

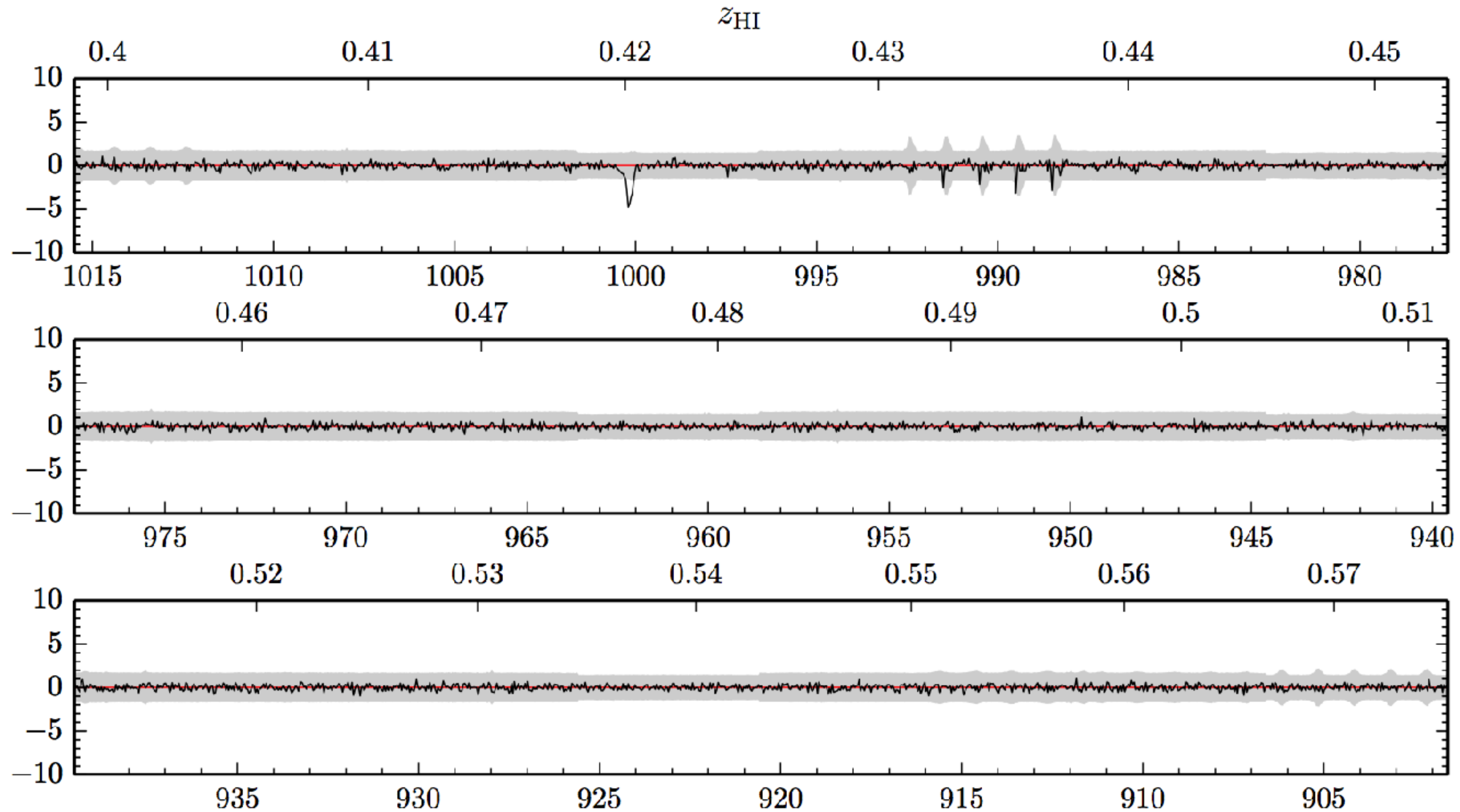
Consolidated HI Absorption Database

CHAD: progress and plans

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An example HI absorber



Line-width = **75 km s⁻¹**

Peak optical depth = **0.05**

$N_{\text{HI}} = \mathbf{7.3 \times 10^{20} \text{ cm}^{-2}}$

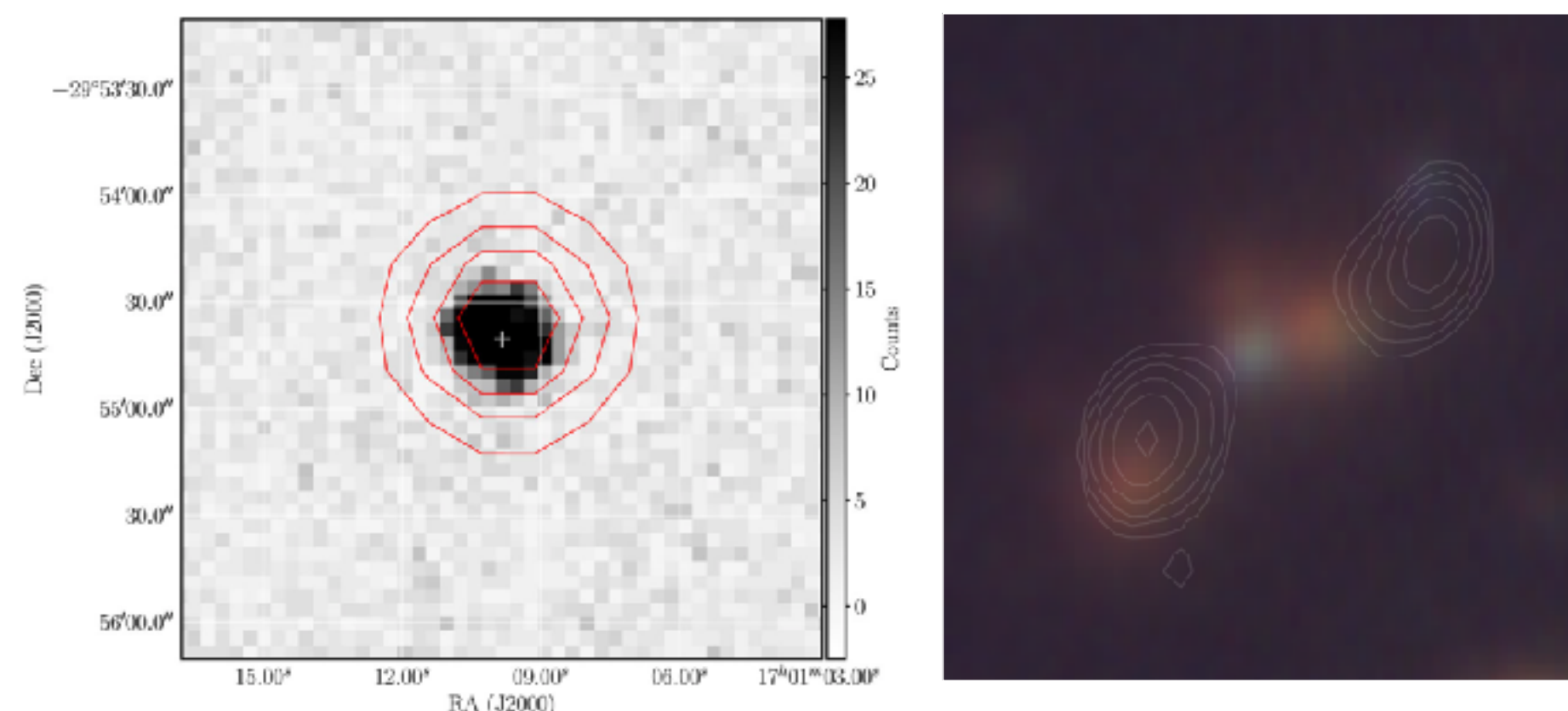
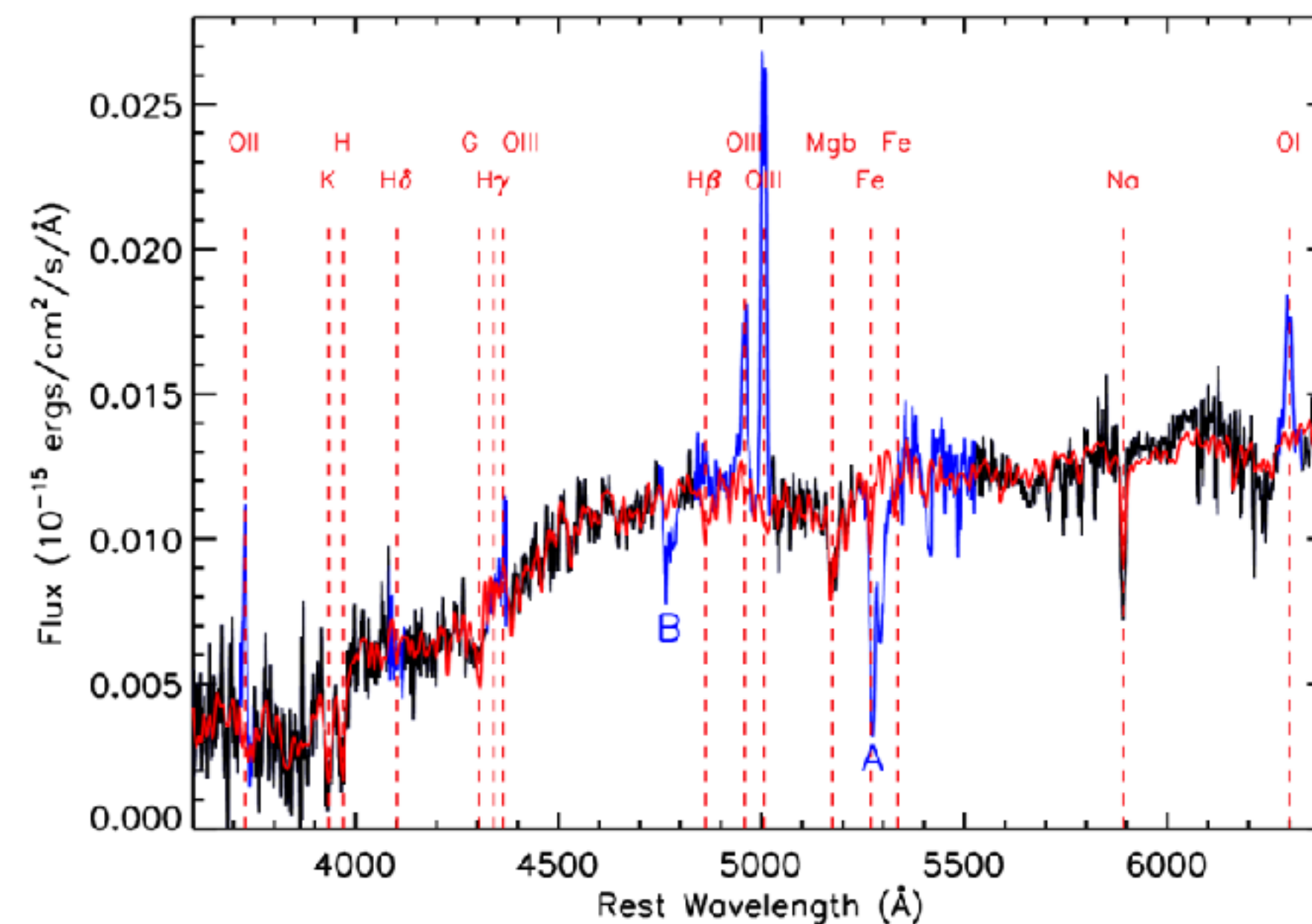
An example HI absorber

3.1.2 PKS 1657–298

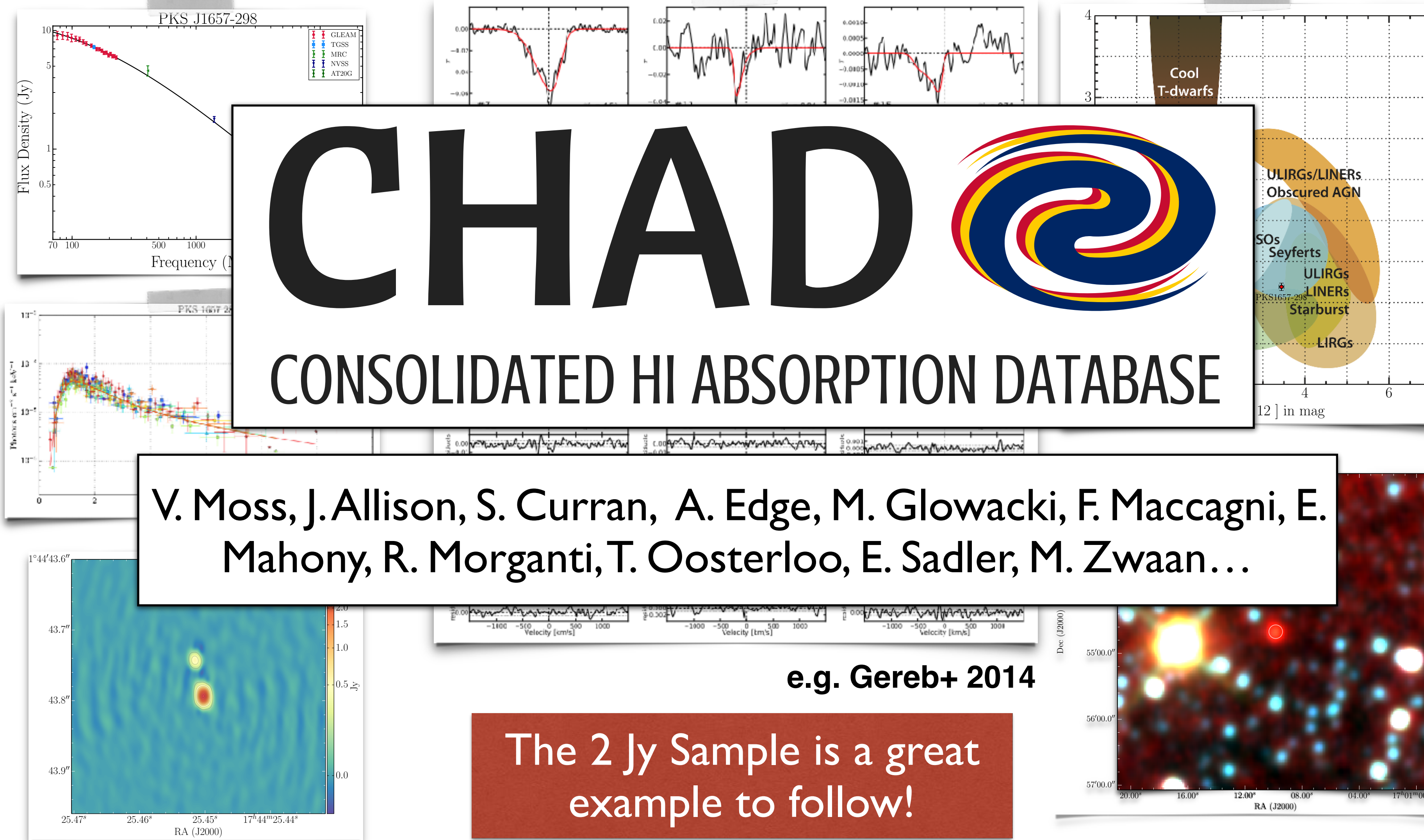
This is a largely unknown and unstudied radio galaxy, identified as a compact double at VLBI resolution. Due to its low Galactic latitude ($+7^\circ$), there has been no optical counterpart identified and no previously known redshift for the galaxy. During a study of *ROSAT* X-ray sources in globular clusters, Verbunt (2001) identified the X-ray counterpart for this galaxy within the field of view to a positional accuracy of 3 arcsec. Petrov, Honma & Shibata (2012) provide the most accurate position for this source based on VLBI data at 22 GHz.

Multi-wavelength properties

- HI absorption provides a **censored** sightline of neutral gas towards a line-of-sight radio source
- **PKS 1740-517**: ionised gas (**Gemini**), double-source structure (**LBA**), molecular gas (**ALMA**)
- **PKS 1657-298**: associated + ionised gas (**NTT**), reddened (**WISE**), X-ray bright (**XMM-Newton**)
- **PKS 0410-75**: resolved radio source (**LBA**), gas associated with nearby galaxy (**Gemini**)
- To understand the **full physical context** of our galaxies, we require **multi-wavelength** data!



CHAD: The concept

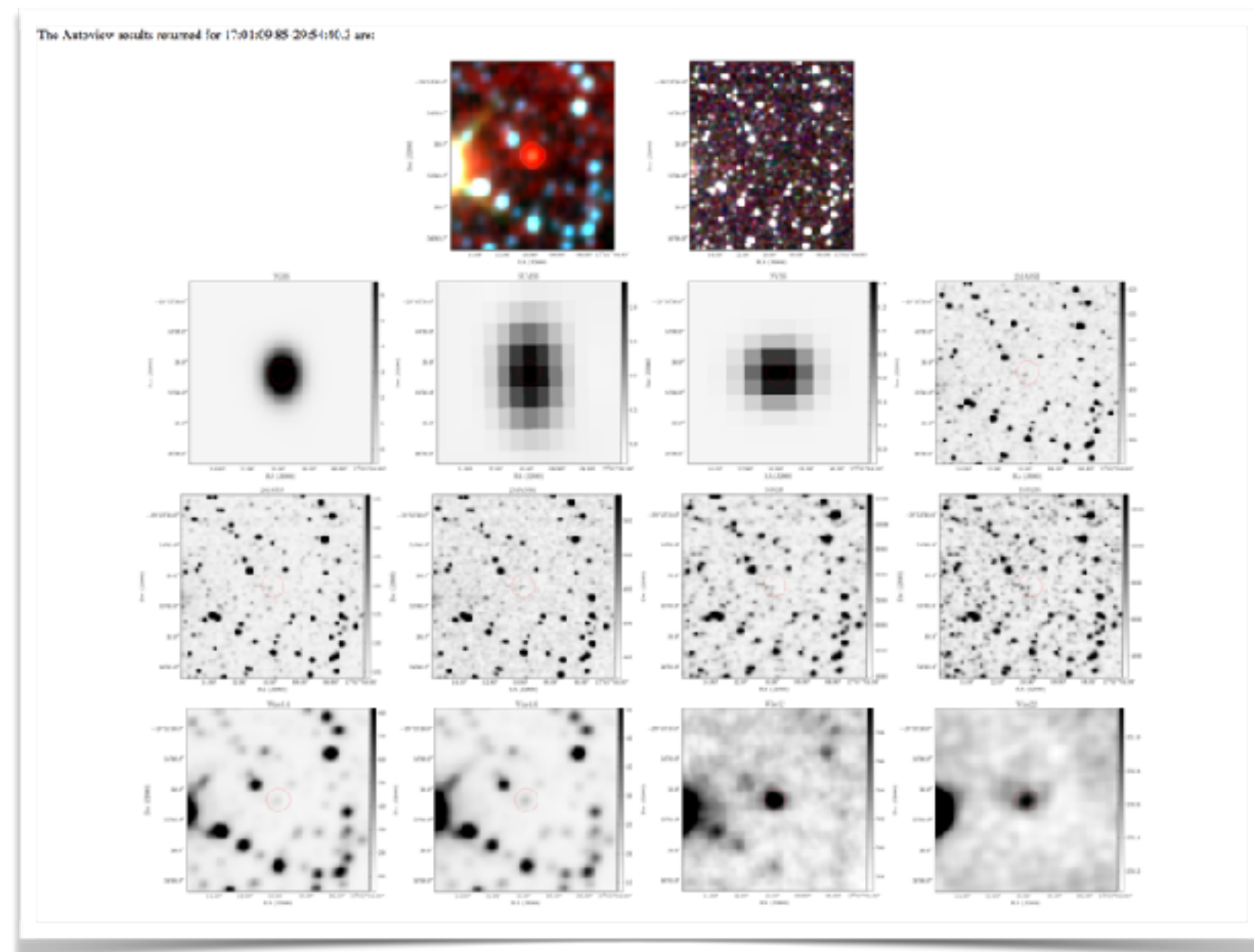


V. Moss, J. Allison, S. Curran, A. Edge, M. Glowacki, F. Maccagni, E. Mahony, R. Morganti, T. Oosterloo, E. Sadler, M. Zwaan...

The 2 Jy Sample is a great example to follow!

CHAD: The goals

- **CHAD.historic:** consolidate **existing HI absorption** literature into one easily-accessible place, alongside whatever multi-wavelength data we can find
- **CHAD.multi:** bring together the same kinds of **multi-wavelength data** for all radio sources, in prep for upcoming large-scale surveys like **FLASH** and **SHARP**



CHAD Associated

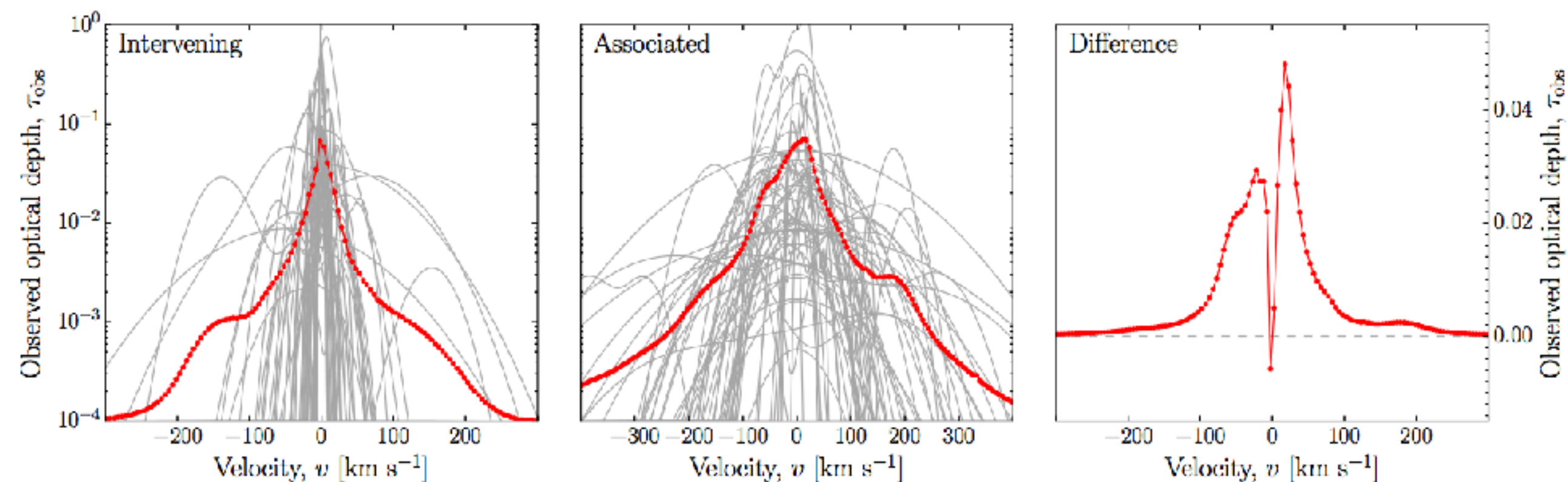
ID	Name	Detection	Redshift	Tau	Flux
1	J001605-234	det	0.06401	0.169	0.266
2	J0025-2602	det	0.32162	0.0093	8.15
3	0055+30	det	0.01648	0.05	24.2
4	0108+388	det	0.06847	0.44	0.17
5	J0119+3210	det	0.0602	0.04	2.64
6	J0141+1353	det	0.621	0.026	3.78
7	0258+35	det	0.01649	0.0023	24
8	0316+16	det	0.907	0.034	12.5
9	J0410+7655	det	0.5985	0.01	6.3
10	J0414+0534	det	2.6365	0.019	3.31
11	J0431+2037	det	0.219	0.0445	4.56
12	0500+019	det	0.5846	0.045	1.6
13	0648+27	det	0.04143	0.0074	23.7
14	0722+30	det	0.01885	0.064	23
15	0754+401	det	0.066	0.042	0.092
16	3C190	det	1.1946	0.011	5.69
17	J0806+1906	det	0.098	0.099	0.142
18	0806+35	det	0.082	0.009	0.142
19	0833+442	det	0.055	0.016	0.134
20	J0834+5534	det	0.242	0.0032	7.1
21	0839+458	det	0.192	0.273	0.331
22	J0901+0304	det	0.288611	0.1	0
23	J0901+2901	det	0.19392	0.000516	2.01

CHAD progress



CHAD.historic

- Including non-detections, there are **~100s** of galaxies which have been searched for intervening or associated HI absorption with many detections - this will become **1000s** of galaxies with the advent of FLASH, SHARP, MALS ...
- Curran+2016 compiles 55 associated and 43 intervening HI absorption spectra for $z \geq 0.1$ as well as their associated physical properties
- **chad.historic** aims to capture that information and provide a structure as the known HI absorption population grows in the coming years



CHAD.historic



CHAD field definitions

File Edit View Insert Format Data Tools Add-ons Help Last edit was on 1 March

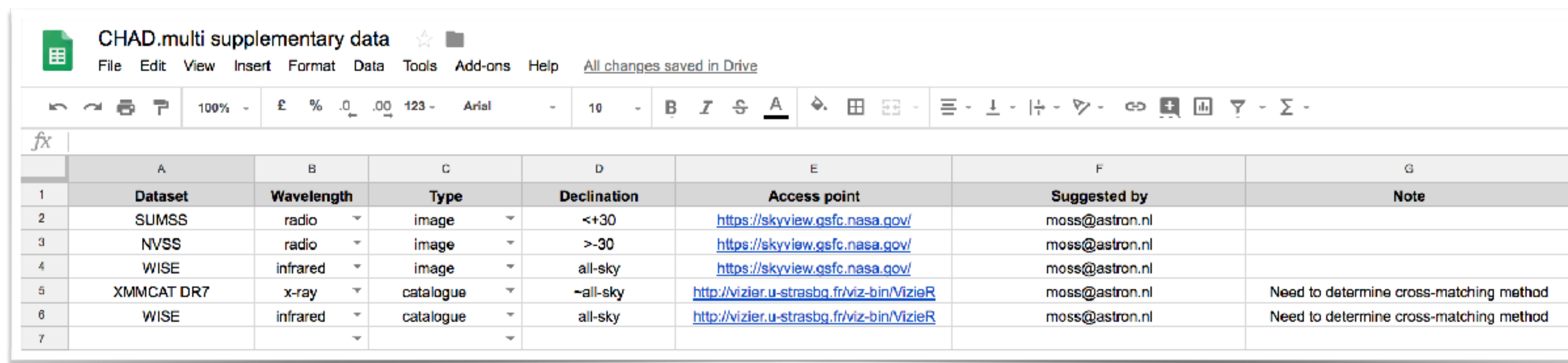
100% Arial 10

	A	B	C	D	E
1	Field name	Type	Example	Description	Notes
2	RA	required	17:44:25.4	right ascension, sexagesimal	position of radio source (other positions can be additional info)
3	Dec	required	-51:44:44	declination, sexagesimal	see above. Also -- matching sources of slightly different positions?
4	Spectral line	required	HI	spectral line type, HI/OH/CO	What should be the options here for other types of absorption?
5	Absorption type	required	Associated	associated or intervening or ?	
6	Detection	required	Y	detection or non-detection	
7	Redshift	required	0.4413	redshift	how to plan for exception of non-detection? should also include errors for all values...
8	Central frequency	required	863.5 MHz	central freq in MHz/other	
9	Bandwidth	required	304 MHz	bandwidth of search in MHz	
10	Channel width	required	18.5 khz	channel width in frequency	
11	Sensitivity	required	20 mJy/beam	RMS noise in mJy/beam	
12	FWZI	required	200 km/s	full width zero intensity	how do we deal with multiple components? FWHM_1, FWHM_2, etc?
13	Redshift of peak optical depth	required	0.4413		
14	Peak optical depth	required	0.2	optical depth, peak	
15	Integrated optical depth	required	2.73	optical depth, integrated	
16	Reference	required	2015MNRAS.453.1249A	ADS code ?	could also be arXiv code 1503.01265 or written out reference Allison et al. 2015
17	Contact	required	vmoos.astro@gmail.com	email address of submitter	to trace issues or contact about the particular entry
18	Continuum flux (this obs)	required	8.15 Jy	Flux of background source	is this necessary? should it be at the same frequency as the absorption? do we care, since we can form our own SED?
19	Continuum frequency	required	843 MHz	frequency of flux measurement	See above
20	Telescope	required	ASKAP	telescope/instrument of observation	
21					
22	Optional Fields				
23	Name	optional	PKS 1740-517	user-assigned name of source	Do we need to assign CHAD names? e.g. CHAD174425-514444
24	Redshift emission	optional	-	redshift of background source	only if an intervening system
25	Derived width	optional?	11.47 km/s	derived width, km/s	integrated optical depth / peak tau - possibly a good way for homogenous comparison? Can derive ourselves
26	Radio source size	optional	300 pc	size in pc	only if available? requires VLBI or high resolution radio information
27	Additional information	optional	-	other additional parameters	e.g. metallicity, metal lines, etc... how to encode this information?

<https://tinyurl.com/chadfields>

CHAD.multi

- Interpretation of galaxies requires **other wavelengths**: optical, infrared, X-ray...
- This information exists in both **catalogues** and **supplementary data**, and is accessible via a wide range of tools e.g. VO, SkyView, etc
- Goal: identify a set of **core catalogues and data-sets**, and bring this together for all radio sources across northern and southern catalogues
- Contribution document: <https://tinyurl.com/chadsurveys>



	A	B	C	D	E	F	G
	Dataset	Wavelength	Type	Declination	Access point	Suggested by	Note
1	SUMSS	radio	image	<+30	https://skyview.gsfc.nasa.gov/	moss@astron.nl	
2	NVSS	radio	image	>-30	https://skyview.gsfc.nasa.gov/	moss@astron.nl	
3	WISE	infrared	image	all-sky	https://skyview.gsfc.nasa.gov/	moss@astron.nl	
4	XMMCAT DR7	x-ray	catalogue	~all-sky	http://vizier.u-strasbg.fr/viz-bin/VizieR	moss@astron.nl	Need to determine cross-matching method
5	WISE	infrared	catalogue	all-sky	http://vizier.u-strasbg.fr/viz-bin/VizieR	moss@astron.nl	Need to determine cross-matching method
6							
7							

CHADonline wiki



- PBWorks wiki online: <http://chadonline.pbworks.com>

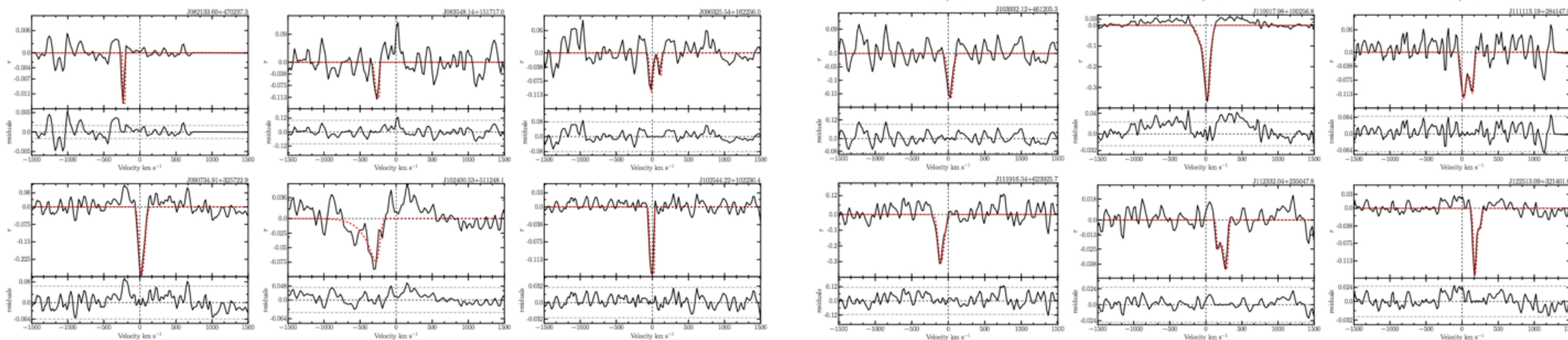
A screenshot of the CHADonline wiki home page. The page has a yellow header bar with navigation tabs for 'Wiki', 'Pages & Files', 'Users', and 'Settings'. Below the header, there are 'VIEW' and 'EDIT' tabs. The main content area features a star icon next to the word 'Home'. Below this, it says 'last edited by Vanessa 11 months ago' and has a 'Page history' link. The central part of the page displays the CHAD logo and the text 'CONSOLIDATED HI ABSORPTION DATABASE'. Below the logo, there is a welcome message: 'Welcome to the CHAD planning and development wiki!'. This is followed by a section titled 'The goal of CHAD is twofold:' with two numbered points: '1) To consolidate existing HI absorption detections/non-detections into one centralised database, including properties of the host galaxies and ancillary data where applicable (CHAD.historic)' and '2) To bring together a suite of visual and numerical diagnostics for radio sources to aid with rapid interpretation and analysis of new HI absorption detections from various telescopes (CHAD.multi)'. Below the goals, there is a section titled 'Members of CHAD' listing Vanessa Moss (lead), James Allison, Steve Curran, Alastair Edge, Marcin Glowacki, Filippo Maccagni, Elizabeth Mahony, Raffaella Morganti, Tom Oosterloo, Elaine Sadler, and Martin Zwaan. At the bottom, there is a section titled 'Questions for discussion' with a link to 'CHAD questions'.

CHAD plans



WHAD: WSRT test case

- **Gereb+2015, Maccagni+2017:** 248 galaxies searched for HI absorption over the redshift range $0.02 < z < 0.25$, with detections in 66 sources
- This is a great testbed data-set for **chad.historic**, with the goal of bringing together information and data for a homogeneous sample of sources
- Progress tracked: <http://chadonline.pbworks.com/whaddetails>



Questions for HI Abs2018



- **Which surveys** would benefit from CHAD.multi tools (other than **FLASH** and **SHARP**)? Are there **already** plans for multi-wavelength integration?
- Where can we best **avoid duplicating effort**? We don't want to reinvent the wheel so if there are existing tools (e.g. Skyview) we should use them!
- **When is CHAD needed?** CHAD.historic and CHAD.multi could have separate timelines, but some of CHAD.multi also is useful for CHAD.historic
- What kind of model can we develop to ensure CHAD.historic **stays up to date**? Direct connection to new surveys? User-submission? Automated scraping?
- Please provide input on **CHAD.historic fields** (<https://tinyurl.com/chadfields>) and **CHAD.multi surveys** (<https://tinyurl.com/chadsurveys>)! ^_^