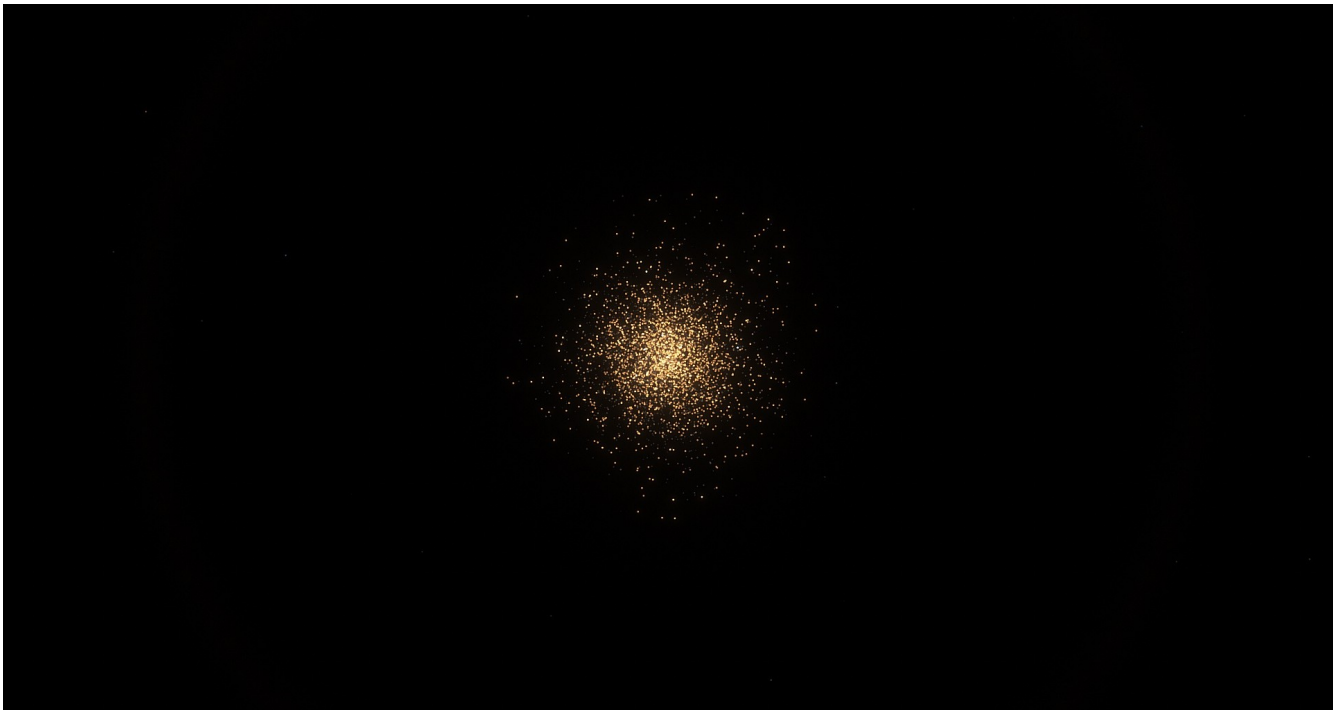
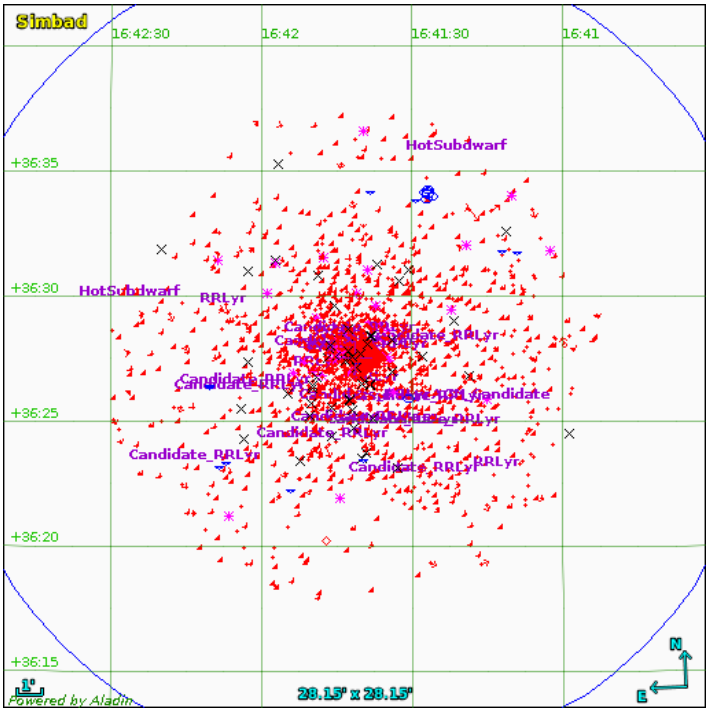
Mapping Star Clusters

2012/03/04

After talking with Dr. Seab yesterday, he thought it would be neat to make a 3d star map, where I feed some coordinates and it gives you a map of the region. I decided to start with the Hercules' Cluster since it's a dense region of space:



Researching, I found this



(http://simbad.u-strasbg.fr/simbad/sim-plot?ident=M+
+13&coo=16+41+41.634%2B36+27+40.75&radius.unit=arcmin&x=57&y=57&radius=10)

This website has an interactive map where you can click on the objects and it brings up the star in question. For example, http://simbad.u-strasbg.fr/simbad/sim-id?Ident=NGC
%20%206205%20%20%20%2045, which has information on it. I am mainly interested in a coordinate system, so I can map the stars relative to each other accurately on a plane, and the parallax, which gives me distance, so I can properly position them correctly in 3d space. It seems clicking on the outer stars gives me something I need, but the inner stars lack a parallax angle. Nonetheless, I think I can work with this.

Exploring the website for a bit, I found that you can collect the data.
http://simbad.u-strasbg.fr/simbad/sim-coo?
Coord=16+41+41.634%2B36+27+40.75&CooFrame=ICRS&CooEqui=2000.0&CooEpoch=J2000&Radius=10.0&Radius.unit=arcmin&submit=get+the+list+of+objects

There are around 9000 stars in this plot. It's way less than 300,000, which is how many are in the Hercules' cluster, but it's a great starting point and might be the best I can get it. It does have a list of distances in arcseconds, and it uses a consistent coordinate system called ICRS, or International Celestial Reference System, which seems to be very to equatorial coordinates used in hobby observational astronomy, which I am familiar with, and Dr. Seab is very familiar with, so he can possible be of great help with this part.

I noticed that there's a "Query" command being "coord 16 41 41.634+36 27 40.75 (ICRS, J2000, 2000.0), radius: 10.0 arcmin", which to me seem pretty intutitive. You choose a spot in the sky and the radius around it and it gives you your stars. Since, there seems to be no way to just download the current data. I wonder if I can pull it from their website in Python, so I will begin searching for a way to do so.

A beautiful thing about python is that there is almost always a library to do exactly what you want. In this case it's astroquery. This page tells me how to query SIMBAD, which is where I want to pull the data from.

https://astroquery.readthedocs.io/en/latest/simbad/simbad.html

To install it, I did it as you would any normal python package. I opened a terminal (Linux) and ran:

```
# pip install astroquery
```

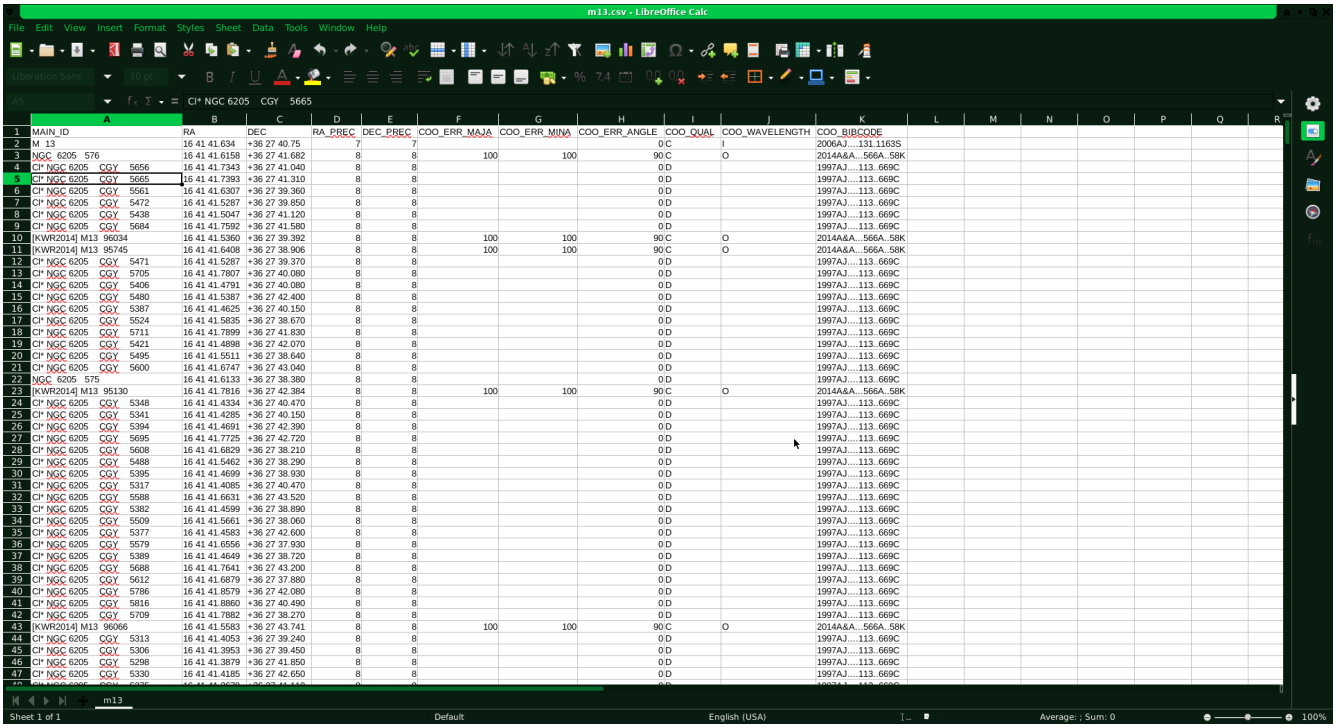
Then I ran a python3 environment and did the following commands

```
>>> from astroquery.simbad import Simbad
>>> result_table = Simbad.query_region("m13",radius='0d10m0s')
>>> print(result_table)
         MAIN_ID                RA      ...     COO_BIBCODE
                              "h:m:s"    ...
---------------------------- ------------ ... -------------------
                    M  13  16 41 41.634 ... 2006AJ....131.1163S
             NGC  6205   576 16 41 41.6158 ... 2014A&A...566A..58K
  Cl* NGC 6205    CGY    5656 16 41 41.7343 ... 1997AJ....113..669C
  Cl* NGC 6205    CGY    5665 16 41 41.7393 ... 1997AJ....113..669C
  Cl* NGC 6205    CGY    5561 16 41 41.6307 ... 1997AJ....113..669C
  Cl* NGC 6205    CGY    5472 16 41 41.5287 ... 1997AJ....113..669C
                     ...          ... ...              ...
    SDSS J164148.72+361755.2 16 41 48.7256 ... 2018yCat.1345....0G
  Cl* NGC 6205     CM       1 16 40 53.1433 ... 2018yCat.1345....0G
[SLB2011b] 250.61825+36.41084  16 42 28.381 ... 2009yCat.2294....0A
    SDSS J164212.27+361954.6 16 42 12.2725 ... 2018yCat.1345....0G
  Cl* NGC 6205    KAD     610 16 42 01.0633 ... 2018yCat.1345....0G
  Cl* NGC 6205    KAD     686 16 42 29.3988 ... 2018yCat.1345....0G
    SDSS J164228.01+362408.2 16 42 28.0162 ... 2018yCat.1345....0G
Length = 8239 rows
```

Which seems to be the same exact data I was looking for. I was able to write the data into a .csv file using Astropy

```
>>> from astropy.io import ascii
>>> ascii.write(result_table, 'm13.csv', format='csv', fast_writer=False)
```

The file can be read in excel for convenience, or in my case, since I don’t have access to excel because I use Linux, LibreOffice Calc can be used as well.



	A	B	C	D	E	F	G	H	I	J	K
1	MAIN_ID	RA	DEC	RA_PREC	DEC_PREC	COO_ERR_MAJA	COO_ERR_MINA	COO_ERR_ANGLE	COO_QUAL	COO_WAVELENGTH	COO_BIBCODE
2	M 13	16 41 41.634	+36 27 40.75	7	7			0	C	I	2006AJ....131.1163S
3	NGC 6205 576	16 41 41.6158	+36 27 41.682	8	8	100	100	90	C	O	2014A&A...566A..58K
4	Cl* NGC 6205 CGY 5656	16 41 41.7343	+36 27 41.040	8	8			0	D		1997AJ....113..669C
5	Cl* NGC 6205 CGY 5665	16 41 41.7393	+36 27 41.310	8	8			0	D		1997AJ....113..669C
6	Cl* NGC 6205 CGY 5561	16 41 41.6307	+36 27 39.360	8	8			0	D		1997AJ....113..669C
7	Cl* NGC 6205 CGY 5472	16 41 41.5287	+36 27 39.850	8	8			0	D		1997AJ....113..669C
8	Cl* NGC 6205 CGY 5438	16 41 41.5047	+36 27 41.120	8	8			0	D		1997AJ....113..669C
9	Cl* NGC 6205 CGY 5684	16 41 41.7592	+36 27 41.580	8	8			0	D		1997AJ....113..669C
10	[KWR2014] M13 96034	16 41 41.5360	+36 27 39.392	8	8	100	100	90	C	O	2014A&A...566A..58K
11	[KWR2014] M13 95745	16 41 41.6408	+36 27 38.906	8	8	100	100	90	C	O	2014A&A...566A..58K
12	Cl* NGC 6205 CGY 5471	16 41 41.5287	+36 27 39.370	8	8			0	D		1997AJ....113..669C
13	Cl* NGC 6205 CGY 5705	16 41 41.7807	+36 27 40.080	8	8			0	D		1997AJ....113..669C
14	Cl* NGC 6205 CGY 5406	16 41 41.4791	+36 27 40.080	8	8			0	D		1997AJ....113..669C
15	Cl* NGC 6205 CGY 5480	16 41 41.5387	+36 27 42.400	8	8			0	D		1997AJ....113..669C
16	Cl* NGC 6205 CGY 5387	16 41 41.4625	+36 27 40.150	8	8			0	D		1997AJ....113..669C
17	Cl* NGC 6205 CGY 5524	16 41 41.5835	+36 27 38.670	8	8			0	D		1997AJ....113..669C
18	Cl* NGC 6205 CGY 5711	16 41 41.7899	+36 27 41.830	8	8			0	D		1997AJ....113..669C
19	Cl* NGC 6205 CGY 5421	16 41 41.4898	+36 27 42.070	8	8			0	D		1997AJ....113..669C
20	Cl* NGC 6205 CGY 5495	16 41 41.5511	+36 27 38.640	8	8			0	D		1997AJ....113..669C
21	Cl* NGC 6205 CGY 5600	16 41 41.6747	+36 27 43.040	8	8			0	D		1997AJ....113..669C
22	NGC 6205 575	16 41 41.6133	+36 27 38.380	8	8			0	D		1997AJ....113..669C
23	[KWR2014] M13 95130	16 41 41.7816	+36 27 42.384	8	8	100	100	90	C	O	2014A&A...566A..58K
24	Cl* NGC 6205 CGY 5348	16 41 41.4334	+36 27 40.470	8	8			0	D		1997AJ....113..669C
25	Cl* NGC 6205 CGY 5341	16 41 41.4285	+36 27 40.150	8	8			0	D		1997AJ....113..669C
26	Cl* NGC 6205 CGY 5394	16 41 41.4691	+36 27 42.390	8	8			0	D		1997AJ....113..669C
27	Cl* NGC 6205 CGY 5695	16 41 41.7725	+36 27 42.720	8	8			0	D		1997AJ....113..669C
28	Cl* NGC 6205 CGY 5608	16 41 41.6829	+36 27 38.210	8	8			0	D		1997AJ....113..669C
29	Cl* NGC 6205 CGY 5488	16 41 41.5462	+36 27 38.290	8	8			0	D		1997AJ....113..669C
30	Cl* NGC 6205 CGY 5395	16 41 41.4699	+36 27 38.930	8	8			0	D		1997AJ....113..669C
31	Cl* NGC 6205 CGY 5317	16 41 41.4085	+36 27 40.470	8	8			0	D		1997AJ....113..669C
32	Cl* NGC 6205 CGY 5588	16 41 41.6631	+36 27 43.520	8	8			0	D		1997AJ....113..669C
33	Cl* NGC 6205 CGY 5382	16 41 41.4599	+36 27 38.890	8	8			0	D		1997AJ....113..669C
34	Cl* NGC 6205 CGY 5509	16 41 41.5661	+36 27 38.060	8	8			0	D		1997AJ....113..669C
35	Cl* NGC 6205 CGY 5377	16 41 41.4583	+36 27 42.600	8	8			0	D		1997AJ....113..669C
36	Cl* NGC 6205 CGY 5579	16 41 41.6556	+36 27 37.930	8	8			0	D		1997AJ....113..669C
37	Cl* NGC 6205 CGY 5389	16 41 41.4649	+36 27 38.720	8	8			0	D		1997AJ....113..669C
38	Cl* NGC 6205 CGY 5688	16 41 41.7641	+36 27 43.200	8	8			0	D		1997AJ....113..669C
39	Cl* NGC 6205 CGY 5612	16 41 41.6879	+36 27 37.880	8	8			0	D		1997AJ....113..669C
40	Cl* NGC 6205 CGY 5786	16 41 41.8579	+36 27 42.080	8	8			0	D		1997AJ....113..669C
41	Cl* NGC 6205 CGY 5816	16 41 41.8860	+36 27 40.490	8	8			0	D		1997AJ....113..669C
42	Cl* NGC 6205 CGY 5709	16 41 41.7882	+36 27 38.270	8	8			0	D		1997AJ....113..669C
43	[KWR2014] M13 96066	16 41 41.5583	+36 27 43.741	8	8	100	100	90	C	O	2014A&A...566A..58K
44	Cl* NGC 6205 CGY 5313	16 41 41.4053	+36 27 39.240	8	8			0	D		1997AJ....113..669C
45	Cl* NGC 6205 CGY 5306	16 41 41.3953	+36 27 39.450	8	8			0	D		1997AJ....113..669C
46	Cl* NGC 6205 CGY 5298	16 41 41.3879	+36 27 41.850	8	8			0	D		1997AJ....113..669C
47	Cl* NGC 6205 CGY 5330	16 41 41.4185	+36 27 42.650	8	8			0	D		1997AJ....113..669C

I will try to plot these stars in python so I can see if it indeed resembles M13.

END OF 2021/03/04