

# Thoughts on PFS spectrum viewer and database access (inspired by the SDSS example)

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## SDSS vs. PFS spectra

- SDSS data are organized into plates. So a given observation is specified by a plate number, fiber number, and a date of observation. All objects on a given plate have the same exposure.
- For cosmology survey, PFS spectra will be roughly analogous. But galaxy evolution survey (and also galactic archeology) will have very different exposure times for different objects in a given pointing. The plate/fiber model will break down.
- PFS cosmology and galaxy evolution spectra will often be much lower S/N than SDSS.

# In SDSS, there are multiple ways to access the spectra

- Downloading data in bulk:
  - All spectra in a given plate.
  - All spectra from a list of objects that come from a DB query.
  - All spectra from a pre-defined list

The screenshot shows the SDSS Science Archive Server (SAS) interface. The top navigation bar includes links for Home, Imaging, Optical Spectra (selected), and Infrared Spectra. A 'DR13' dropdown menu is visible. The main content area is divided into several panels:

- eBOSS Plate:** A table with columns Survey, Program, Quality, and Chunk. The values are sdss, legacy, good, and chunk85 respectively.
- eBOSS Specobj:** A table with columns Plate, MJD, FiberID, RA, DEC, Version, bestobj\_id, specobj\_id, z, zerr, Class, and Subclass. The values are 1678, 53433, 425, 15:18:06.13, +42:44:45.07, 26, 1237662301903192106, 1889376924388583424, 0.0402719, 1.39951e-05, GALAXY, and STARBURST respectively.
- ZWARNING:** A table with columns ZWARNING and a count. The value is 4 - MANY\_OUTLIERS with a count of 16.
- Bitmasks:** A table with columns Bitmasks and a count. The values are LEGACY\_TARGET1, 5 - GALAXY\_RED, and 6 - GALAXY with a count of 96.

On the right side, there is a 'Search Options' panel with fields for Redshift (z, z\_noqso), RA/Dec (Sexagesimal, Decimal), RA / Dec Search Range (arcmin) (default 10 arcmin), and Download spec as (lite, full). An 'Update' button is at the bottom of this panel. Below the search options, there are links for 'spec data model' and 'CAS'.

<https://dr13.sdss.org/optical/spectrum/view>

# Going from images to spectra

This “explore” page is one click from the SDSS equivalent of hscMap.

Note the links on the left-hand side that take you directly to the detailed parameters for each object:

- Photometric information
- Targeting information (why was a spectrum taken of this object?)
- Parameters measured from this spectrum (redshift, classification, line strengths, spectral quality, etc)
- Easy links to the bulk data (fits images, spectra of the full plate, etc.

<http://cas.sdss.org/dr13/en/tools/explore/summary.aspx>

DR13

Explore Home

Search

Imaging Summary

Finding chart

Other Observations

Neighbors

Galaxy Zoo

PhotoTag

Field

Frame

PhotoObj

PhotoZ

Cross-ID

Spec Summary

All Spectra

FITS

Plate

SpecObj

sppLines

galSpecLine

galSpecIndx

galSpecInfo

Fit Parameters

sppParams

StarformingPort

PassivePort

emissionLinesPort

PCAWiscM03

PCAWiscM11

FSPSGranEarlyDust

FSPSGranEarlyNoDust

FSPSGranWideDust

NED search

SIMBAD search

ADS search

Notes

Save in Notes

Show Notes

Print

Powered by

## SDSS J151806.13+424445.0

Look up common name This object was also observed in [MaNGA](#)

Not logged in

Type	run	rerun	camcol	field	obj	SDSS ObjID
GALAXY	3918	301	3	213	42	1237662301903192106

RA, Dec		Galactic Coordinates (l, b)	
Decimal	Sexagesimal	l	b
229.525575754, 42.745853761	15:18:06.13, +42:44:45.07	70.347835766	56.486500939

### Imaging

Flags DEBLEND DEGENERATE DEBLENDED\_AT\_EDGE STATIONARY BAD\_MOVING\_FIT BINNED1 INTERP COSMIC\_RAY CHILD

Magnitudes				
u	g	r	i	z
16.27	15.30	14.76	14.32	14.02

Magnitude uncertainties				
err_u	err_g	err_r	err_i	err_z
0.01	0.00	0.00	0.00	0.00

Image MJD	mode	Other observations	parentID	nChild	extinction_r	PetroRad_r (arcsec)
52758	PRIMARY	0	1237662301903192104	0	0.06	10.49 ± 2.598

Mjd-Date	photoZ (KD-tree method)	Galaxy Zoo 1 morphology
04/29/2003	0.049 ± 0.0097	Uncertain

### Cross-identifications [Show](#)

### Optical Spectra SpecObjID = 1889376924388583424 [Interactive spectrum](#)

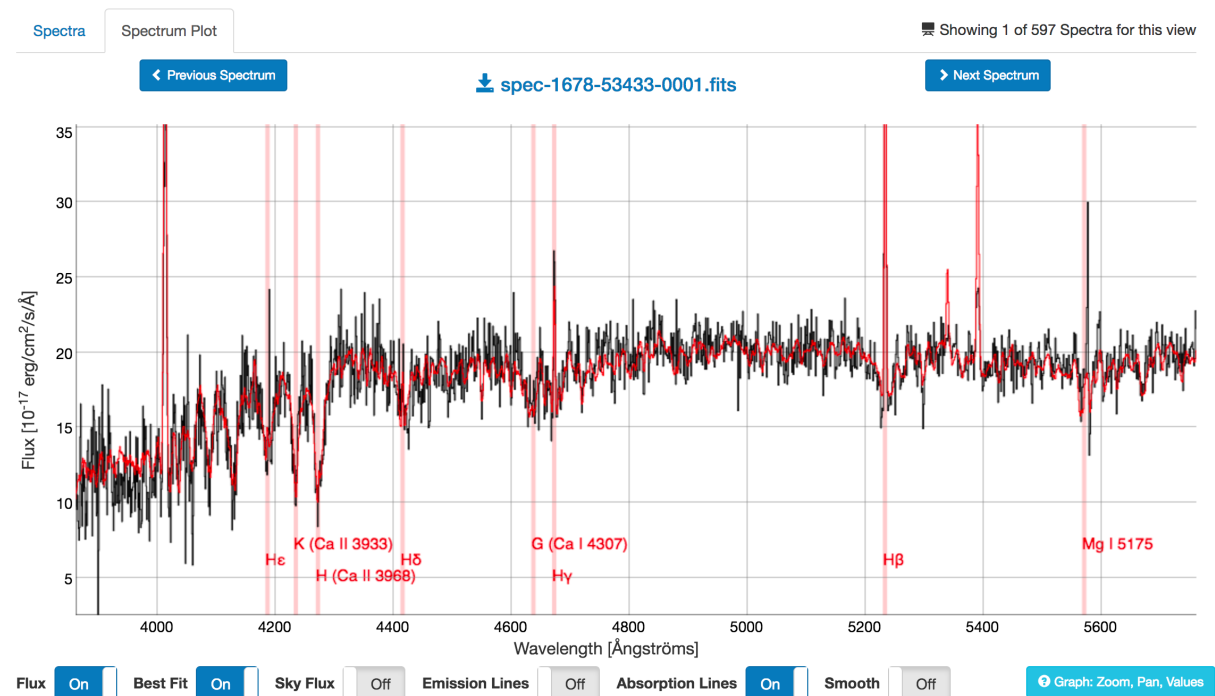
Survey: sdss Program: legacy Target: GALAXY RED GALAXY  
 Run: SDSS-III, Run-66, TRIM, Trunc-1875, Trunc-1875, Run-1875  
 Field: 2017-12-0107 Name: GALAXY STATIONARY  
 Wavelength: 4000-9000

Spectrograph	
class	GALAXY
Redshift (z)	0.040
Redshift error	0.00001
Redshift flags	MANY_OUTLIERS
survey	sdss
programname	legacy
primary	1
Other spec	0
sourcetype	GALAXY
Velocity dispersion (km/s)	241.21
veldisp_error	7.496
targeting_flags	GALAXY GALAXY_RED
plate	1678
mjd	53433
fiberid	425

# Interacting with the spectra

We would like the ability to:

- Zoom into any part of the spectrum
- Change the smoothing
- Superpose best-fit model(s)
- Show difference (residuals) between spectrum and model
- Indicate position of emission & absorption lines
- Show estimated noise per pixel
- Show background sky
- Show mask bits
- Show spectral resolution



## PFS-specific thoughts

- The provenance of our spectra may be complicated, with multiple exposures over multiple times. We need to make this history apparent to the user. We may want the ability to look at subsets of the data taken at different times for a given object.
- PFS cosmology spectra will mostly be very low S/N, with 1-2 emission lines, and little continuum. How best to present the data in this context?
- PFS galaxy evolution spectra will often also be low S/N. We will want to smooth in various ways, to emphasize different features. Or to zoom into Ly alpha.
- PFS galactic archeology spectra will be higher S/N. They may want the ability to subtract continuum, superpose atmosphere models. Not needed within hscMap?
- Scientists will want to stack spectra. But this may be best done outside database/hscMap.