Marvin
A Toolkit for Streamlined Access and Visualization of the SDSS-IV MaNGA Data Set
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What is MaNGA?

SDSS Legacy
Single Fiber Spectroscopy

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.

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

full sql syntax

```
```
“give me all galaxies at $z < 0.1$ with stellar mass $> 1.0 \times 10^9$, with their g-r colors as well”

pseudo sql syntax

```sql
```

```python
f = 'nsa.z < 0.1 and nsa.elpetro_mass > 1.0E9'
q = Query(searchfilter=f, returnparams=['absmag_g_r'])
```
Resources

- **pip install sdss-marvin**
- **Web** - https://dr15.sdss.org/marvin/
- **Github** - https://github.com/sdss/marvin
- **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