Report Outline

* **Abstract**:

Summarisers key goal/aims of the project and gives a basic background of the report.

* **Personal Statement**
* Raise all the complications that were faced during this project
* Coding skills and book keeping were crucial to this project because of complications
* Allowed to improve my scripts that aided the time for computation
* **Acknowledgements**
* Prof. Ross McLure
* Dr. Ryan Begley
* Dr. Derek McLeod
* Modules used:
* Numpy
* Pandas - Catalogues handled

1. **Introduction**

* 2 Main goals
* Outline how this report will be talk thought the project

1. **Background**
   1. Epoch of Cosmic Reionisation

* Discuss why we are looking that distant galaxies in the first place by explaining before the JWST the farthest galaxies were known at around z=10.
* Introduce redshift (with formula) and the concept of Look-back time as well as its importance to the project, especially because of the emission lines of interest.
* Talk about any relevant (to this report) star-formation processes that would have occurred before or after that the point of observation.
  1. Emission Lines
     + Find images for emission
     + Hα
       - H-alpha used an indicator for Star-Formation Rate
       - Include the expected redshift range to be looked at using filter maps.
       - Signatures
     + O[III]
       - O[III] is proportional to the no. of ionising photons that are being produced in the stellar population. Helps to understand if there are enough ionising photons to ionise the universe in reionisation.
       - Include the expected redshift range to be looked at using filter maps.
       - Signatures
  2. JWST and JADES Survey (Need to come back to this section)
* Name the filters used to for study from the JADES survey. Also, name the ones from the HST ACS. Include the filter maps (filter band plots – “Tophat” plots) and discuss.
* Include a graph of the field of view in relation to previous survey. Illustrate how extensively this field of view has been studied.
* Mention about the survey properties (image size in arcseconds, number of pointings, Area of field: ~25 arcmins.)
* Maybe talk about the spectroscopic stuff that are already available for objects in this survey.

1. **Inspecting the JADES Dataset**
   * + Visualising the data with Gaia
     + Field of Views in the data – Different for different filters because there the focus for medium band and wide bands are different.
     + Account for the fact the images were aligned before analysis.
     + Establishing what needs to be done with the data.
2. Image Features Observed

* Acknowledge the fact that the regions are not all the same.
* Spatial res decreases with increasing wavelength.
* Saturation in the centre of some objects.

1. **Calibrating the Data**
2. PSF Homogenisation
   * Describe the Aperture correction process PSF Homogenisation
   * Flux percentage decision, isolated star selection; diffraction spikes for stars – cause of point source flux
   * Moffat Distribution profile and why we prefer it over the Gaussian distribution. Maybe, talk about the free parameters in each model and discuss how it’s more convenient with Moffat.
   * The don’t all sit on a perfect 70%
3. Constructing Convolution Kernels
   * Convolutional kernel constructions with a set of parameters for each filter with respect to a chosen filter, f444w. Explain why we chose the 444 filter (the filter band size and the S/N ratio compared to other filters.)
   * Using the kernels, the images are convolved for data analysis.
4. Mapping Background Noise
   * Finding the detection sensitivity for each filter by collecting the flux within carefully selected apertures with Source Extractor.
   * Only sky apertures are considered to understand the noise that might affect our galaxies; which needs to be accounted for.
   * Looking at noise because we are observing galaxies in the distant universe and therefore, these galaxies would be faint and in theory the noise can be considered as the error in the flux.
   * Plot of the sky flux shows gaussian – explain why?: The noise would be centred at 0 since the prob of getting positive and negative values would somewhat equally distributed.
   * Detail the selection process for sky apertures using a tolerance and the segmentation map to ignore any objects in the image. Explain the distance between apertures and the size (reference aperture)
5. **Building the Catalogue**
   1. Deriving the Error on the Flux
      * MAD estimates were calculated due the nature of the Gaussian and Limiting Magnitudes were calculated to understand where to truncate the catalogue. Table of these values goes here. Using astropy – cite. Include plot for the distribution of the sky flux in all filters and describe the shape and the varying widths compared to filters.
        + Explain why we use MAD estimate instead of the common sigma width estimate.
   2. Generating a Catalogue
      * Using an equivalent version of dual image mode from Source Extractor, the photometry for all the objects detected in f356w are collected in all the filters.
        + Explain why f356w is used as detection image
      * 5-sigma cut is applied to remove any noise using a rounded value of the Limiting Magnitude for the filter described as the “continuum” filter (f335).
      * The catalogue is then run through EAZY (explain what the code does a little bit and cite documentation) to calculate the redshifts.
        + Maybe include a graph the χ2 to show how well it worked/fit.
        + Zero-point set at 23.9 mJy
6. **Results and Discussion**
   1. Generating Redshifts
      * Using the redshifts from spectroscopic data, the objects are matched with their RA and Dec.
      * The magnitudes are calculated with the f355 as continuum and f410 as emission line filters.
      * The EWs are derived with the magnitudes.
   2. Equivalent Widths of the data
   3. Photon Escape Fraction
7. **Conclusions and Future Prospects**
8. Summary
   * The final message from everything
9. Future Prospects
   * Things I could do given more time.
   * What more could we learn from
   * MUSE objects
   * SFR with H-alpha
10. **References**
11. **Appendix (Optional)**