PX2155 Observational Techniques in Astronomy
Electronic Laboratory Diary
(Experiment title)
February 22, 2024
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1 Aims and Objectives

2 Plan

3 Risk Assessment

This experiment has little to no risk so it is safe to carry out the experiment.

Table 1: Risk Assessment

Risk	Mitigation
Tripping	Place trip hazards under desk
Electric shock	Do not drink water in the lab
Sitting for long period of time	Can cause wrist and band injuries so take frequent breaks to stand up and stretch.

4 Context:

5 Methods

This experiment was split into three parts: a) manually determing galaxy types and colours, b) using radial search to determine galaxy types and colours and c) tracking galaxy colours as a function of redshift. These three parts will allow an overview of how colour classifcationncan find the makeup and evolution of galxies in the universe.

5.1 Part A: Galaxy types and colours

A selection of 9 galaxies from *2023/24 - PX2155 Observational Techniques in Astronomy Laboratory Handbook* [2023] were classified by their type according to the Hubble's tuning fork diagram. The types as well as the Ra/Dec of each of these galaxies are shown in Table 2. The type of galaxy was determined by its shape and, for spiral galaxies, their arms.

To compare a manual classification with the colour-colour diagram technique the same 9 galaxies were located in the SDSS Object Explorer Tool [SDSS-OET, 2019] using data from Ahumada et al. [2020] and their colour magnitudes in the u, g and r filters were recorded. This data can be found in Table 3.

Table 2: Manual selection of galaxy types

Galaxy	a	b	c	d	e	f	g	h	i
RA	248.920	254.768	248.295	248.051	248.275	248.064	256.022	249.860	256.384
Dec	0.331	16.715	-0.213	-0.304	-0.189	-0.049	16.764	11.211	17.304
Type	E0	Sb	Sc	E5	E3	E0	E7	Sa	E0

The galaxies a to i are from *2023/24 - PX2155 Observational Techniques in Astronomy Laboratory Handbook* [2023] and the types were manually determined by their shapes

Table 3: Colour magnitudes of manual selection galaxies

Galaxy	a	b	c	d	e	f	g	h	i
u	17.15324	18.56369	16.63296	17.5638	16.33673	17.96088	18.04585	18.9135	16.59498
g	15.80188	16.72327	15.32729	16.44441	14.27109	16.19392	16.05928	16.92161	15.23521
r	15.18173	15.79623	14.6805	15.96938	13.33829	15.26711	15.11235	15.91144	14.62179

Found using the Object Explorer tool [SDSS-OET, 2019]. u is the ultraviolet magnitude, g is the green magnitude and r is the red magnitude.

5.2 Part B: Clusters of galaxies

Investigating the properties of individual galaxies is not a usefull metric when trying to predict behaviours of all galaxies in the universe. Finding the mean behaiours of a large number of galaxies is more insiteful way of finding galaxy properties. Galactic clusters have a large number of galaxies with similar redshifts and therefore the similar ages which allow for an anlysis of galactic classification. Abell 2255 (A2255) is a galactic cluster with 426 member galaxies [Shim et al., 2010] at Ra/Dec: 258.1292/+64.0925. Two techniques were used to find the colour magnitudes of member galaxies in A2255: manual selection of cluster members and radial search of the area of the cluster.

Manual selection of cluster members: The position of A2255 was entered into the SDSS Navigate Tool [SDSS-NT, 2019] and 21 galaxies were selected fro SDSS-NT [2019] is show in Figure 1. Three metrics were used to of A2255. Galaxies in the same cluster will have been redshifte ill be very similar. Therefore, cluster members were chosen b to y galaxies. Proximity, cluster members will be close by to each o account. Size, given that the members are at the same dista parison to galaxies that are closer or further away. The colour e

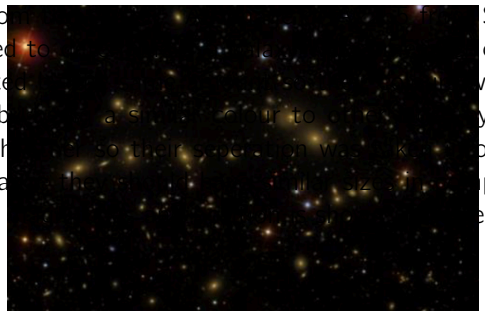

Figure 1

Table 4: Manual selection of A2255 members

Galaxy	RA	Dec	u	g	r
1	258.145	64.071	17.944	15.427	14.454
2	258.096	64.033	19.730	17.554	16.543
3	258.208	64.053	19.197	16.991	16.032
4	258.066	64.073	19.717	17.584	16.649
5	258.067	64.037	19.869	17.792	16.808
6	258.213	64.073	19.228	17.193	16.262
7	258.120	64.061	17.325	14.937	14.037
8	258.107	64.065	19.596	17.791	16.863
9	258.144	64.053	20.965	18.954	17.961
10	258.227	63.992	18.142	16.190	15.264
11	258.258	64.052	17.967	15.819	14.829
12	257.992	64.089	18.857	16.838	15.926
13	258.026	64.054	21.631	19.738	18.901
14	258.135	64.003	18.509	16.494	15.549
15	258.231	64.029	20.357	18.214	17.312
16	258.319	64.056	19.200	17.232	16.315
17	258.371	64.047	17.802	15.653	14.647
18	258.266	64.117	18.471	16.476	15.532
19	258.341	64.069	18.696	16.648	15.710
20	258.329	64.077	18.137	16.102	15.158
21	258.313	64.073	18.363	16.299	15.373

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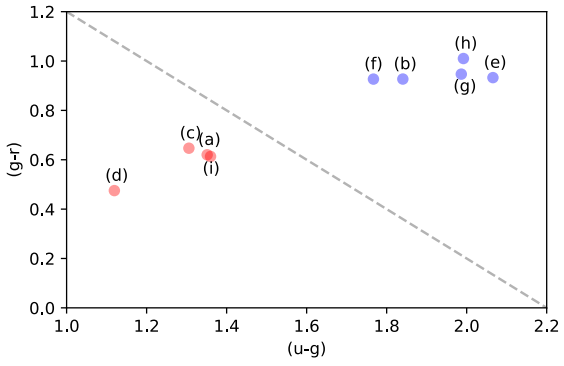
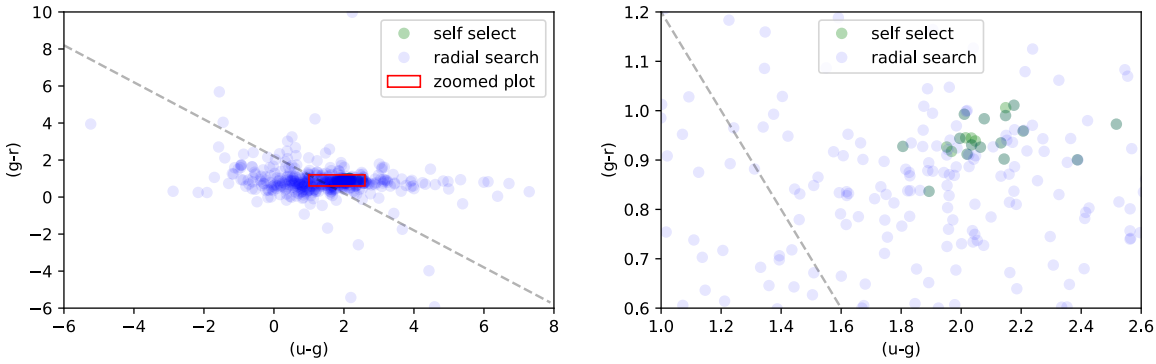


Figure 2:



(a) (b)

Figure 3:

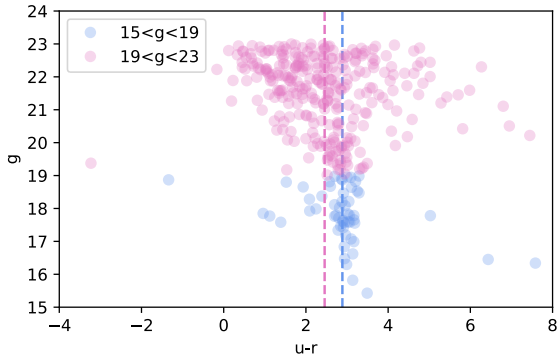


Figure 4:

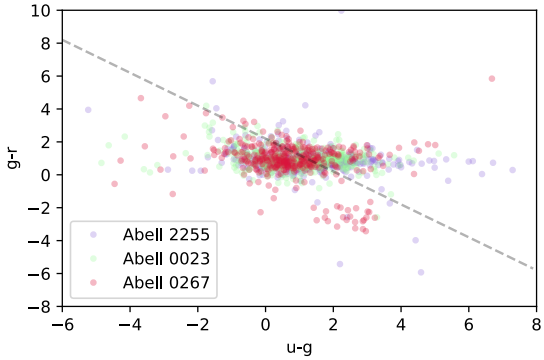
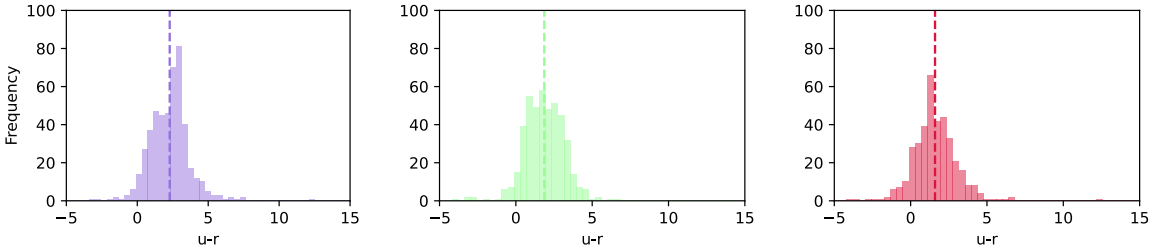
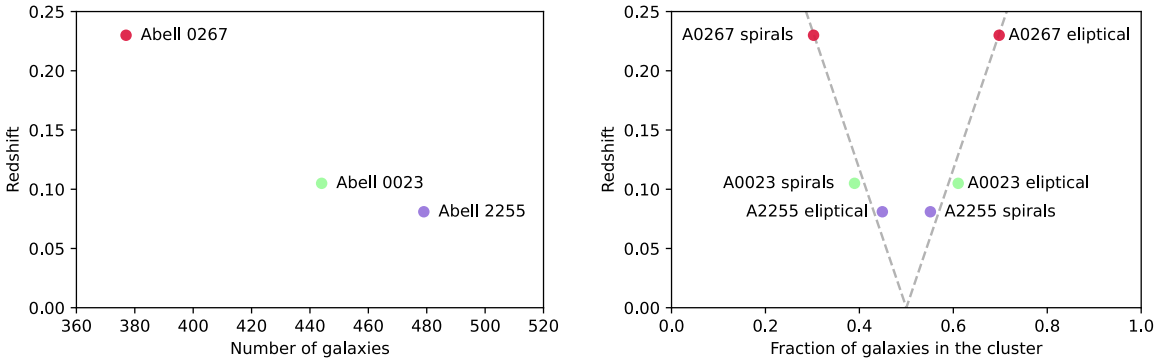


Figure 5:



(a) Abell 2255 (b) Abell 0023 (c) Abell 0267

Figure 6:



(a) (b)

Figure 7:

6 Results and discussion

7 Conclusion

References

2023/24 - PX2155 Observational Techniques in Astronomy Laboratory Handbook [2023].

Ahumada, R., Prieto, C. A., Almeida, A. and et al. [2020], 'The 16th data release of the sloan digital sky surveys: First release from the apogee-2 southern survey and full release of eboss spectra', *The Astrophysical Journal Supplement Series* **249**(1), 3.
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