

## The relation between stars and gas in distant galaxies

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Level 4 Project, MPhys Theoretical Physics

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Observing any galaxy in the universe will yield the fact that it contains stars and also gas. The dynamics of both can be explored by observing galaxies and collecting spectroscopic data.

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## 1. INTRODUCTION

Amongst the different types of cosmic structure within our universe, galaxies can be seen as the island powerhouses of industry and activity. Containing countless stars, gas, dust, and dark matter [1], it would be difficult not to express the statement that the motions of these objects must be linked in some form of a galactic relationship.

By utilising astronomy's most powerful tool, observation, galaxies, their structure and the motions of the objects within them can be studied to a great depth. For example if we took optical measurements of the stellar population, then we could use that information to estimate the potential age of the galaxy. [ref] Or if we wanted to know about the material composition or the distance to that galaxy, we could split the collected light in a spectrograph. [ref]

Gathering and processing this optical and spectroscopic data allows us to build a broad picture of the internal workings of a galaxy. However this picture would not be complete unless we had a general understanding of galaxies themselves.

### a. Galaxy classification

If we observed a large enough sample of galaxies then we would begin to see that some of them can be grouped together, this categorisation is called the *Hubble Sequence* or the *Hubble Tuning Fork*. With a horizontal handle and two prongs, the sequence itself does not show the evolution of the galaxies, rather it provides a way to view the possible different types of galaxies on one graph. [REF and show an example of the sequence - find some data and plot it? or images of galaxies?]

We introduced the concept that through optical measurements of the stars

What do I want to say with this? I want to introduce galaxies, the different types of galaxies, how they form, how they can be confused with other types of structure.

## 2. DATA

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### a. Hubble Ultra Deep Field

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### b. MUSE

To obtain spectroscopic information on the Hubble UDF objects, the Multi-Unit Spectroscopic Explorer or MUSE was employed. This instrument is

what is MUSE, where it is on the VLT, problems, limitations of MUSE - why it is useful...etc

### 3. ANALYSIS

#### a. pPXF

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### 4. DISCUSSION

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### 5. CONCLUSIONS

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### Acknowledgments

(OPTIONAL) The author would like to thank...

### References

- [1] Bradley W. Carroll and Dale A. Ostlie. An Introduction to Modern Astrophysics. Pearson, 2nd edition, 2007.