AggieSTAAR Python Bootcamp

Tutorial 4: Tables and plotting

TEXAS A&M UNIVERSITY

To-do:

Open up Jupyter lab through Anaconda, or by typing “jupyter lab” into a terminal, and open up tutorial4_tables.ipynb.

To complete both exercises in the tutorial, you will need to have numpy and astropy installed, as well as ngvs_ucd_tab4.txt downloaded in the same folder as tutorial4_tables.ipynb.

Tables

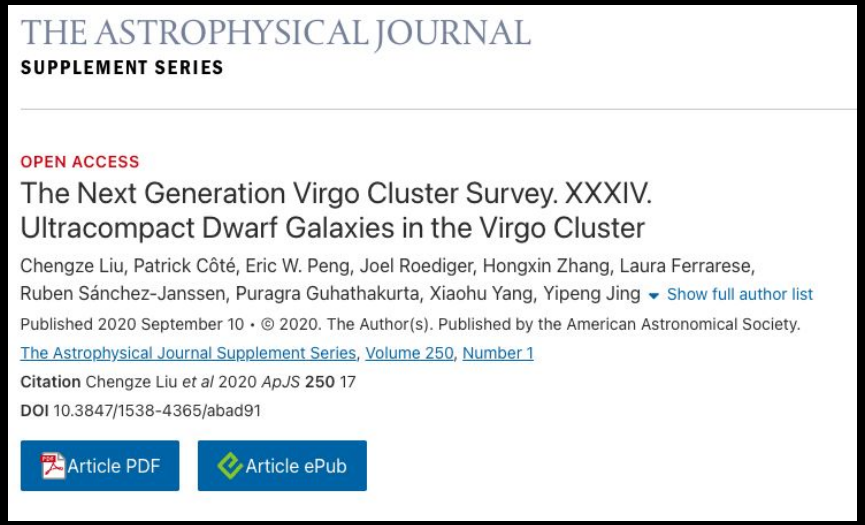
Tables are your best friends when working with large sets of data!

There are many ways to open tables in Python:

- numpy
- pandas
- open()
- astropy

In this tutorial, we will use astropy.tables.

Saving tables from a paper



THE ASTROPHYSICAL JOURNAL
SUPPLEMENT SERIES

OPEN ACCESS

The Next Generation Virgo Cluster Survey. XXXIV. Ultracompact Dwarf Galaxies in the Virgo Cluster

Chengze Liu, Patrick Côté, Eric W. Peng, Joel Roediger, Hongxin Zhang, Laura Ferrarese, Ruben Sánchez-Janssen, Puragra Guhathakurta, Xiaohu Yang, Yipeng Jing ▾ Show full author list

Published 2020 September 10 • © 2020. The Author(s). Published by the American Astronomical Society.

The Astrophysical Journal Supplement Series, Volume 250, Number 1

Citation Chengze Liu *et al* 2020 *ApJS* **250** 17

DOI 10.3847/1538-4365/abad91

Article PDF Article ePub

Go to the online paper, download as ASCII. Most journals will have this (or a similar) option.

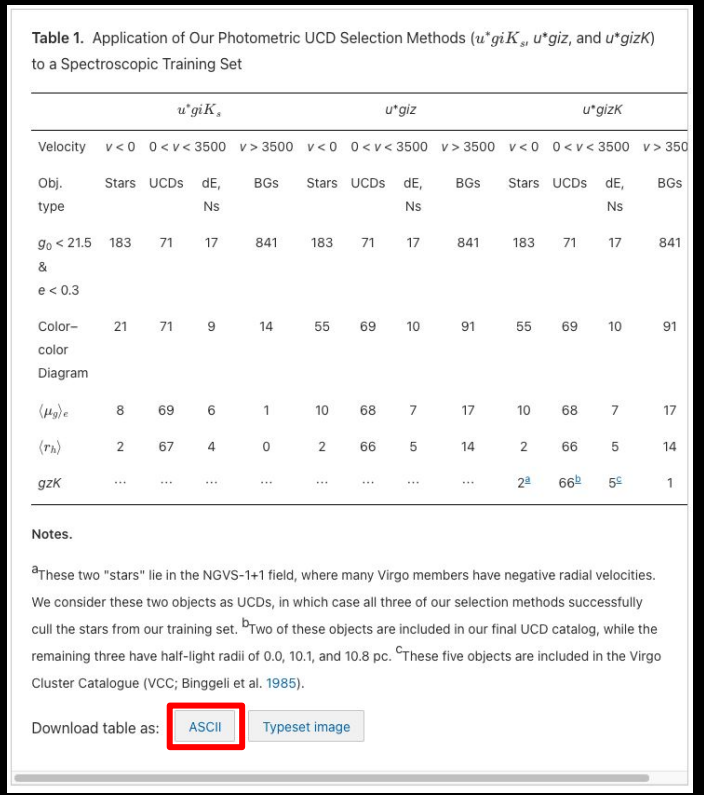


Table 1. Application of Our Photometric UCD Selection Methods (u^*giK_s, u^*giz, and u^*gizK) to a Spectroscopic Training Set

	u^*giK_s				u^*giz				u^*gizK			
Velocity	$v < 0$	$0 < v < 3500$		$v > 3500$	$v < 0$	$0 < v < 3500$		$v > 3500$	$v < 0$	$0 < v < 3500$		$v > 350$
Obj. type	Stars	UCDs	dE, Ns	BGs	Stars	UCDs	dE, Ns	BGs	Stars	UCDs	dE, Ns	BGs
$g_0 < 21.5$ & $e < 0.3$	183	71	17	841	183	71	17	841	183	71	17	841
Color–color Diagram	21	71	9	14	55	69	10	91	55	69	10	91
$\langle \mu_g \rangle_e$	8	69	6	1	10	68	7	17	10	68	7	17
$\langle r_h \rangle$	2	67	4	0	2	66	5	14	2	66	5	14
gzK	...	...	...	...	...	...	...	...	2[a]	66[b]	5[c]	1

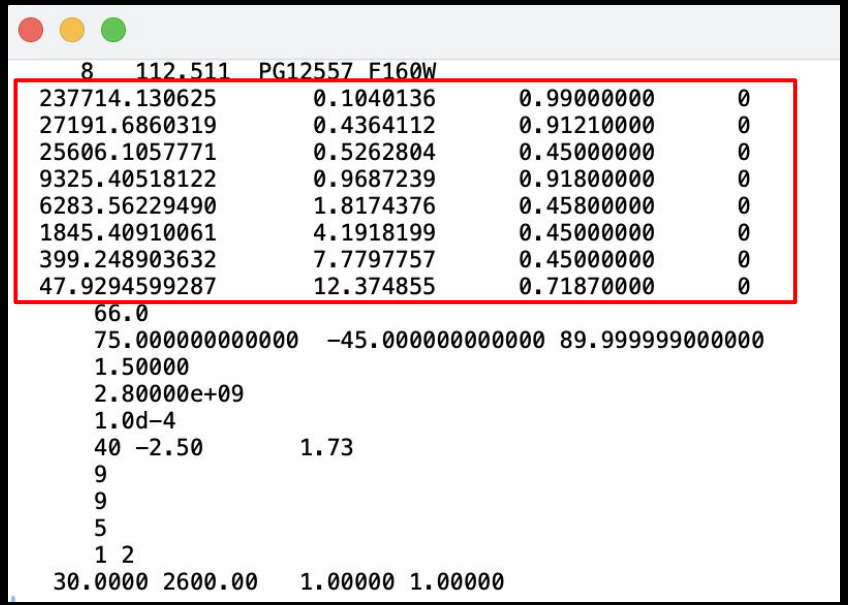
Notes.

[a]These two "stars" lie in the NGVS-1+1 field, where many Virgo members have negative radial velocities. We consider these two objects as UCDs, in which case all three of our selection methods successfully cull the stars from our training set. [b]Two of these objects are included in our final UCD catalog, while the remaining three have half-light radii of 0.0, 10.1, and 10.8 pc. [c]These five objects are included in the Virgo Cluster Catalogue (VCC; Binggeli et al. 1985).

Download table as: ASCII Typeset image

Soft requirements for tables

astropy.tables only really work with nicely formatted tables:



```
    8   112.511  PG12557 F160W
237714.130625        0.1040136       0.99000000       0
27191.6860319        0.4364112       0.91210000       0
25606.1057771        0.5262804       0.45000000       0
9325.40518122        0.9687239       0.91800000       0
6283.56229490        1.8174376       0.45800000       0
1845.40910061        4.1918199       0.45000000       0
399.248903632        7.7797757       0.45000000       0
47.9294599287        12.374855       0.71870000       0
     66.0
     75.000000000000  -45.000000000000 89.999999000000
     1.50000
     2.80000e+09
     1.0d-4
     40 -2.50       1.73
     9
     9
     5
     1 2
  30.0000 2600.00   1.00000 1.00000
```

Here, I only want the four column table highlighted in red. astropy.tables won't be able to ignore all of the other text; I have to manually format the table.

Reading in tables

Use ascii.read() to load in tables. You need the table text file name and location.

```
data = ascii.read('./ngvs_ucd_tab4.txt')
data
```

Table length=828

Name	MB	MV	rh	e_rh	Mstar	HRV	r_HRV	Class	Envelope	Method	OName
	mag	mag	pc	pc	dex(Msun)	km / s					
str11	float64	float64	float64	float64	float64	int64	str33	int64	int64	str2	str19
NGVS-UCD1	-11.62	-11.38	14.03	0.39	6.5	-38	SDSS	5	0	m1	--
NGVS-UCD2	-9.68	-9.21	29.86	0.76	6.3	--	--	1	0	m5	--
NGVS-UCD3	-9.27	-8.76	15.34	0.38	6.1	--	--	1	0	m5	--
NGVS-UCD4	-9.7	-9.27	29.48	0.54	6.2	--	--	1	0	m5	--
NGVS-UCD5	-9.33	-8.8	22.44	0.28	6.1	--	--	3	0	m5	--
NGVS-UCD6	-9.36	-8.93	24.29	1.07	6.0	--	--	1	0	m5	--
NGVS-UCD7	-9.4	-8.97	24.51	0.37	6.1	--	--	1	0	m5	--
NGVS-UCD8	-9.41	-8.95	23.33	0.37	6.2	--	--	1	0	m5	--
NGVS-UCD9	-9.3	-8.8	25.0	0.68	6.2	--	--	1	0	m5	--

Header names are listed here.

Some columns have units!

Column types here. You cannot mix and match!

Rows and columns

Rows: accessed with regular Python indexing.

```
first_row = data[0]
print(first_row)
```

```
   Name      MB      MV      rh   e_rh    Mstar     HRV    r_HRV Class Envelope Method OName
            mag     mag      pc    pc  dex(Msun) km / s
--------- ------ ------ ------ ------ --------- ------ ----- ----- -------- ------ -----
NGVS-UCD1 -11.62 -11.38  14.03   0.39       6.5    -38  SDSS     5        0     m1    --
```

```
data['Mstar'][3]
```

✓ 0.0s

```
6.2
```

Columns: accessed by calling headers.

```
stellar_mass = data['Mstar']
print(stellar_mass)
```

```
  Mstar
dex(Msun)
---------
      6.5
      6.3
      6.1
      6.2
```

Can be combined to find certain values: 4th row in the Mstar column.

Constraints

Constraints: probably the most powerful function that astropy tables has! Think of it as a filter.

Stellar class	Temperature	Constraint
O	20,000K	True
B	10,000K	False
A	5,000K	False

Stellar class	Temperature
O	20,000K

Say we apply a constraint of >15,000K to this table. We can apply the constraint array to our original table to get a cropped table.

Modifying and writing tables

- You can add, delete, and replace columns.
- Individual values in individual rows can be changed.
- Constraints can be placed on your tables.
- Write out tables using astropy.write().
    - Tables do not automatically overwrite, you may need to specify overwrite = True as a kwarg in astropy.write().