In search of extremely high-velocity outflows and ultra fast outflow coexistence

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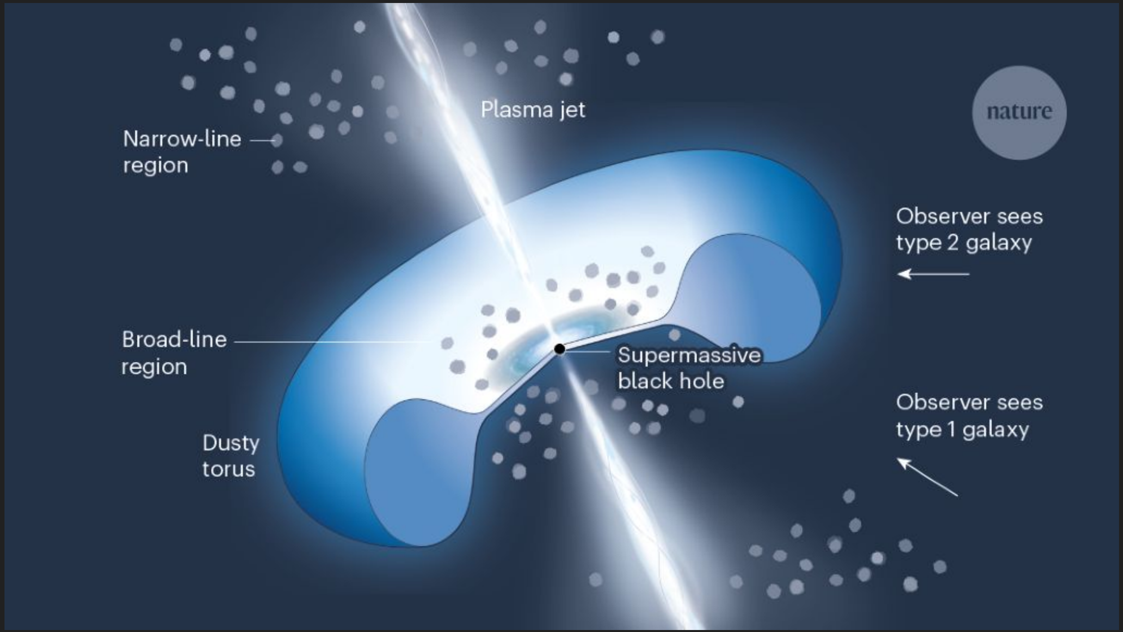
Background

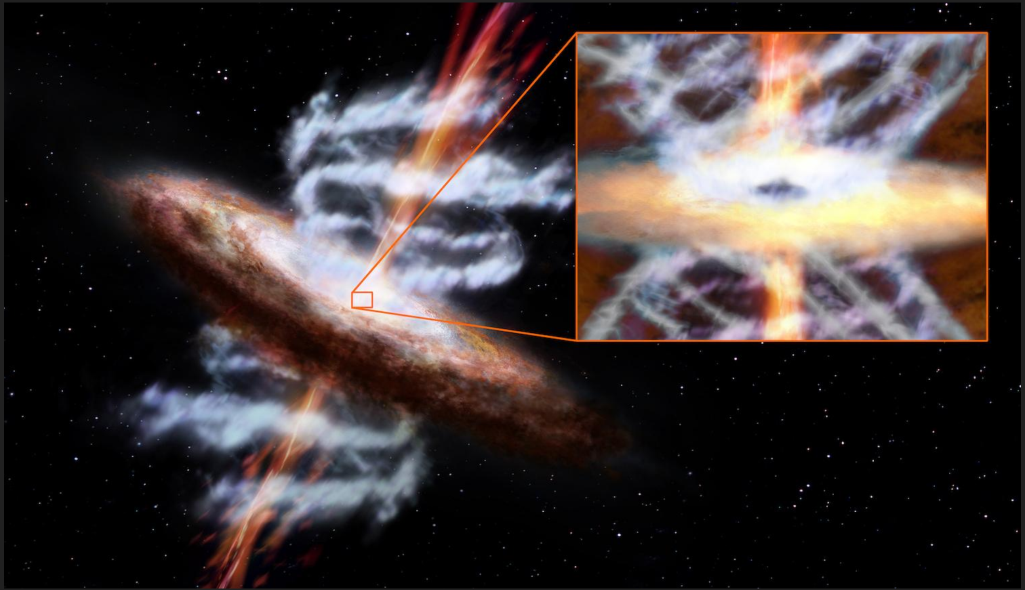
- Active galactic nuclei (AGN)
  - Composition
    - Supermassive blackhole
    - Accretion disk
    - Torus
  - Viewing Angle
    - Quasar



AGN composition [Gamez Rosas]

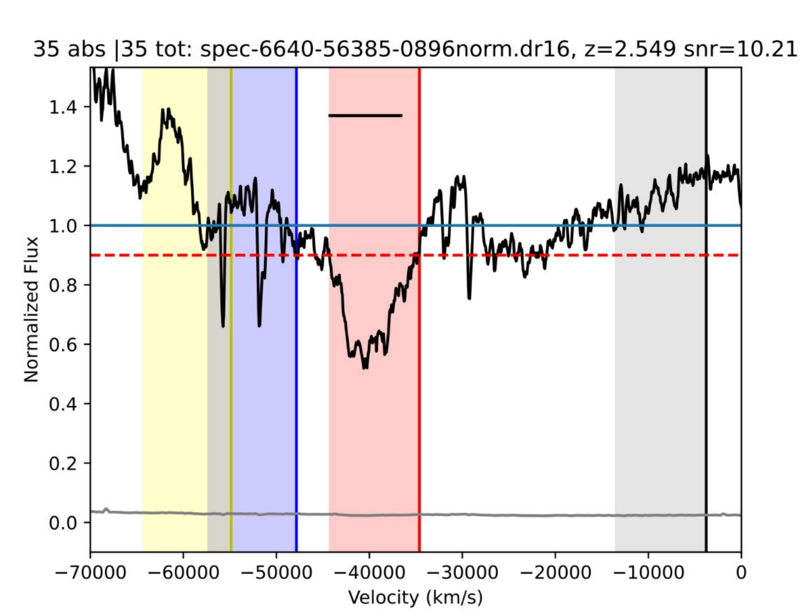
Main project

- Study outflows in the UV/Optical wavelength
  - Energy carrying ionized gas
  - CIV absorption
  - Sloan digital sky survey data release 16 (SDSS DR16)
  - Extremely high-velocity outflow (EHVO)
- Feedback information
  - Star formation
  - Galactic evolution

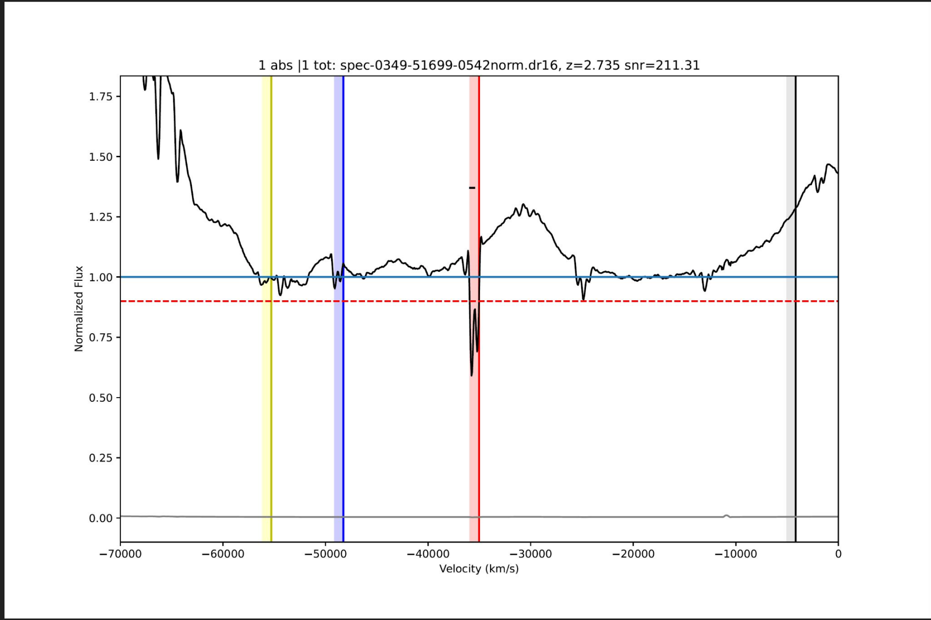


Artist impression of AGN outflow [AASNova]

Broad Absorption Lines vs Narrow Absorption Lines



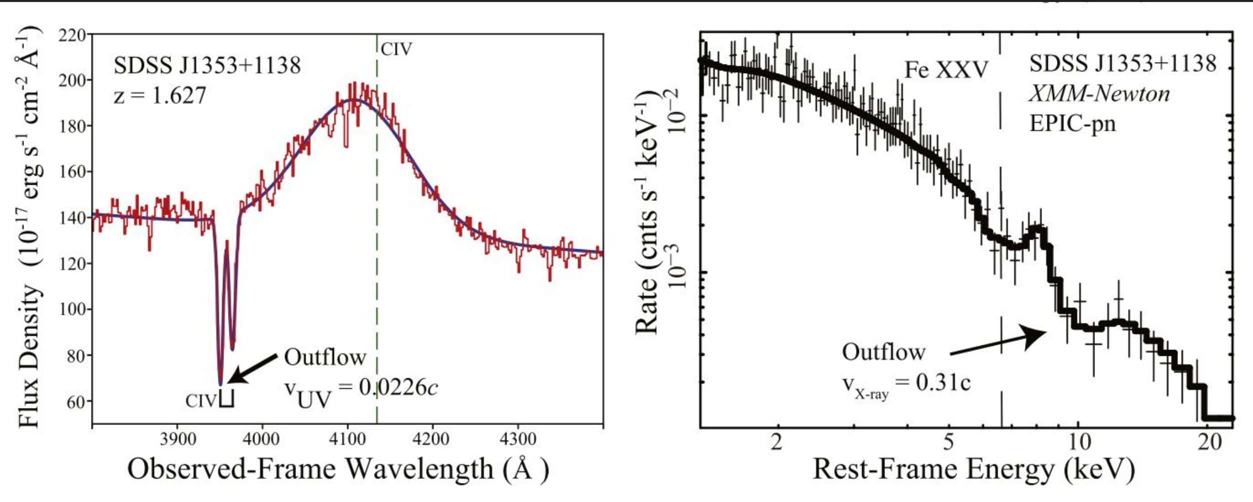
Broad absorption line (BAL)



Narrow absorption line (NAL)

Subproject

- Possible coexistence of
  - ultra fast outflow (UFO)
    - Highly ionized gas
    - Velocity of 0.1c-0.3c at z<0.1
  - extremely high velocity outflow (EHVO)



Detection method used to identify outflows. Light absorption (Left) vs X-ray absorption (Right) [Chartas]

Data

- Redshift cutoff
  - z>1.8
- Find them in SDSS DR16

Quasars with UFO presence [Chartas]

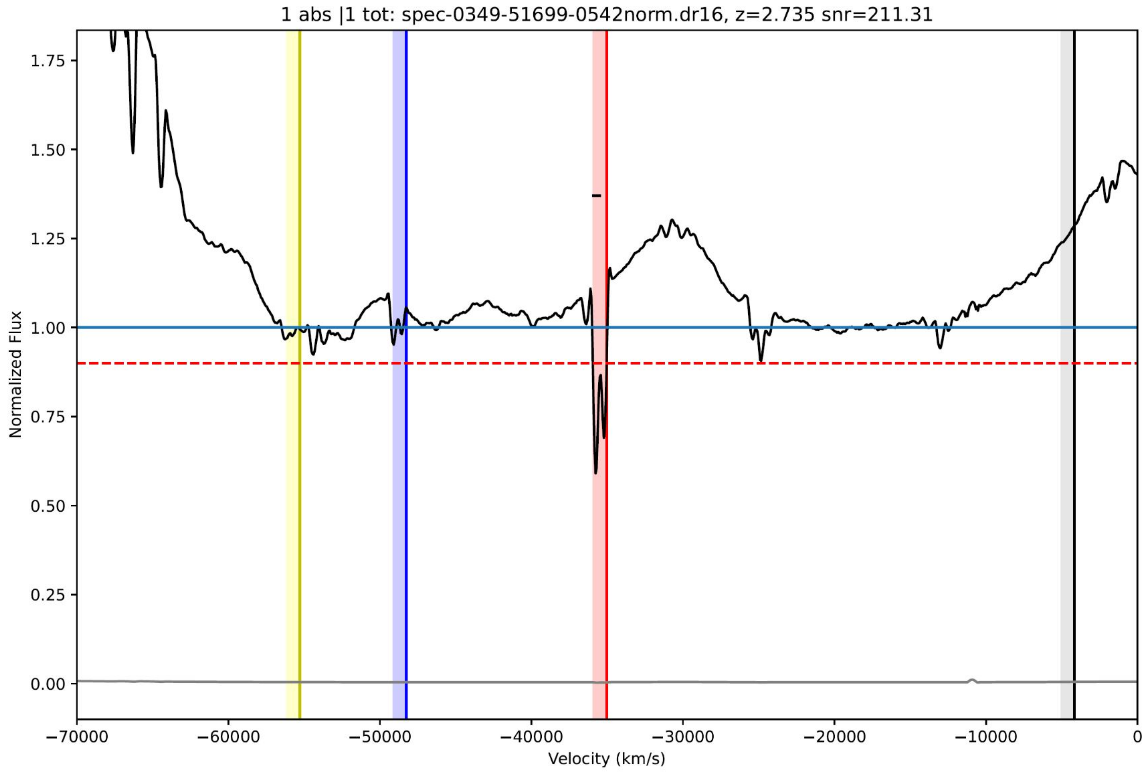
Object	Classification	z_s	z_l	N_H^{Gal} [a] (10^{20} cm^{-2})	$\log(M_{BH})$ ($M_\odot$)
APM 08279+5255	BALQSO	3.91	1.01	3.84	$10.0^{+0.1}_{-0.1}$ [c]
HS 1700+6416	NALQSO	2.735	– [b]	2.66	$10.2^{+0.2}_{-0.2}$ [d]
MG J0414+0534	QSO	2.64	0.9584	11.4	$9.0^{+0.2}_{-0.2}$ [e]
SDSS J1442+4055	NALQSO	2.593	∼0.4	1.30	$9.7^{+0.2}_{-0.2}$ [d]
SDSS J1029+2623	NALQSO	2.197	0.58	1.78	$8.8^{+0.2}_{-0.2}$ [d]
SDSS J1529+1038	NALQSO	1.984	∼0.4	2.72	$8.9^{+0.2}_{-0.2}$ [d]
SDSS J0904+1512	NALQSO	1.826	∼0.3	3.69	$9.3^{+0.2}_{-0.2}$ [d]
PG 1115+080	mini-BALQSO	1.72	0.31	3.53	$8.8^{+0.2}_{-0.2}$ [f]
Q 2237+0305	QSO	1.695	0.0386	5.43	$9.1^{+0.4}_{-0.4}$ [f]
SDSS J1353+1138	NALQSO	1.627	∼0.25	1.86	$9.4^{+0.2}_{-0.2}$ [d]
SDSS J1128+2402	NALQSO	1.608	– [h]	1.15	$8.7^{+0.2}_{-0.2}$ [d]
PID352	QSO	∼1.6	– [b]	0.70	$8.7^{+0.4}_{-0.4}$ [g]
HS 0810+2554	NALQSO	1.51	0.08	3.94	$8.6^{+0.2}_{-0.2}$ [f]
SDSS J0921+2854	NALQSO	1.41	0.445	2.30	$8.9^{+0.2}_{-0.2}$ [d]

Quasar	Plate-MJD-Fiber	Date observed
HS 1700+6416	0349-51699-542	06-04-2000
SDSS J1442+4055	6061-56076-0132	05-29-2012
SDSS J1029+2623	6464-56309-782	01-17-2013
SDSS J1529+1038	5493-56009-0900	03-23-2012
SDSS J0904+1512	5295-55978-0976	02-21-2012

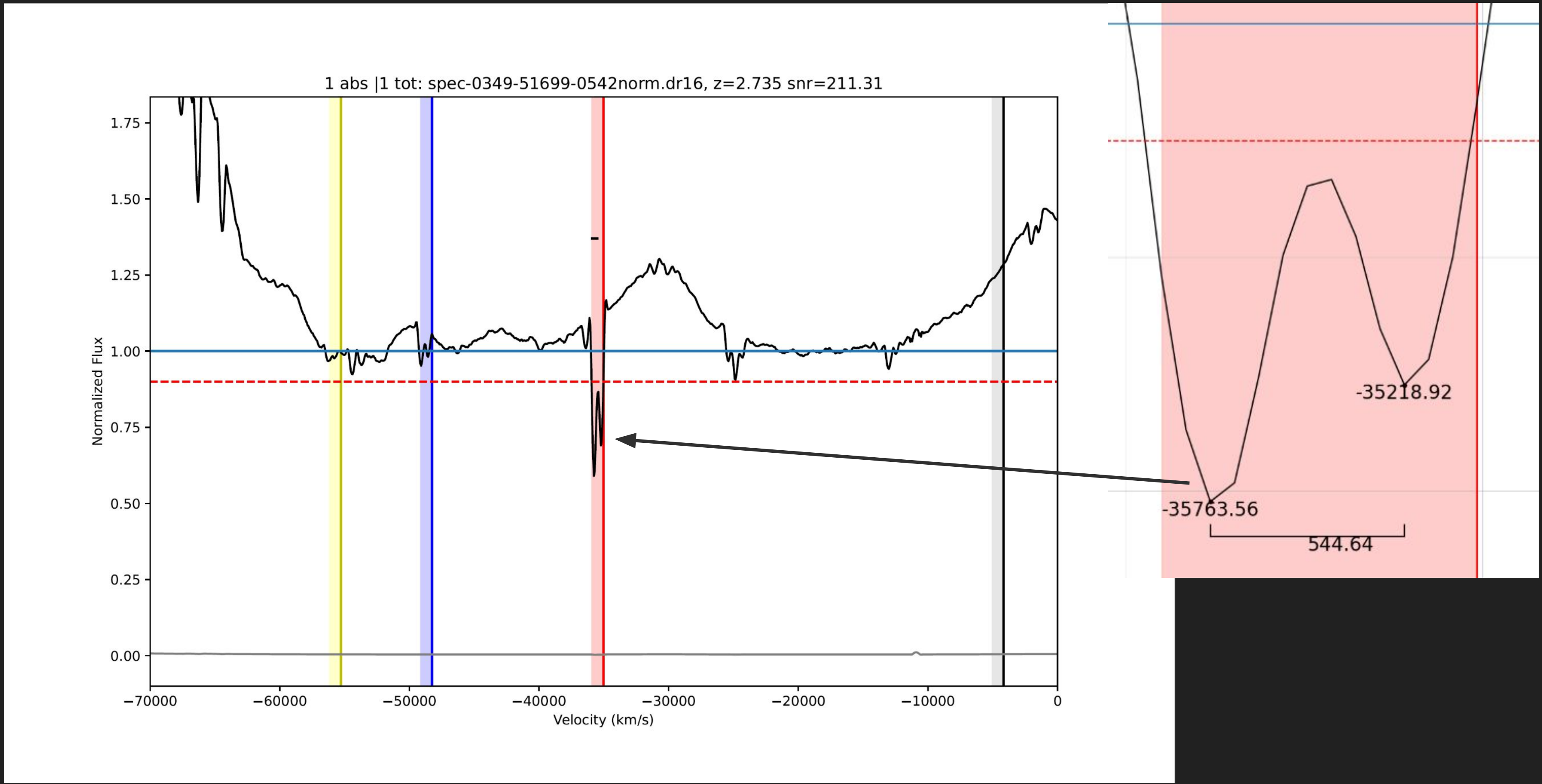
Sample of quasars used with observation date

Method

- Normalize continuum
- Flag possible absorption
- Identify CIV absorption
    - Doublet separation distance

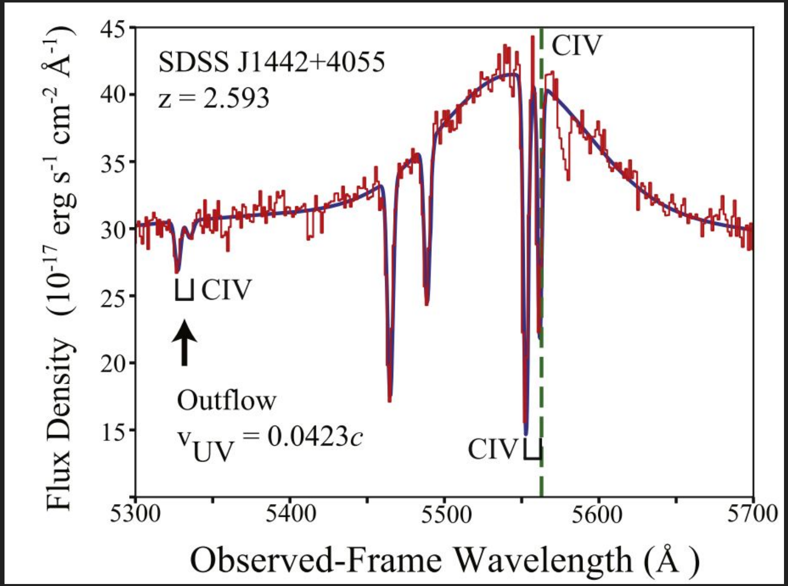


HS 1700+6416

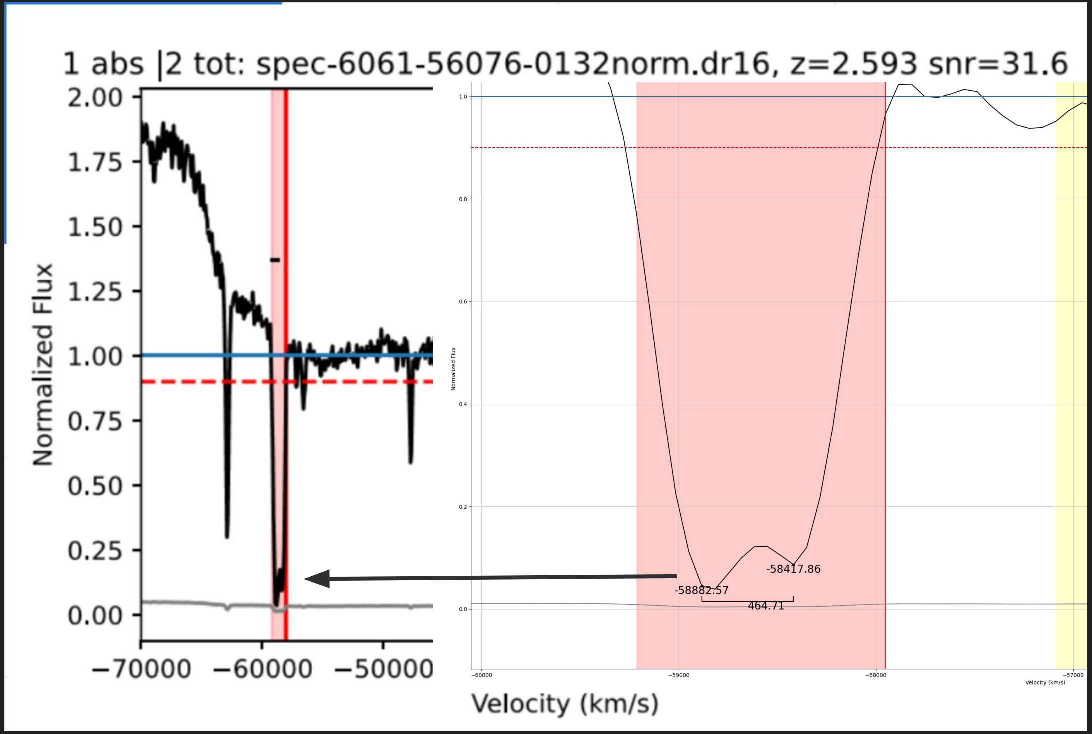


1 abs |1 tot: spec-0349-51699-0542norm.dr16, z=2.735 snr=211.31
Normalized Flux
Velocity (km/s)
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
−70000
−60000
−50000
−40000
−30000
−20000
−10000
0
-35763.56
-35218.92
544.64

SDSS J1442+4055

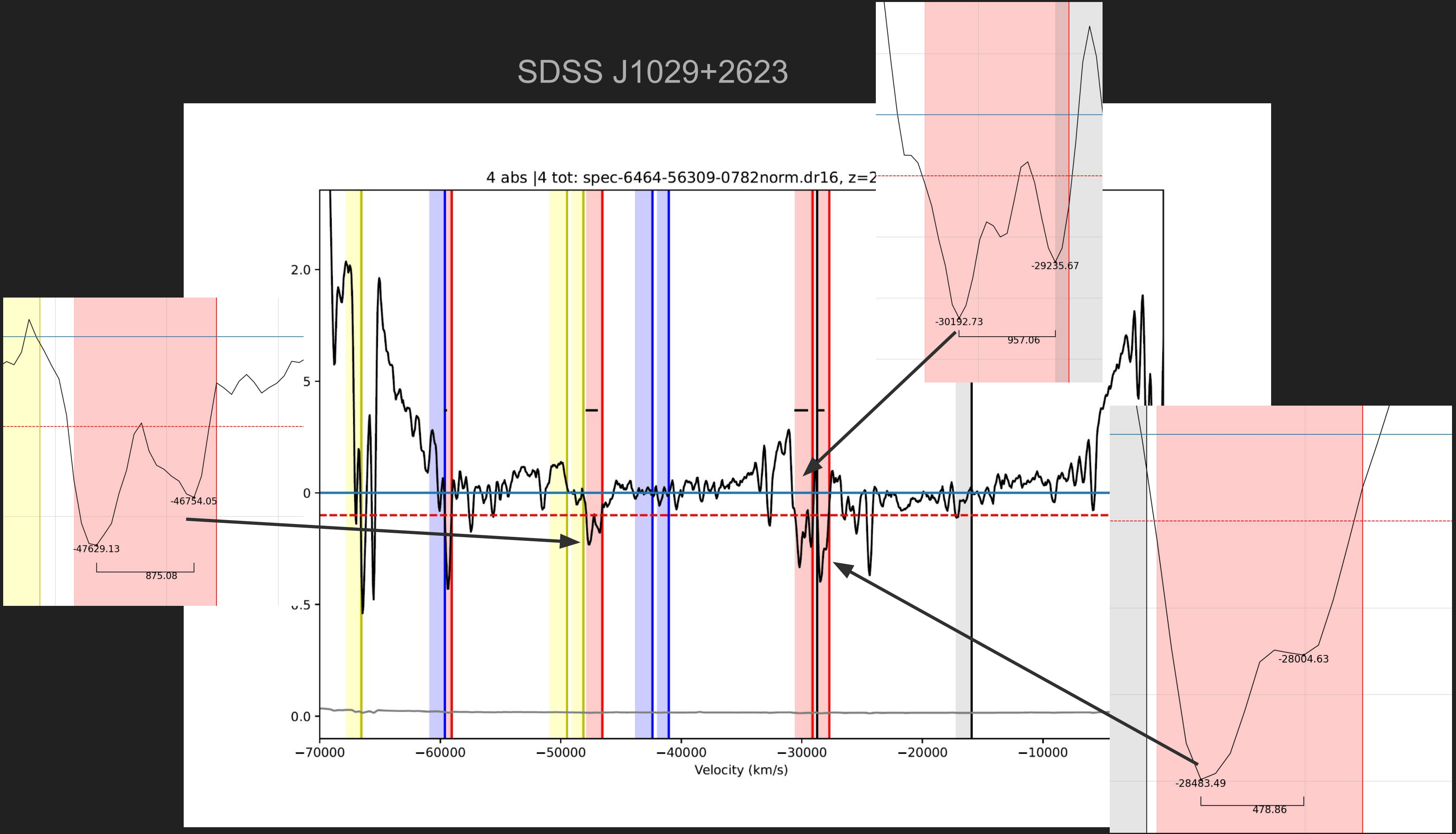


UV absorption spectra [Chartas]

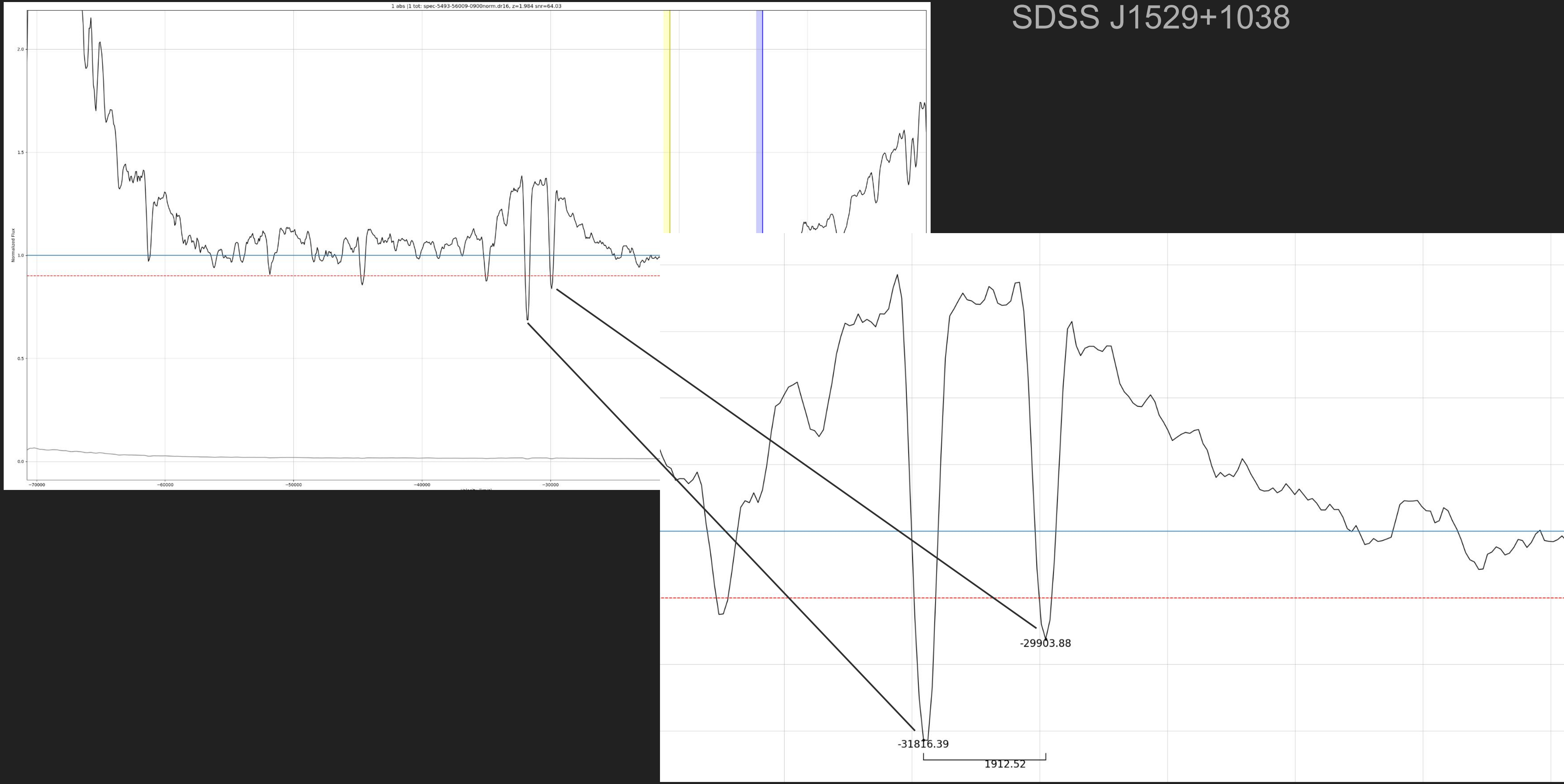


Our absorption search

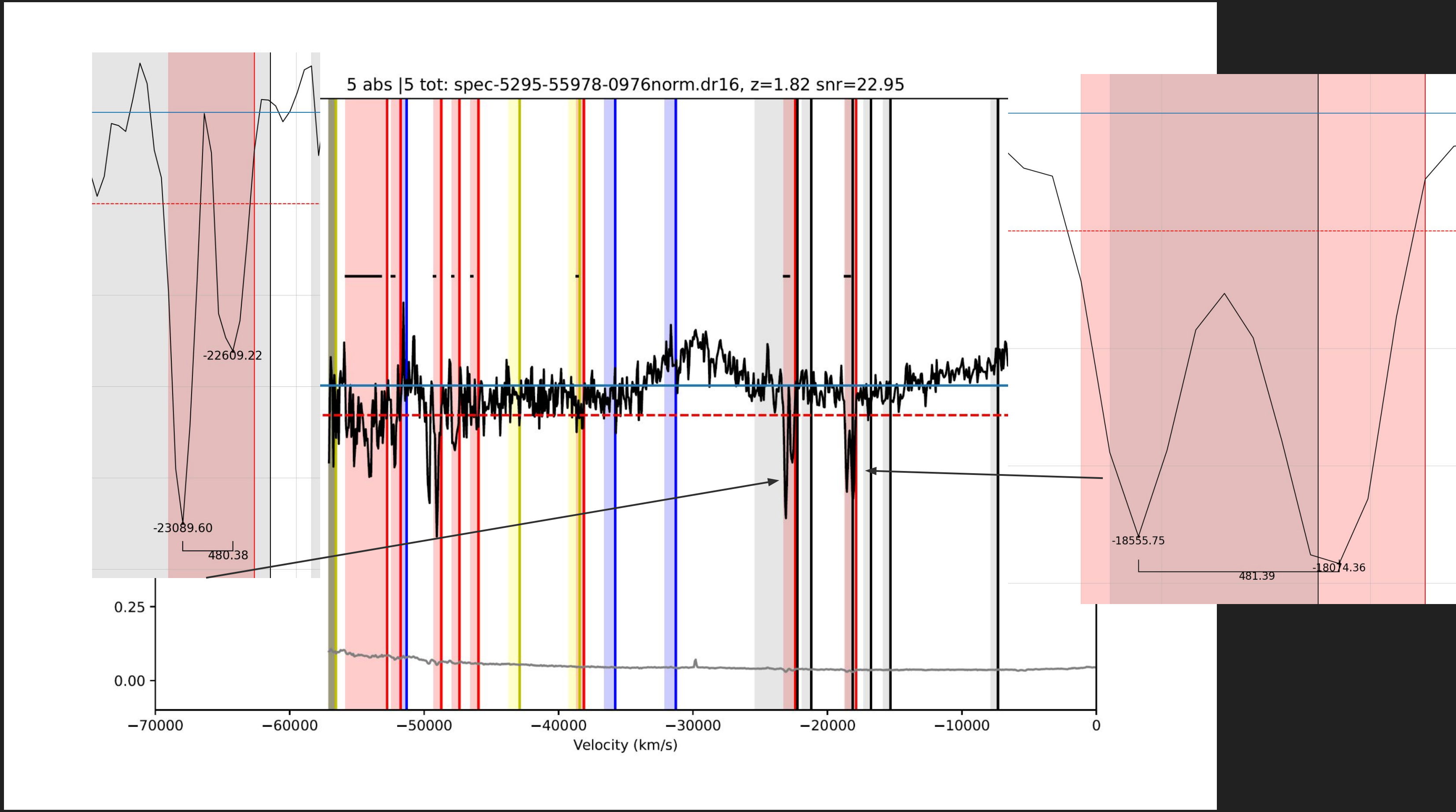
SDSS J1029+2623



SDSS J1529+1038



SDSS J0904+1512



Limitations

- Sample size
- non-BAL
- Single snapshot of quasar

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References

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