Plan of Proposal

Title: Statistically Constraining the Interacting Galaxy Population

Central Question(s) to Answer

The central question I want to answer here is to what extent a the environment around a galaxy impacts its morphology and type. The specific case I want to look into is with galaxy interaction. This will involve numerous prep before it can be done:

1. I need to actually find significant samples of different galaxy types. So, will need to scan the archives for them once again.
2. Will need to confirm the origins of most of them. Specifically:
   1. Spectroscopically confirm interacting galaxies.
   2. Intense follow-up on other kinds of galaxies.
3. Will need to develop algorithms for accurate measurement of the galactic environment.
4. At first, will control for morphological / tidal features:
   1. Use *Zoobot* which will already be incorporated into ESA pipeline.
5. Then, will control for more fundamental parameters:
   1. Stellar Masses
   2. Emission lines
   3. AGN Activity
   4. Star Formation Rates

What Results do I Hope to Achieve

1. Largest spectroscopically confirmed interacting galaxy catalogue.
2. A host of other catalogues of confirmed objects.
3. A large ancillary catalogue by combining searching the archives in this way with Euclid and JWST.
4. Analysis of said catalogue in terms of morphology.
5. Analysis of said catalogue in terms of parameterisation of sources.
   1. E.g. Masses, star formation rates, etc.
   2. Found using FAST, EAZY, LaPhare, etc.
6. These catalogues will be released for community use.
7. Importantly, where do all of these sources exist?
   1. In specific environments?
   2. At random?
8. The specific achievement of this will be the statistical significance of the release.

Specific Papers?

1. Analysis of followup of the O’Ryan+23 catalogue.
2. A large data release of gems of the archives – followed up by Euclid or JWST (look into)
3. A release of a parameterised catalogue, essentially COSMOS with JWST and Euclid.
4. Finally, the environments they all exist in and matching this to their parameterisation and morphology.

Timeline

Year 1

The timeline here is pretty simple, I think. In the first year, I’ve got to focus on getting permission to use JWST or Euclid to get decent spectroscopic data of a bunch of the interacting galaxies. As well as find emission lines to measure their stellar masses and such. It will also be important to find sources around them. I’m going to be attempting to calculate the environment they are in.

So, first year will consist of creating the proposal, followed by submitting it. I will also begin further analysis on the catalogue of O’Ryan+23, and potentially investigate further lowering the threshold for more interacting galaxies. I will also begin to use *Zoobot* to find much larger samples of different kinds of gems: jellyfish galaxies, proto-planetary disk, etc. This will be done in collaboration with *Galaxy Zoo* and with significant guidance from the creator of *Zoobot*, Mike Walmsley.

This year, I will also be trawling the archives for interesting systems in Hubble. Any interesting systems found here will then be used in order be put into JWST and Euclid later on.

The primary research outputs of this year will be these catalogues of categorised objects. Much like O’Ryan+23 catalogue, however, will be of a range of objects.

Year 2

This will be when the archives are combined with other instruments. Specifically, interesting objects found in Hubble or in existing JWST and Euclid data will be followed up upon. I want to specifically get emission measurements for parameterisation, and spectroscopic information for confirmation of interacting galaxies and such.

Primary research outputs: ancillary catalogues to he original ones the previous year. Some initial analysis interpreting the raw data. Specifically, it will be combining Galaxy Zoo morphological investigations with the new catalogues. These catalogues will be released to the community for use, and would be an excellent place to stop the project if third year funding is unavailable.

This will also be when we release the dependency on environment, matching different kinds of galaxies

If possible, the development of codes which can match objects throughout the archives.

Year 3

This is where we use the statistically significant samples to gain insight into the relationship between environment, gas content, stellar masses and star formations. For an example of the analysis that will be conducted, see the COSMOS project paper (in prep.). However, this will be done for as many objects as we can get data for.

The final goal here will be to investigate multiple parameterisations of galaxies and types and make statistically robust calculations on environments effects on galaxies.