

MALS-SUGAR: large survey to discover high- z quasars for MALS

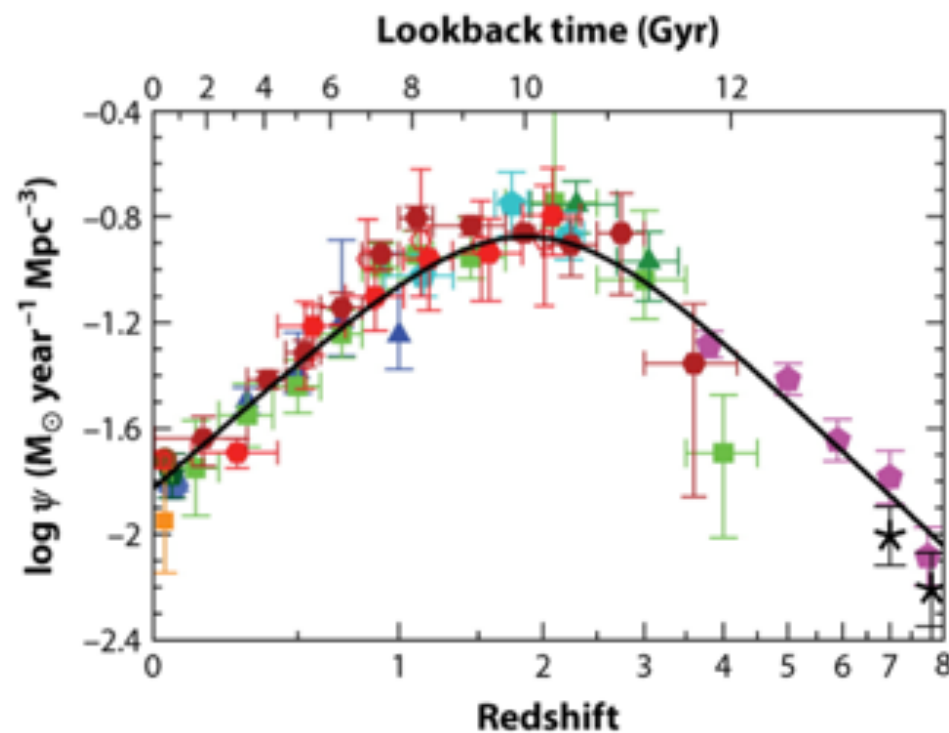
Neeraj Gupta (IUCAA)

<http://mals.iucaa.in/>

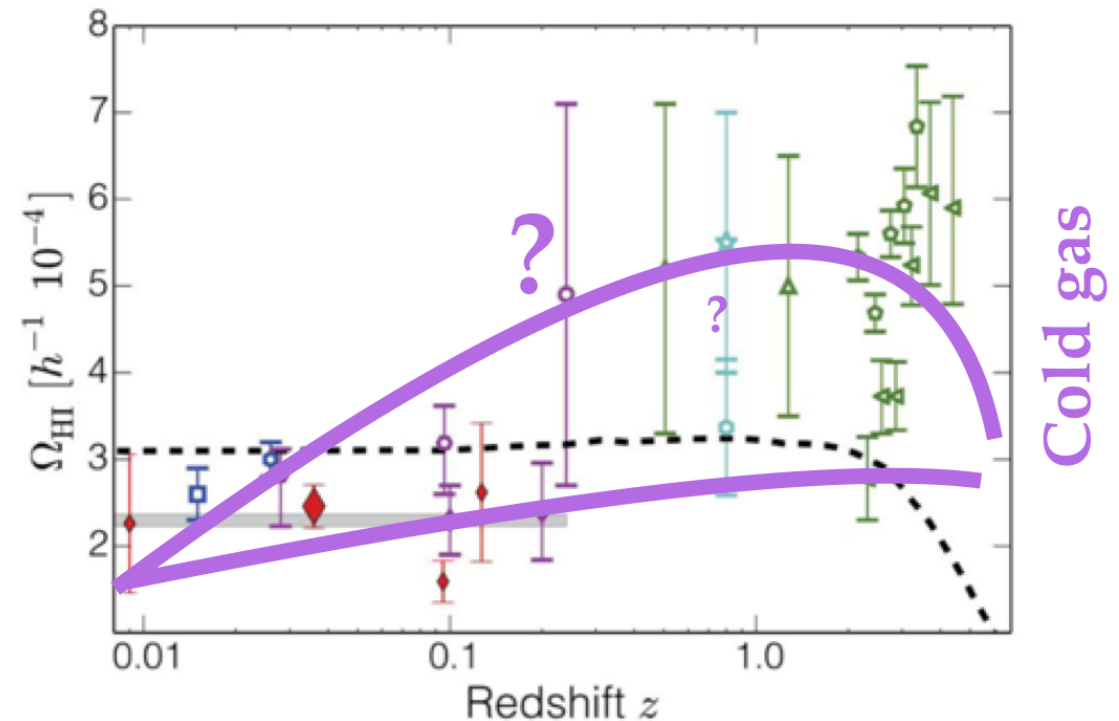


The MeerKAT Absorption Line Survey (MALS)

1655 hrs for the sensitive search of HI 21-cm and OH 18-cm absorption lines to map the evolution of cold atomic and molecular gas in galaxies at $0 < z < 2$: the redshift range where most of the evolution in the star-formation rate density takes place.



← MALS →



The MeerKAT Absorption Line Survey (MALS)

MALS phase	Number of pointings	Time per pointing (mins)	Spectral rms [†] (mJy beam ⁻¹)	Continuum rms (μJy beam ⁻¹)	Total on-source time (hrs)
L-band (900-1670 MHz)	740	56	0.5	3	691
UHF-band (580-1015 MHz)	370	121	0.6	3	746

[†] 900-1670 MHz; [‡] 580-1015 MHz.

Estimated at ~1200 MHz and ~800 MHz for the full band split into 32768 channels.

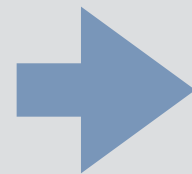


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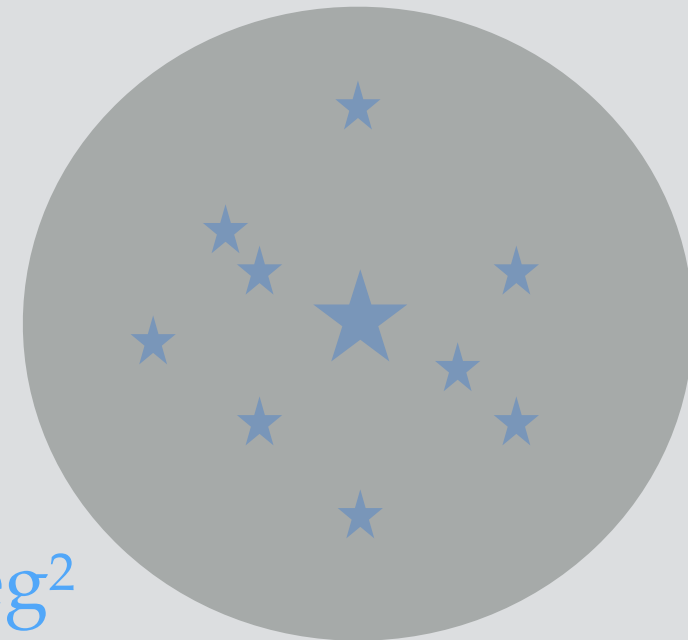
Main science themes:

- ◆ Evolution of cold gas in galaxies and its relationship with SFR density (**~200 detections**),
- ◆ Fuelling of AGN, AGN feedback and determining fraction of dust-obscured AGNs (**~500 detections**),
- ◆ Variation of fundamental constants of physics: most stringent constraints (comparable to terrestrial atomic clocks).

Each pointing will be
centered on a >400 mJy
radio source.



L-band: 1 deg^2



Equivalent detection probability for on-axis and off-axis targets
Dust-unbiased view of cold gas evolution



Discussion: Surveys

Table 1: Summary of various upcoming H I 21-cm absorption line surveys

Survey	Frequency coverage	Redshift range	Time per pointing	Spectral rms per $\sim 5 \text{ km s}^{-1}$	Sky coverage	Total time	No. of sight lines [‡]
	(MHz)	(H I 21-cm)	(hrs)	(mJy/b) [†]	(deg ²)	(hrs)	
Apertif	1130 - 1430	0 - 0.26	12	1.3	4000	6000	25000
SHARP							(>30 mJy)
ASKAP	700 - 1000	0.5 - 1.02	2	3.8	25000	1600	65000
FLASH							(>90 mJy)
ASKAP	1130 - 1430	0 - 0.26	8	1.6	30000	8000	132000
WALLABY							(>40 mJy)
MALS	900 - 1670	0 - 0.57	1	0.5	1000	691	12000
L-band							(>15 mJy)
MALS	580 - 1015	0.4 - 1.44	2	0.6	700	746	12000
UHF-band							(>15 mJy)

[†] Estimated at the center of the band; [‡] See text for details.



The MeerKAT Absorption Line Survey (MALS)

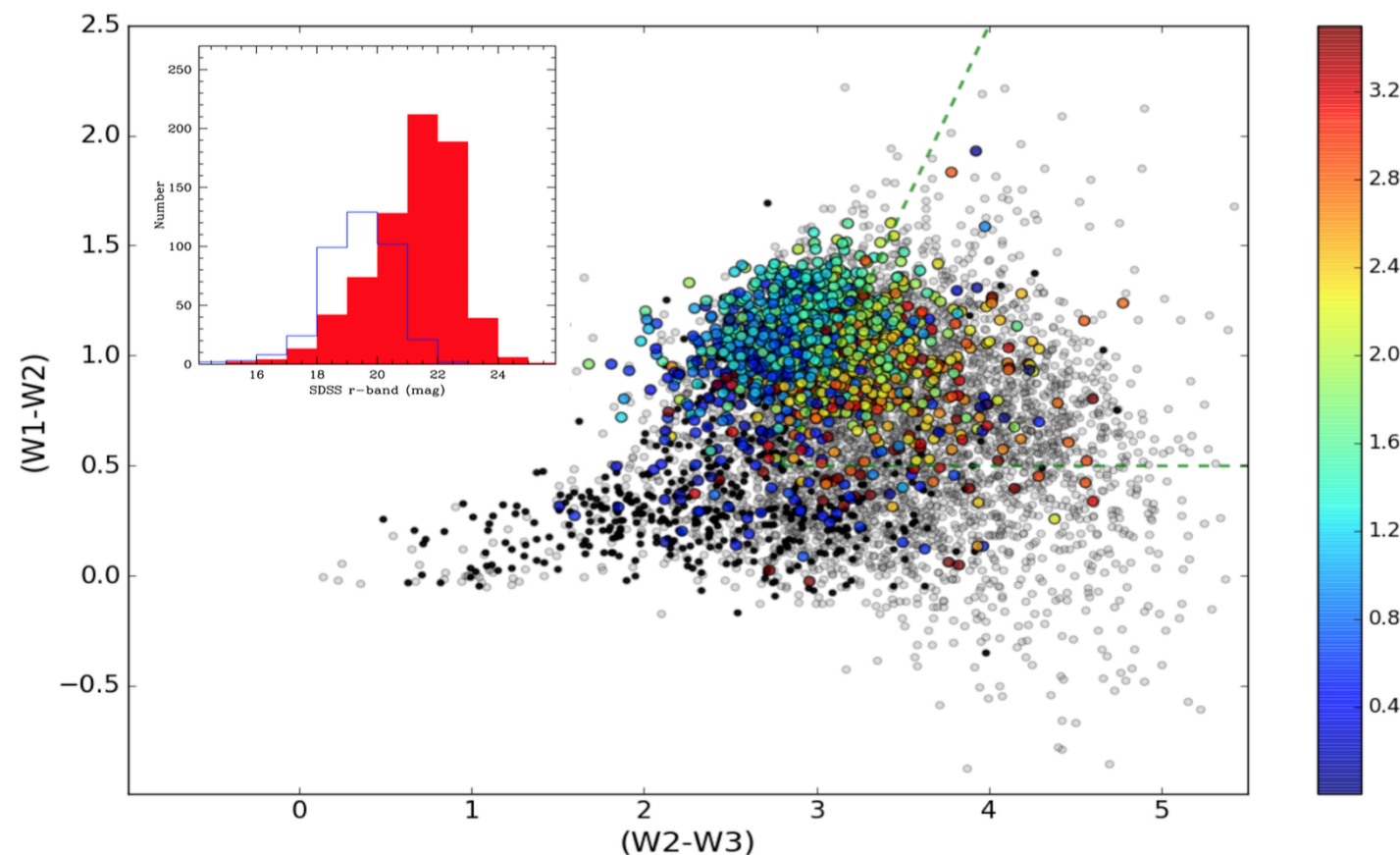
N. Gupta^{*1}, R. Srianand¹, W. Baan², A. Baker³, R. Beswick⁴, S. Bhatnagar⁵, D. Bhattacharya¹, A. Bosma⁶, C. Carilli⁵, M. Cluver⁷, F. Combes⁸, C. Cress⁹, R. Dutta¹, J. Fynbo¹⁰, G. Heald¹¹, M. Hilton¹², T. Hussain¹, M. Jarvis^{7,13}, G. Jozsa¹⁴, P. Kamphuis¹⁵, A. Kembhavi¹, J. Kerp¹⁶, H.-R. Klöckner¹⁷, J. Krogager¹⁸, V. Kulkarni¹⁹, C. Ledoux²⁰, A. Mahabal²¹, T. Mauch¹⁴, K. Moodley¹², E. Momjian⁵, R. Morganti², P. Noterdaeme¹⁸, T. Oosterloo², P. Petitjean¹⁸, A. Schröder²², P. Serra²³, J. Sievers¹², K. Spekkens²⁴, P. Väisänen²², T. van der Hulst²⁵, M. Vivek²⁶, J. Wang¹¹, O.I. Wong²⁷ and A.R. Zungu¹²

<https://arxiv.org/abs/1708.07371>



MALS: SALT/NOT = SUGAR survey

- ◆ Scarcity bright high- z quasars in the southern hemisphere
- ◆ Lack of uniform spectroscopic catalog



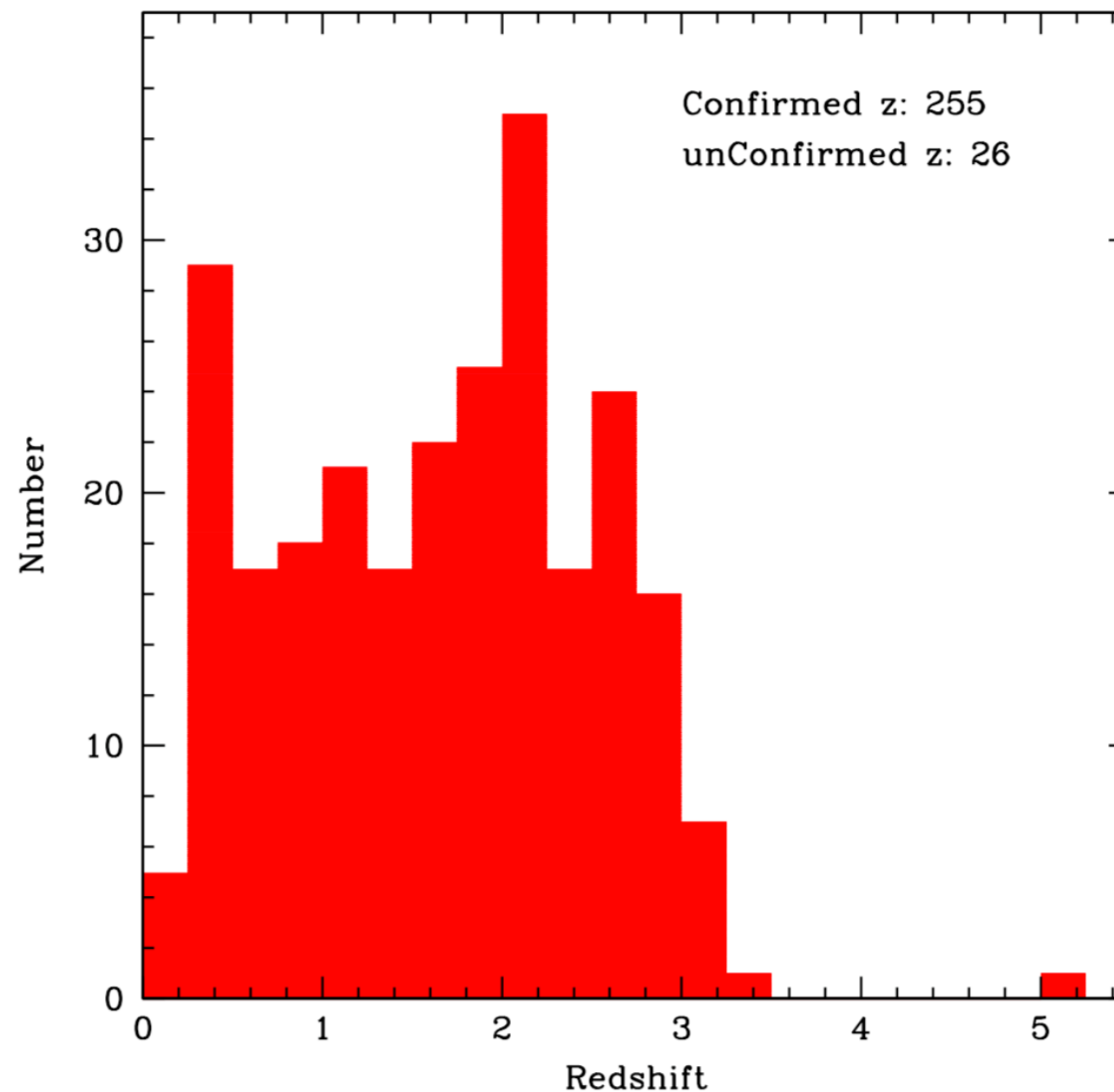
Observations of 373 targets completed

SALT: 232 (IUCAA, Rutgers and South Africa collaboration; 180 hrs)

NOT: 94 (Published as Krogager+18; 6 nights)



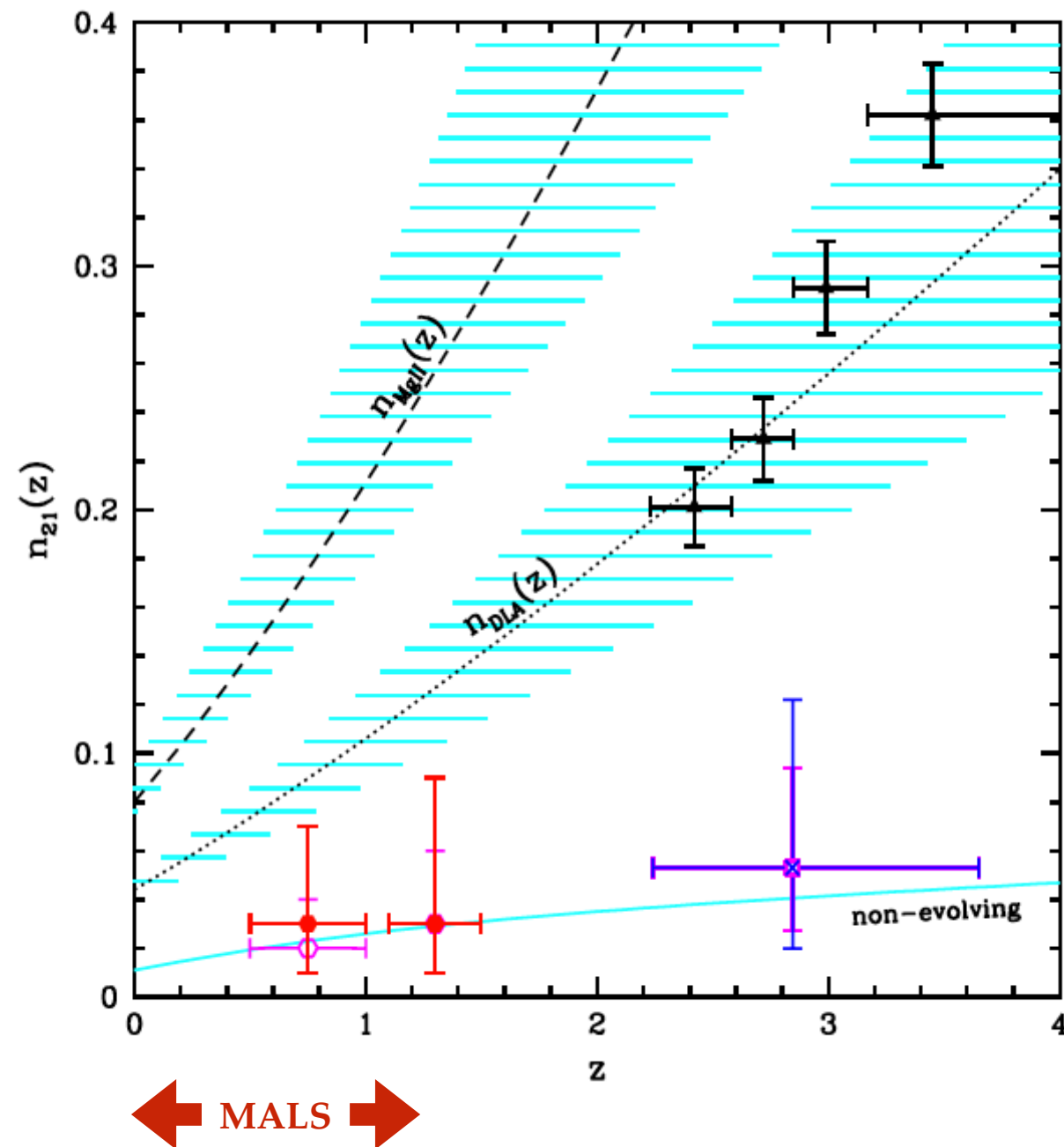
MALS: SALT/NOT survey



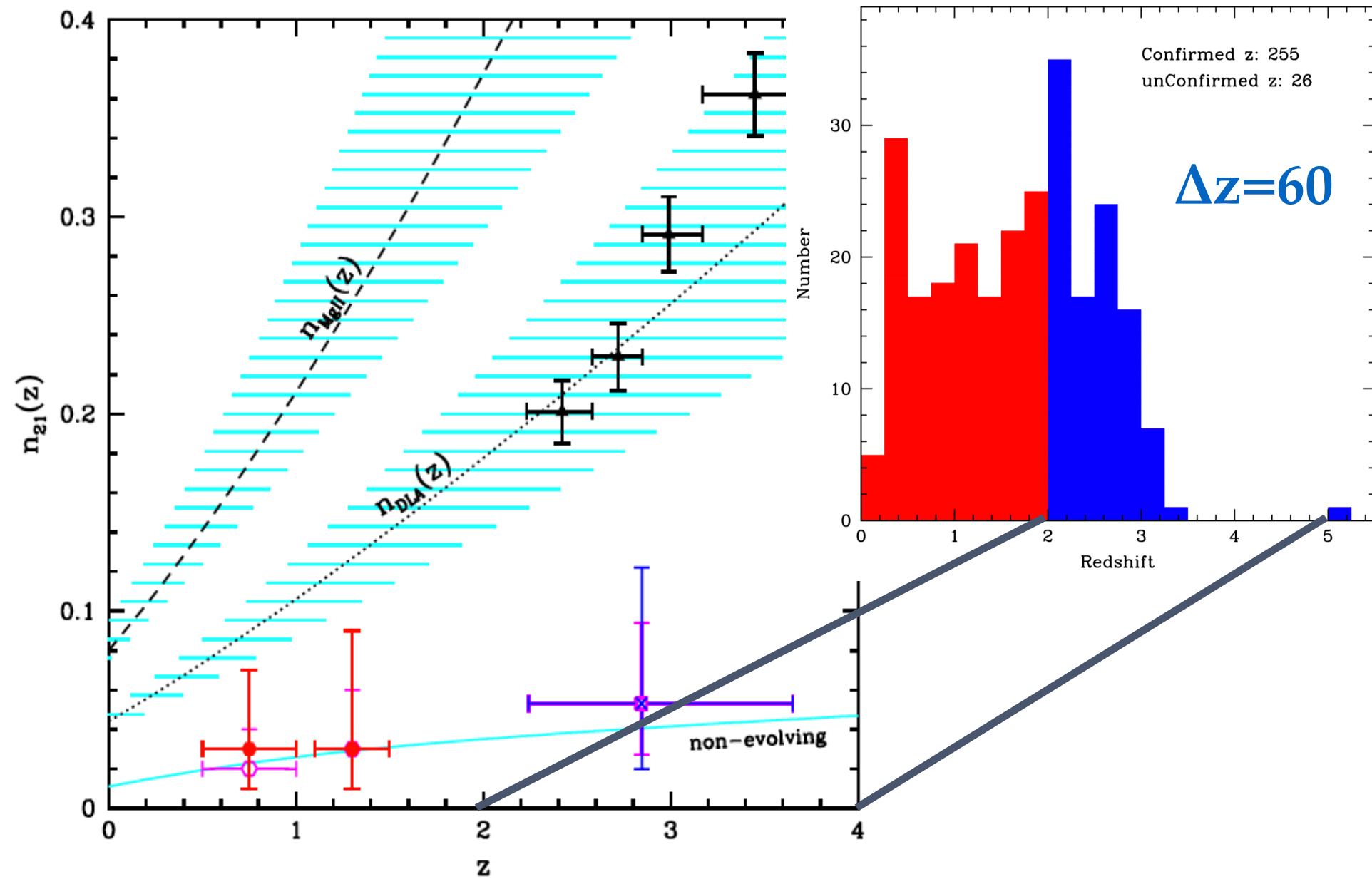
255 new Radio Bright Quasars; 221 at $z > 0.5$ for MALS
(Unique IR selected sample for AGN and absorption line studies)



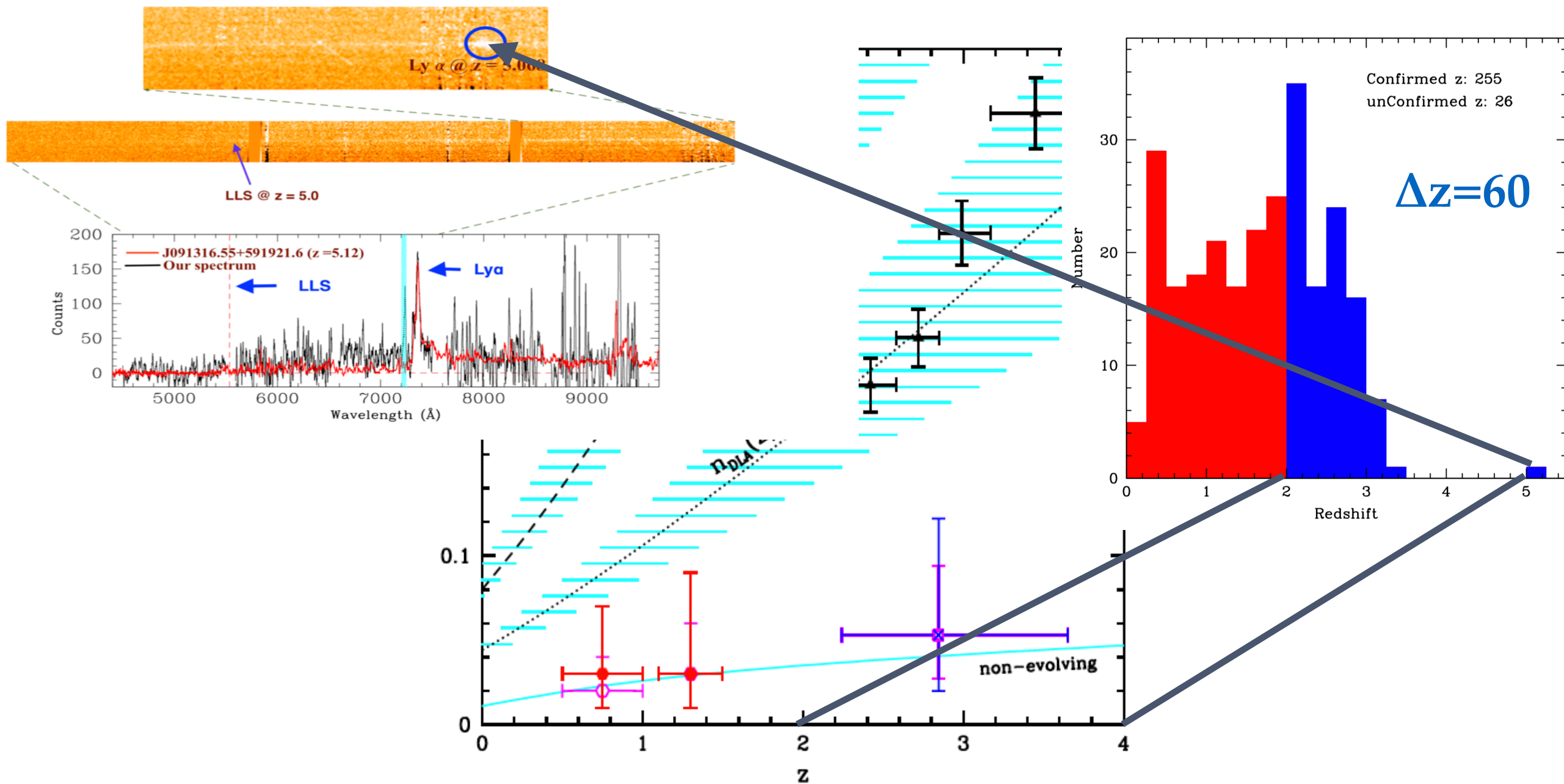
SUGAR survey: uGMRT band-2,3 follow-up



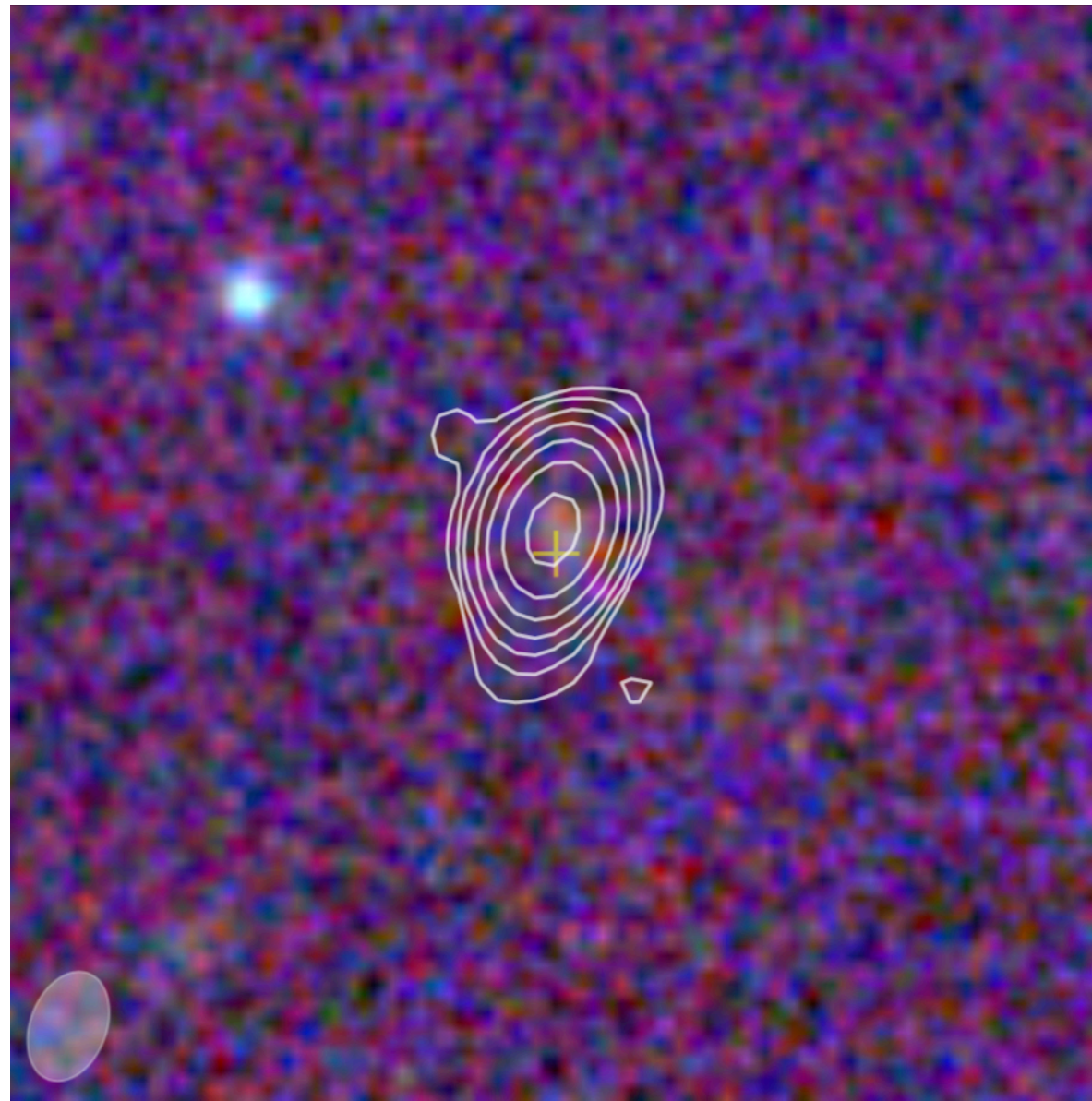
SUGAR survey: uGMRT band-2,3 follow-up



SUGAR survey (Phase-I): uGMRT band-2,3 follow-up



The brightest radio loud quasar at $z > 5$



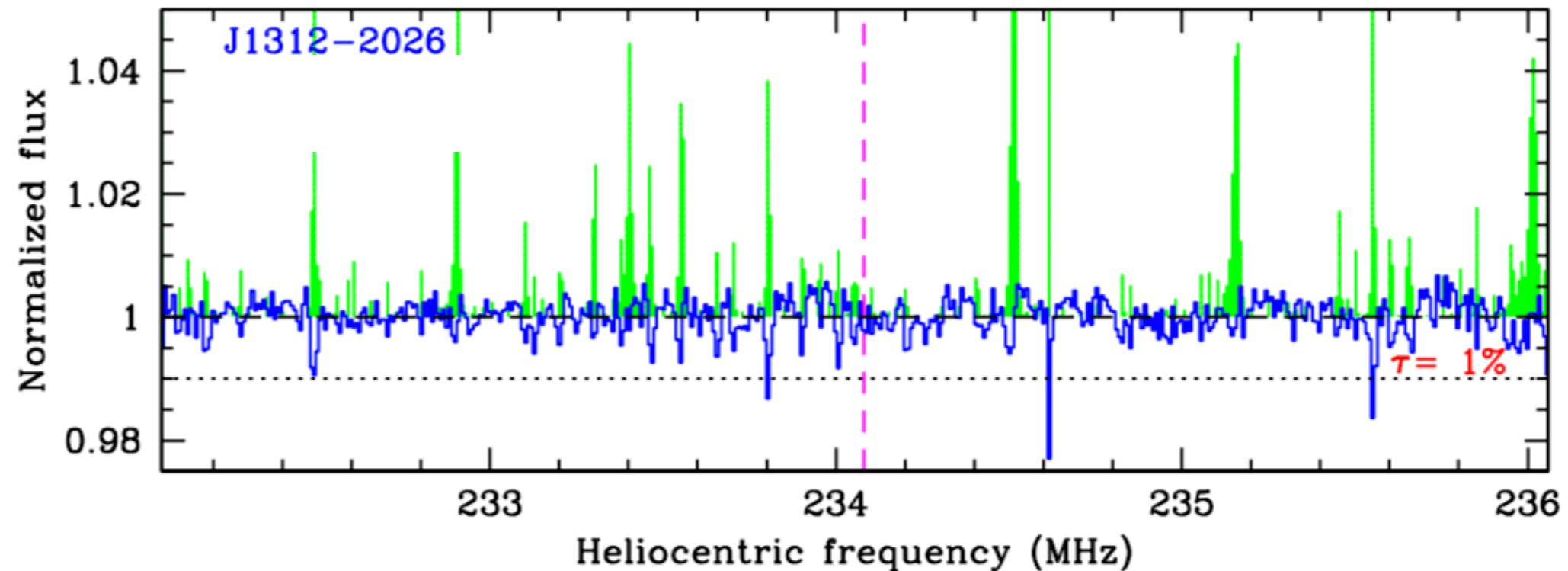
PS1(yig) - uGMRT(1.4GHz)

$$L_{1.4\text{GHz}} = 1.2 \times 10^{29} \text{ W / Hz}; R = 1.4 \times 10^4$$

Hosted by a Compact Symmetric Object?



The brightest radio loud quasar at $z > 5$



uGMRT HI 21-cm absorption spectrum

2- 85 GHz (rest-frame) VLBA observations in progress to determine the nature of steep-spectrum radio source.
VLT observations proposed to determine AGN properties.



Summary - MALS SUGAR

