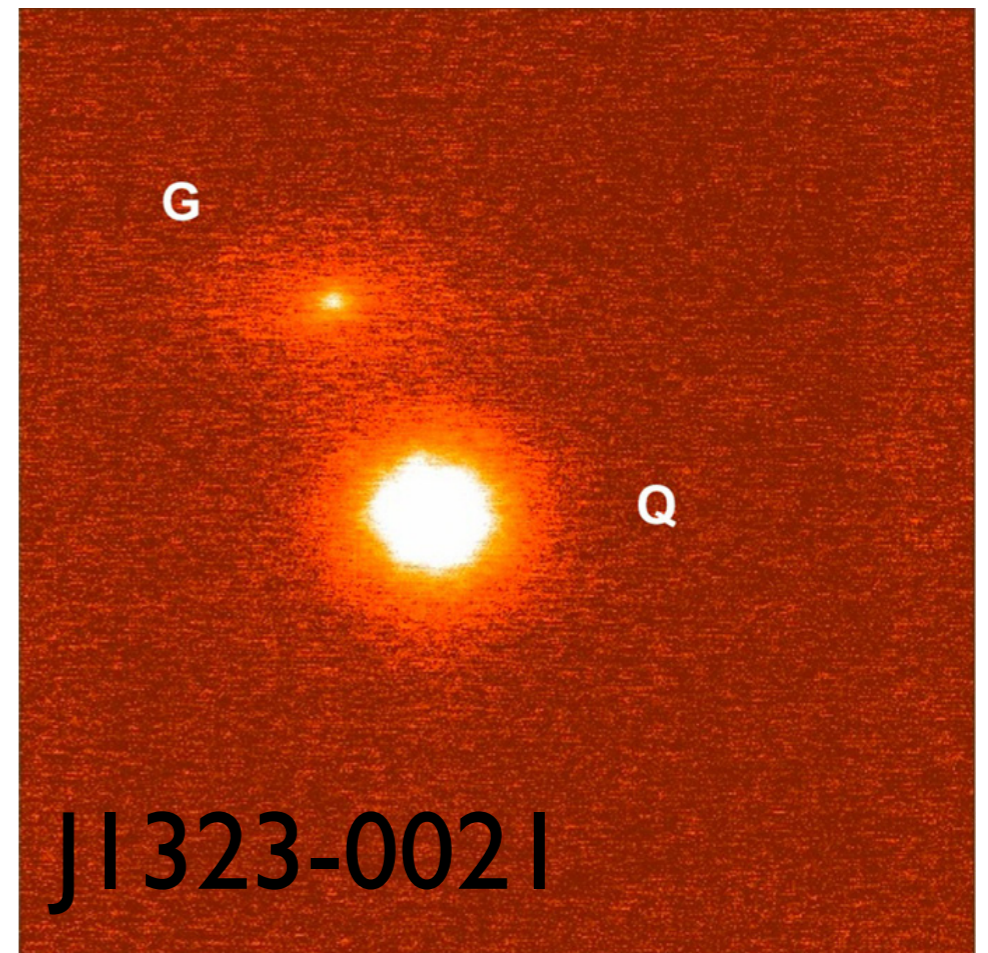
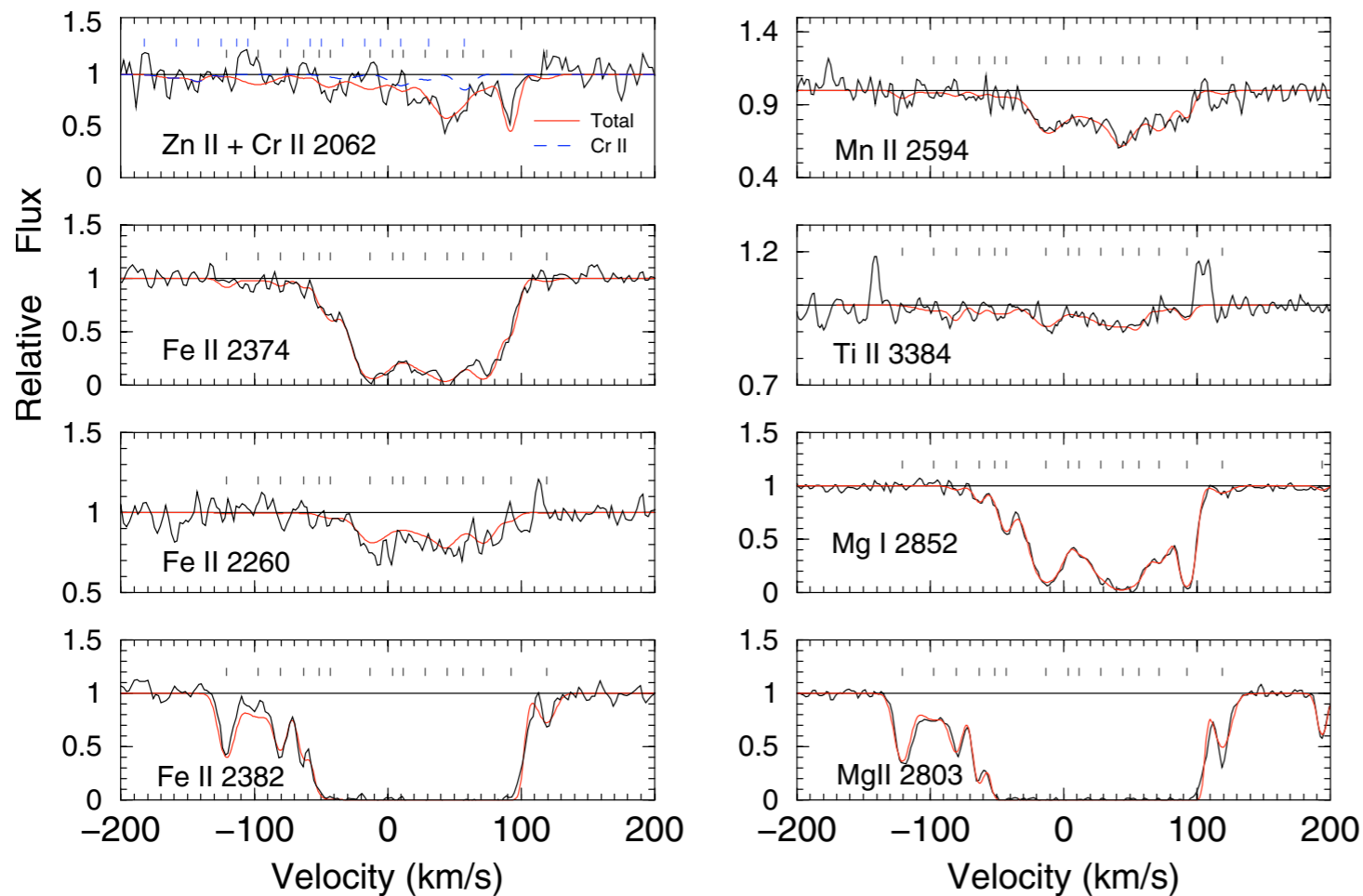


# ALMA: Cycle 2

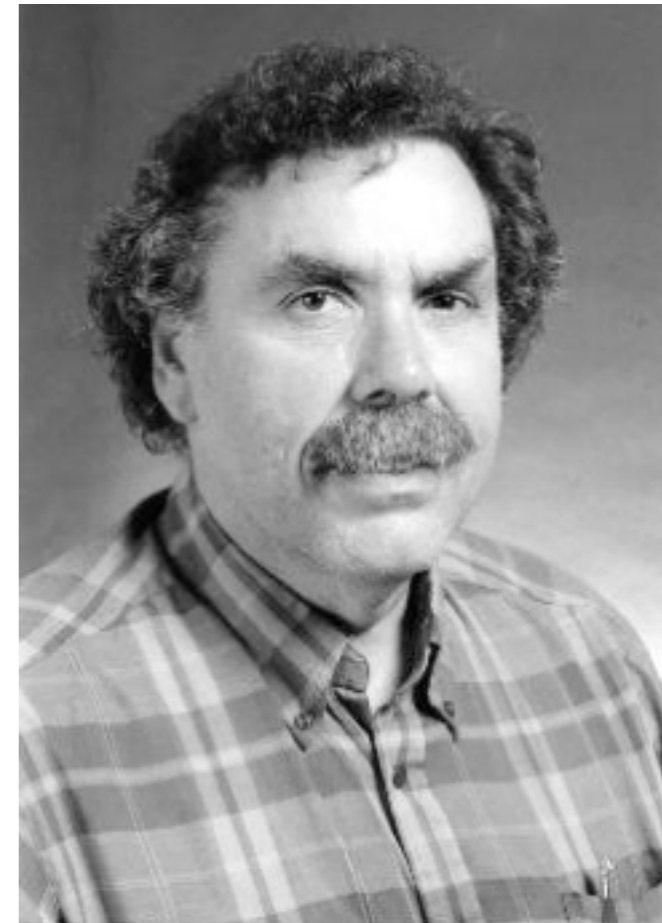
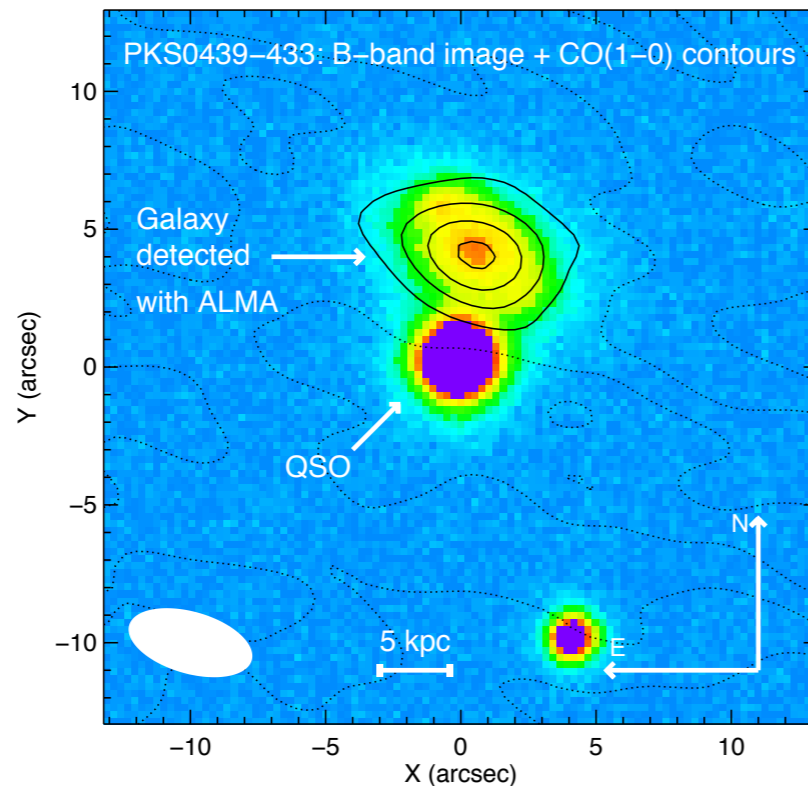
	<b>JASON PROCHASKA</b>	<b>2013.1.01178.S</b>
---	------------------------	-----------------------

<b>PROJECT TITLE:</b>	Uncovering the gas reservoirs of absorption-selected galaxies				
<b>PRINCIPAL INVESTIGATOR NAME:</b>	<b>Jason Prochaska</b>	<b>PROJECT CODE:</b>	<b>2013.1.01178.S</b>		
<b>SCIENCE CATEGORY:</b>	Cosmology and the High Redshift Universe	<b>ESTIMATED 12M TIME:</b>	4.2 h	<b>ESTIMATED ACA TIME:</b>	0.0 h
<b>CO-PI NAME(S): (Large Proposals only)</b>					
<b>CO-INVESTIGATOR</b>	Nissim Kanekar; <a href="#">Martin Zwaan</a> ; Palle Moller; tayyaba Zafar; Miroslava Dessauges-Zavadsky; Johan Fynbo; Lise Christensen; <a href="#">Marcel Neeleman</a> ; Eelco van Kampen				

Observe four “DLAs” at  $z < 1$  with CO (1-0)



# ALMA: Future is Bright



- Cycle 2: [CII] 158 micron in DLAs
- Cycle 3: CO mapping (spatial)
- Cycle 3: Additional CO surveying
- Cycle X: [CII] 158 at high sensitivity

