

Marvin

A Toolkit for Streamlined Access and
Visualization of the SDSS-IV MaNGA Data Set

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sdss-marvin.readthedocs.io

What is MaNGA?

www.sdss.org/dr15

SDSS Legacy

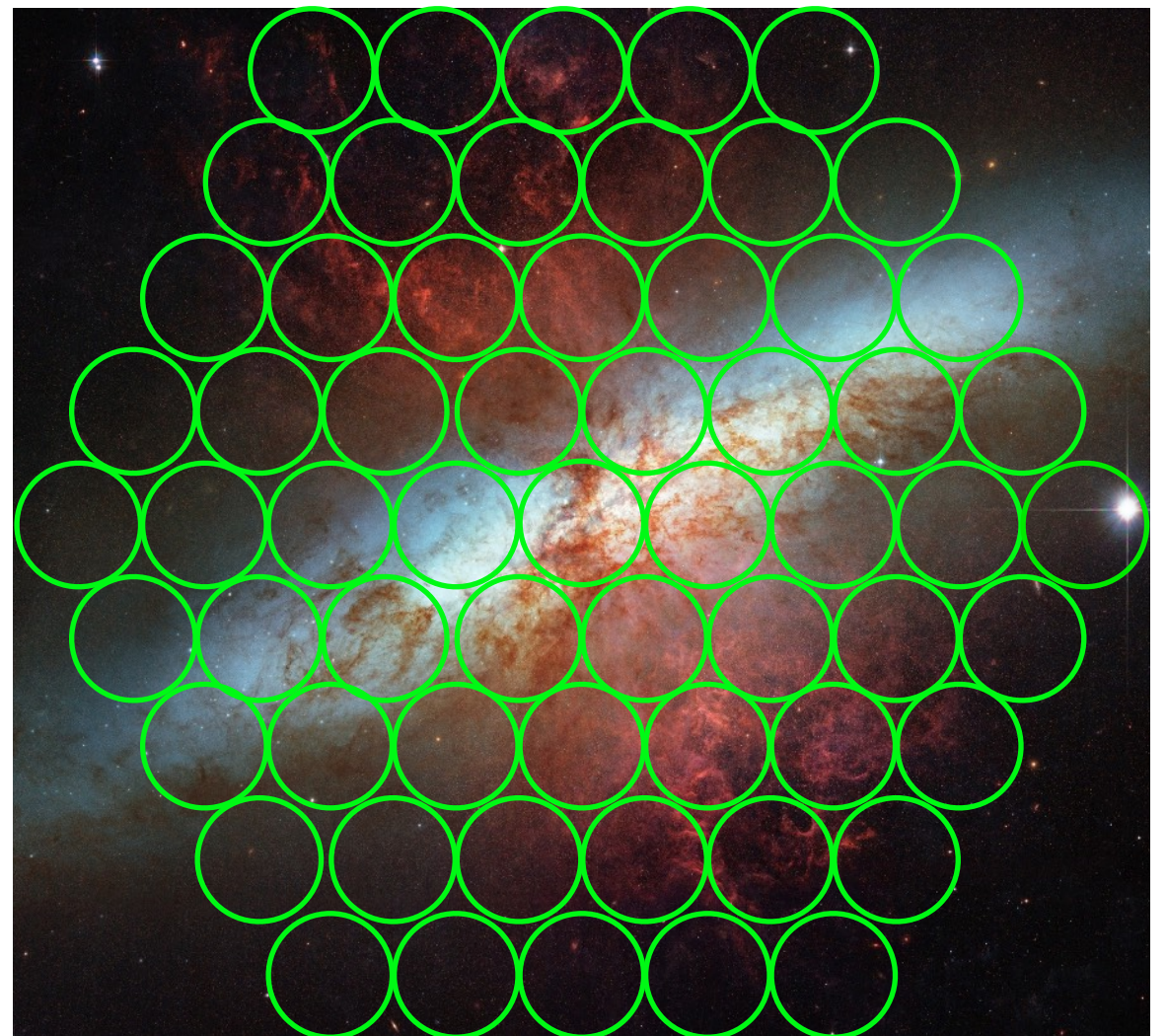
Single Fiber Spectroscopy



www.sdss.org/dr15/manga

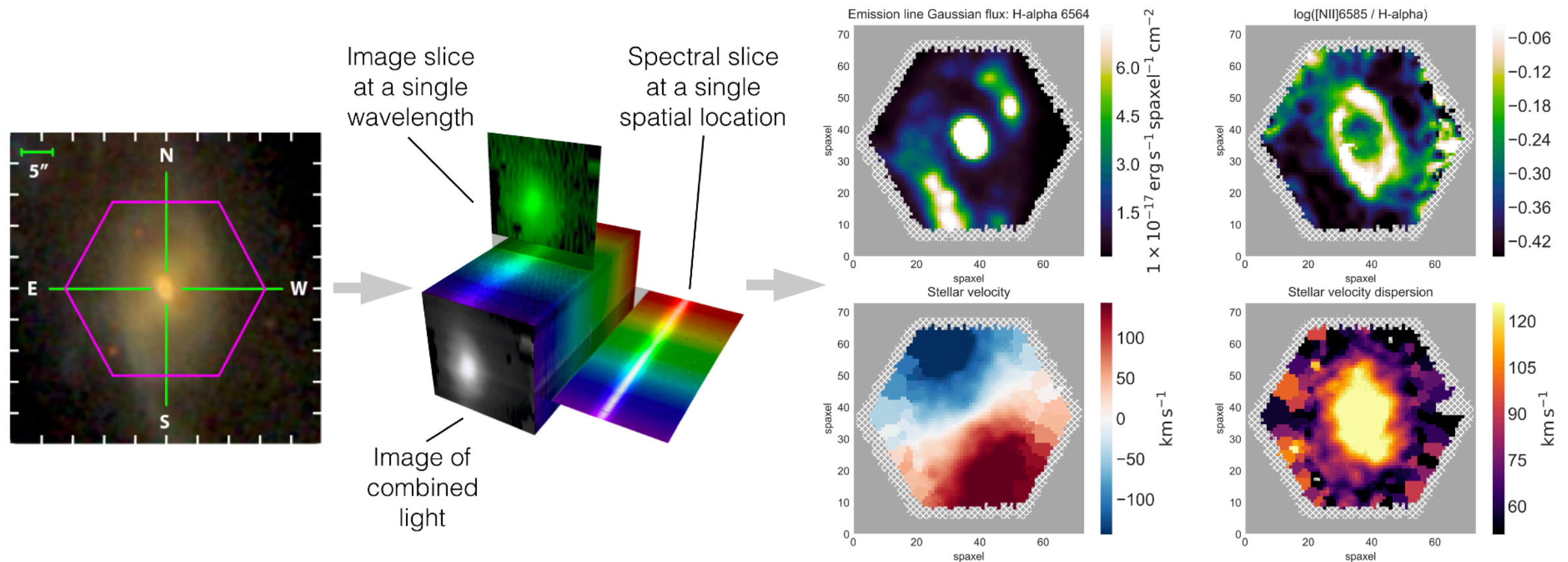
MaNGA

Integral Field Spectroscopy



- wide-field optical IFU survey targeting 10,000 galaxies

MaNGA Data Products



- **Products:** 3d DataCubes, Row-Stacked Spectra, 2d Analysis Maps, and 3d ModelCubes (<https://www.sdss.org/dr15/manga/>)
- 14 data files per galaxy; **Final Release:** ~140,000 data files; 10 TB of data on disk; 35 TB database; ~trillion pixel elements
- How to connect and deliver these products and information?
- How to facilitate quick exploration and visualization?

Our Goals

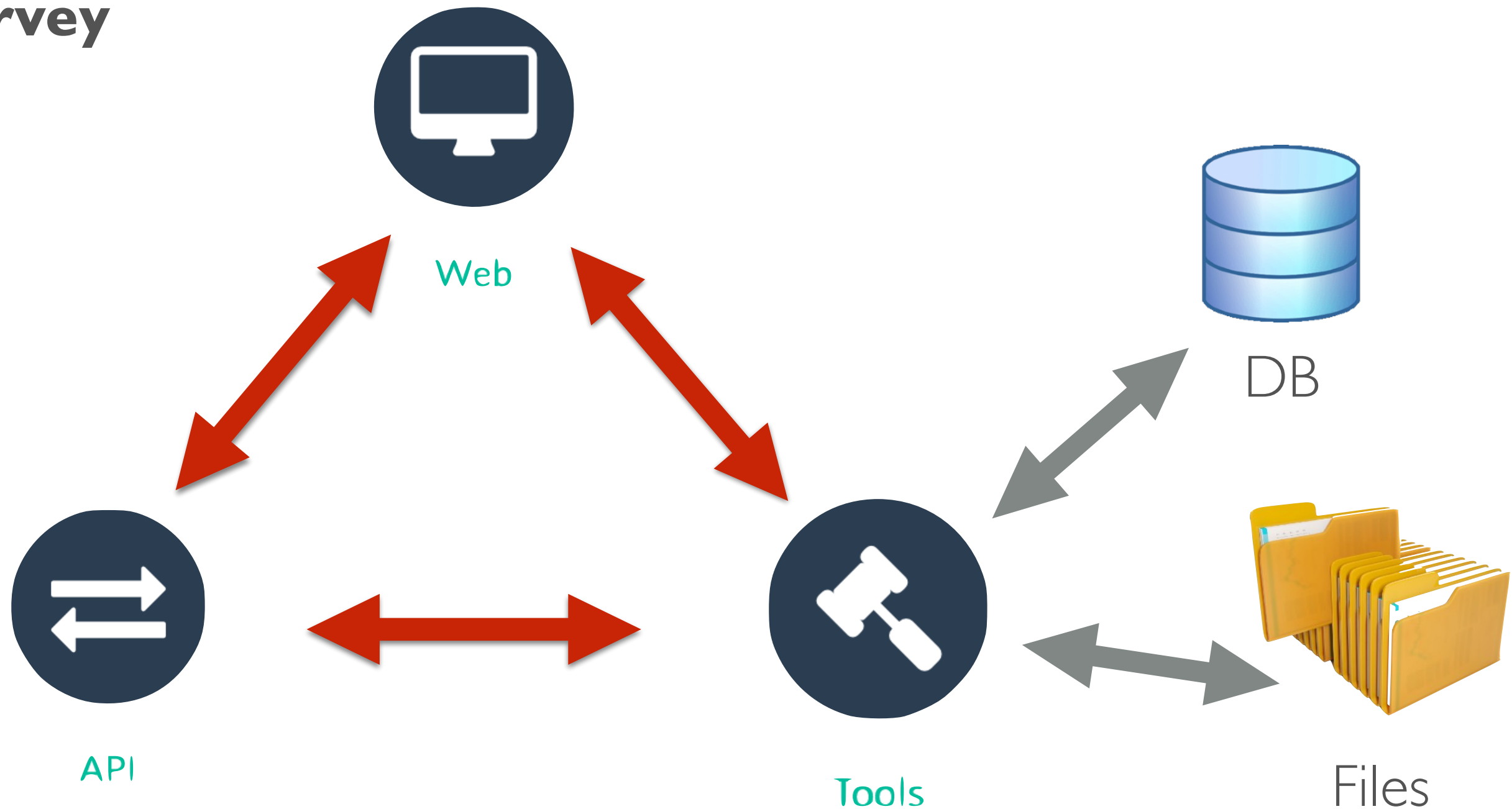
- How to connect and deliver these products and information?
- How to facilitate quick exploration and visualization?
- SDSS clientele (high school students to power astronomy users)
- SDSS science spans a broad and unknown space

Marvin is MaNGA's attempt to address these issues

- Goals
 - Eliminate as much overhead as possible
 - Shift the focus to the Science rather than logistics
 - Don't waste time reinventing wheels
 - To lower the barrier of entry for everyone

What is Marvin?

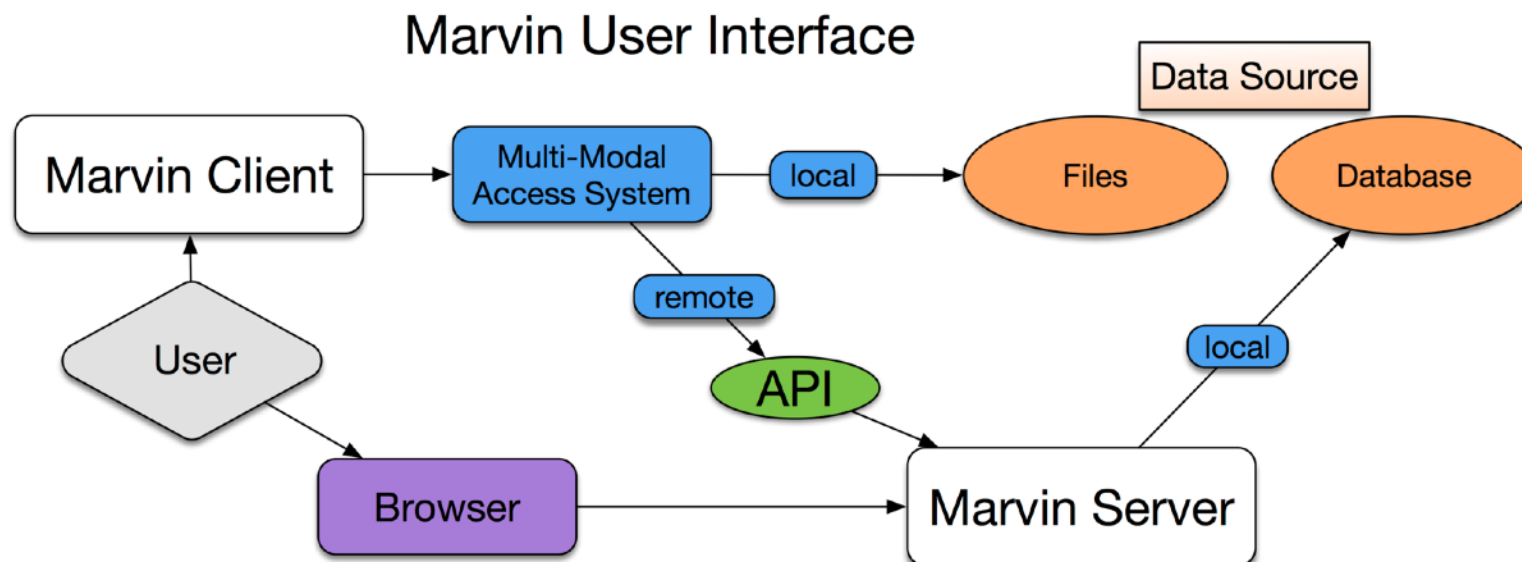
Software Suite for the SDSS-IV MaNGA survey



Core Idea : Smart Multi-Modal Data Access System

Intuitive Data Access

- Provide user-unaware local/remote data access to MaNGA data.



```
from marvin.tools.cube import Cube
```

```
# local file
```

```
c = Cube('/Users/Brian/Work/Manga/redux/v2_3_1/8485/stack/manga-8485-1901-LOGCUBE.fits.gz')
<Marvin Cube (plateifu='8485-1901', mode='local', data_origin='file')>
```

```
# local database or file
```

```
c = Cube('8485-1901')
<Marvin Cube (plateifu='8485-1901', mode='local', data_origin='db')>
```

```
-or-
```

```
<Marvin Cube (plateifu='8485-1901', mode='local', data_origin='file')>
```

```
# remote
```

```
c = Cube('8485-1902')
```

```
WARNING: local mode failed. Trying remote now.
```

```
<Marvin Cube (plateifu='8485-1902', mode='remote', data_origin='api')>
```

Connected Data Products

- Python Tools seamlessly connect all data files/products

```
from marvin.tools import Cube
```

```
# retrieve a remote data cube
```

```
cube = Cube('7443-12703')
```

```
<Marvin Cube (plateifu='7443-12703', mode='remote', data_origin='api')>
```

```
# retrieve the H-alpha flux map
```

```
maps = cube.getMaps()
```

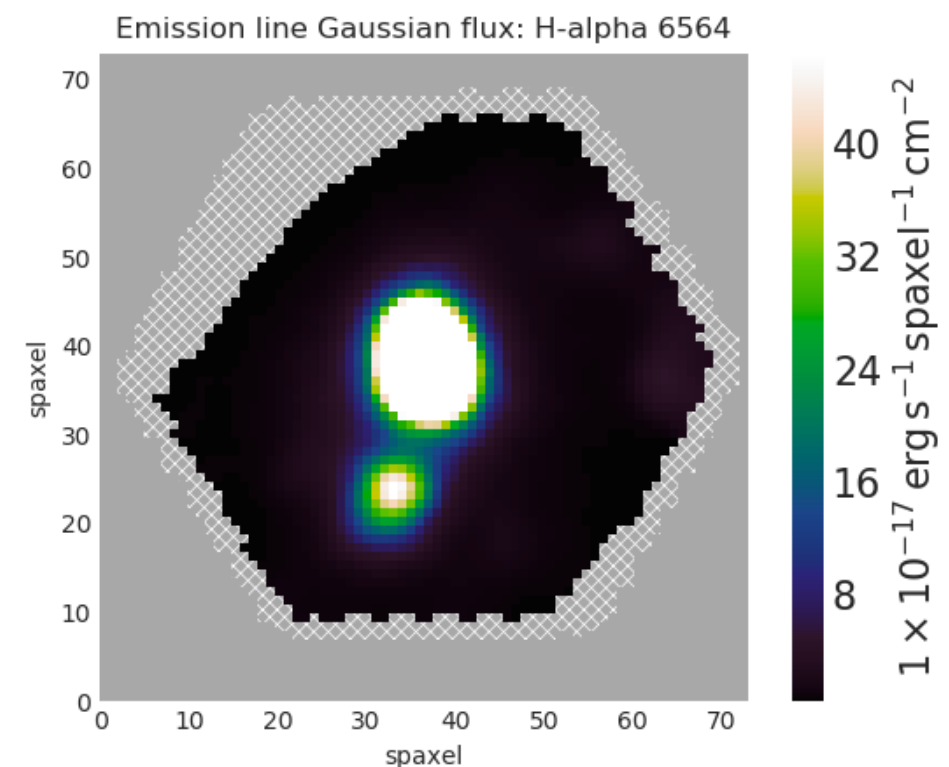
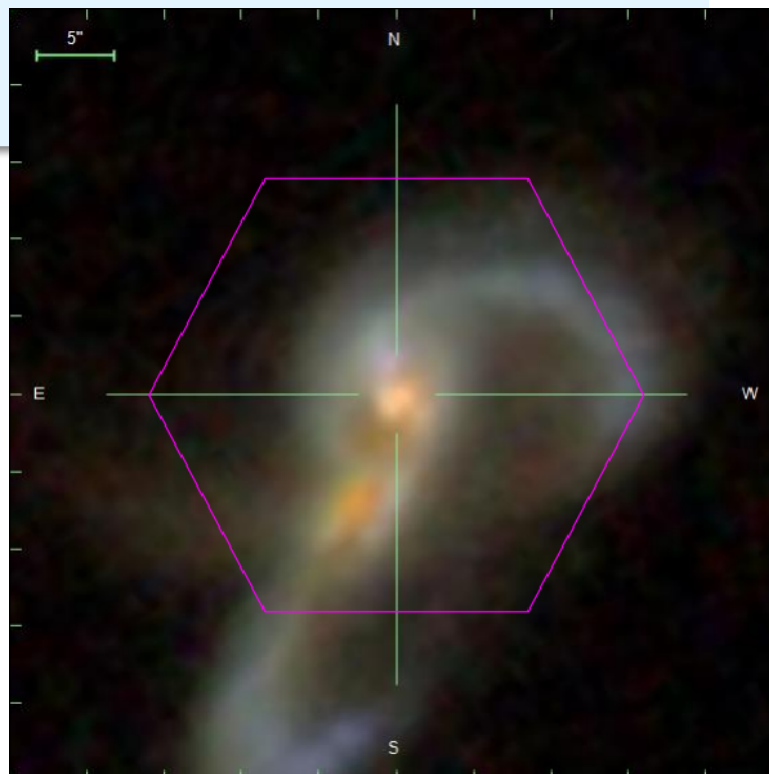
```
ha = maps.emline_gflux_ha_6564
```

```
ha.plot()
```

```
# retrieve the PNG image
```

```
image = cube.getImage()
```

```
image.plot()
```



Simplified Query System

- All MaNGA data stored in databases ; searchable using SQL language
- Currently query on galaxy metadata and inter-galaxy properties!
- Utilizes “Query Syntax Parser” to simplify the writing of queries
- Abstract away SQL details into Python programmatic interface
- **No need to know exact SQL or the database schema design.**

“give me all galaxies at $z < 0.1$ with stellar mass $> 1.e9$, with their g-r colors as well”

Simplified Query System

“give me all galaxies at $z < 0.1$ with stellar mass $> 1.e9$, with their g-r colors as well”

full sql syntax

```
SELECT mangadatadb.cube.mangaid, concat(mangadatadb.cube.plate, '-',  
mangadatadb.ifudesign.name) AS "cube.plateifu", mangasampledbs.nsa.elpetro_absmag[3] -  
mangasampledbs.nsa.elpetro_absmag[4] AS elpetro_absmag_g_r, mangasampledbs.nsa.elpetro_mass,  
mangasampledbs.nsa.z, FROM mangadatadb.cube JOIN mangadatadb.ifudesign ON  
mangadatadb.ifudesign.pk = mangadatadb.cube.ifudesign_pk JOIN mangasampledbs.manga_target ON  
mangasampledbs.manga_target.pk = mangadatadb.cube.manga_target_pk JOIN  
mangasampledbs.manga_target_to_nsa ON mangasampledbs.manga_target.pk =  
mangasampledbs.manga_target_to_nsa.manga_target_pk JOIN mangasampledbs.nsa ON  
mangasampledbs.nsa.pk = mangasampledbs.manga_target_to_nsa.nsa_pk JOIN  
mangadatadb.pipeline_info AS drpalias ON drpalias.pk = mangadatadb.cube.pipeline_info_pk  
WHERE mangasampledbs.nsa.z < 0.1 AND mangasampledbs.nsa.elpetro_mass > 1000000000.0 AND  
drpalias.pk = 29
```

Simplified Query System

“give me all galaxies at $z < 0.1$ with stellar mass $> 1.e9$, with their g-r colors as well”

pseudo sql syntax

```
f = 'nsa.z < 0.1 and nsa.elpetro_mass > 1.E9'  
q = Query(searchfilter=f, returnparams=[ 'absmag_g_r' ])
```

```
SELECT mangadatadb.cube.pipeline_info AS drpalias, mangasampledbs.nsa.elpetro_absmag[0]  
mangasampledbs.nsa.elpetro_absmag[4] AS elpetro_absmag_g_r,  
mangasampledbs.nsa.elpetro_mass, mangasampledbs.nsa.z, FROM mangadatadb.cube JOIN  
mangadatadb.ifudesign ON mangadatadb.ifudesign.pk = mangadatadb.cube.ifudesign_pk JOIN  
mangasampledbs.manga_target ON mangasampledbs.manga_target.pk =  
mangadatadb.cube.manga_target_pk JOIN mangasampledbs.manga_target_to_nsa ON  
mangasampledbs.manga_target.pk = mangasampledbs.manga_target_to_nsa.manga_target_pk JOIN  
mangasampledbs.nsa ON mangasampledbs.nsa.pk = mangasampledbs.manga_target_to_nsa.nsa_pk  
JOIN mangadatadb.pipeline_info AS drpalias ON drpalias.pk = mangadatadb.cube.pipeline_info_pk  
WHERE mangasampledbs.nsa.z < 0.1 AND mangasampledbs.nsa.elpetro_mass > 1000000000.0 AND  
drpalias.pk = 29
```

Clean Simple Web

Marvin [Github](#) [Help](#) [Cite Us](#) [Query](#) MPL-6 What's New Known Issues Provide Feedback Login

Plate-IFU: 8485-1901 v2_3_1

Manga-ID: 1-209232

IAU Name: J153010.73+484124.8

OBJ RA, Dec	232.544703894	48.6902009334
IFU Glon, Glat	78.9550411299	52.6212190954
SN2 Blue, Red	19.98	42.98
Date Observed	2015-04-20	
DAP Output	DAP URL	

Cube Quality: Good

Bit: 0 [Flags](#)

[Download](#)

[Go to SkyServer](#)

MaNGA Target

Galaxy Bit: 2336 [Flags](#)

[Map/SpecView On](#)

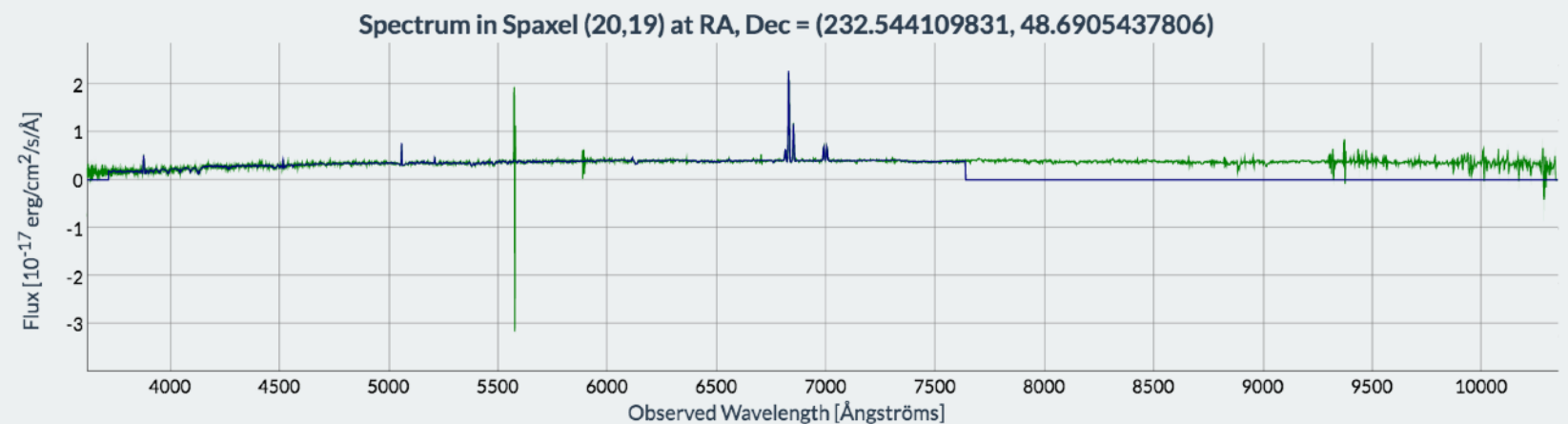
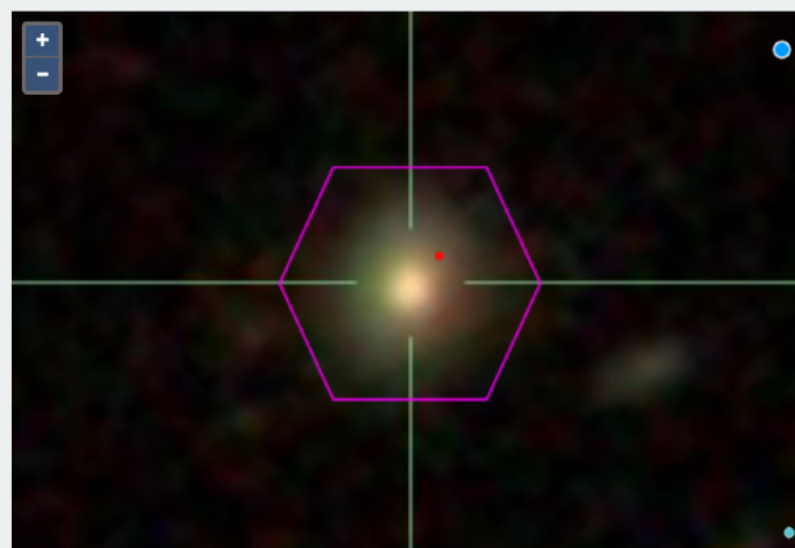
[Use this cube in Python](#)

[Use the spectrum in Python](#)

Marvin Cube - start iPython

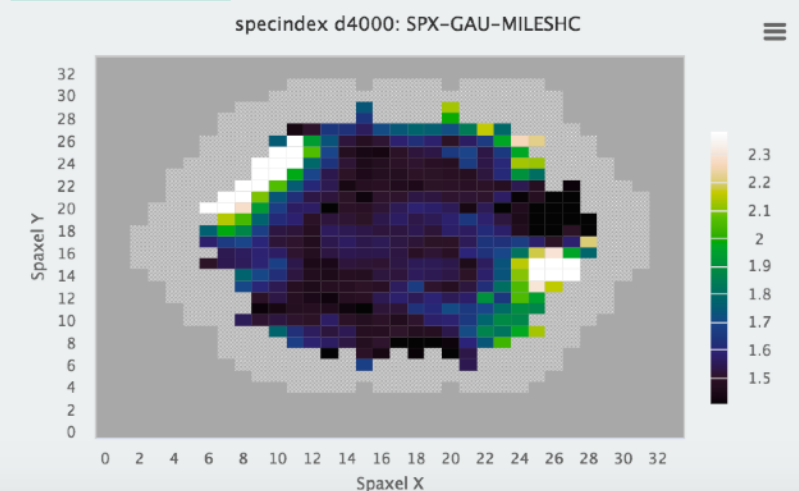
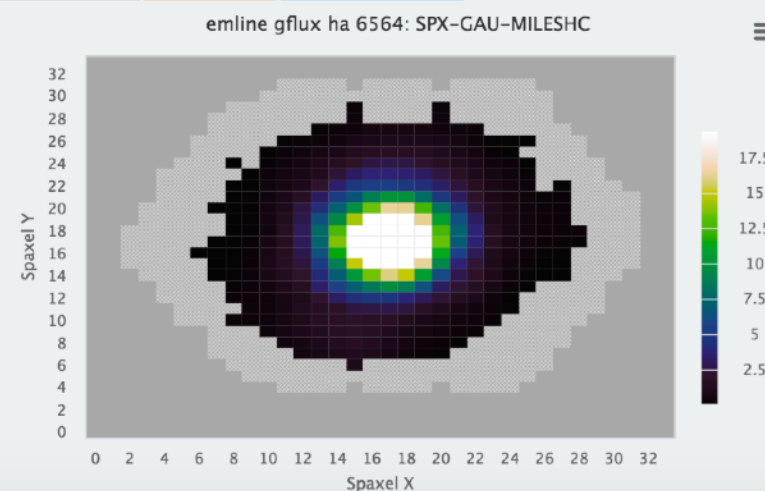
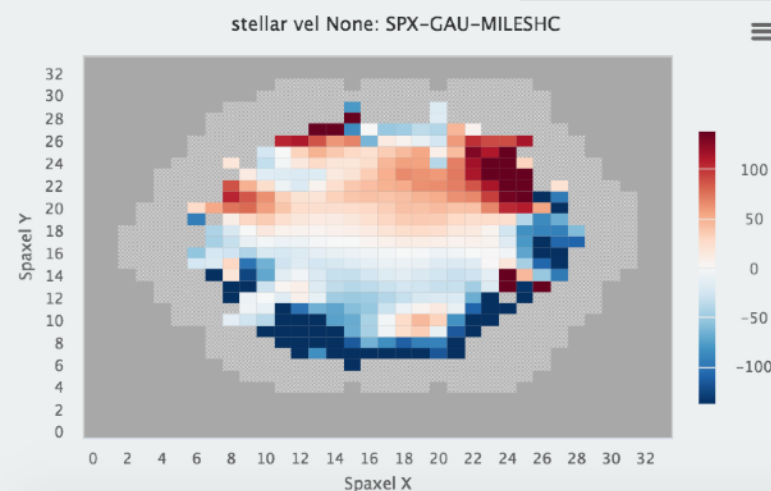
```
from marvin.tools.cube import Cube
cube = Cube(plateifu='8485-1901')
# access the header
cube.header
# get NSA data
cube.nsa
```

MapSpec View [Galaxy Properties](#)



DAP Maps: 3 items selected SPX-GAU-MILES HC [Get Maps](#) [Reset Selection](#)

[Use maps in Python](#)



Resources

- **pip install sdss-marvin**
- **Web** - <https://dr15.sdss.org/marvin/>
- **Github** - <https://github.com/sdss/marvin>
- **Documentation** - <https://sdss-marvin.rtf.d.io/en/latest/>
- **Marvin on SDSS** - www.sdss.org/dr15/manga/marvin/
- **General MaNGA info** - www.sdss.org/dr15/manga
- **Tutorials on SciServer** - see SciServer Demo booth
- **Paper** - <https://ui.adsabs.harvard.edu/abs/2019AJ....158...74C>