

# Corey Pirie

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**Research interests** My interests lie in the field of Extragalactic astronomy looking at galaxy evolution. Specifically why we observe smaller, bluer, more irregular and star forming galaxies at higher redshift compared to larger, redder, more elliptical and quiescent galaxies observed in the local universe. I'm interested in using observations and analysing data from galaxies to investigate how they evolve in the low and high redshift Universe including looking at different galaxy evolution pathways. In doing so, I hope to bridge the gaps that currently exist between observations and theory of galaxy evolution.

**Education** **Queen Anne High School** Aug 2010 – Jun 2016

Highers: Mathematics(A), English(A), Physics(A), Chemistry(A), Computing(A), Geography(B)  
Advanced Highers: Mathematics(A), Physics(A), Chemistry(A)

**University of St Andrews** Sep 2016 – Present

Masters of Physics (MPhys) in Astrophysics with honours

Expected Degree Classification: Upper second class

MPhys Astrophysics Project Title: Investigating mock kinematic data of post-merger galaxies in simulations using the radon transform

**Research experience** **Summer Project 2019** Jun 2019 – Aug 2019

Project Title: Using spectral fitting and synthesis code in the analysis of the spectroscopic data to model dust in galaxies

Supervisor: Dr Vivienne Wild (University of St Andrews)

Funding Offered: Robertson Trust Internship and Royal Astronomical Society (RAS) Funding

Project Aims:

- Identify biases and degeneracies in spectral fitting code BAGPIPES (Bayesian Analysis of Galaxies for Physical Inference and Parameter Estimation).
- Fit spectra to mock data (where the initial parameters are known) to solve biases.
- Investigate factors: dust screens (1-component dust), differential dust geometry (2-component dust), impact of including the Balmer decrements and the adjustment of dust parameters (like dust attenuation and power law slope values).

Key Results:

- Dust screens (1-component dust) cause a bias in the dust attenuation and metallicity. Mass weighted age didn't appear to be biased.
- 2-component dust (which models the ISM and birth clouds of OB stars differently) and including the Balmer decrements in the fitting process eliminates the dust attenuation bias.
- Bias in metallicity could be due to parameters not investigated such as light-weighted age and power-law slope value and this is to be followed up.

**Relevant Undergraduate Modules**

**Extragalactic Astronomy**

- Content: SEDs, galaxy morphology, spectra, scaling relations, introduction to cosmology, AGN, supermassive blackholes and galaxy evolution.
- Project: Python project applied theory learned to SDSS data (for example comparing the colours and morphologies of individual galaxies or quasar distributions with redshift).

## Advanced Data Analysis (Scottish University Physics Alliance Module))

- Content: Basic and advanced statistics, error propagation, modelling and fitting including time series analysis, periodogram analysis, Fourier analysis and cross correlation of data.
- Projects: Analysis of lightcurves and spectra of the Dwarf Nova OY~Car system.

## Observational Astrophysics

- Content: Building observing instruments, planning observations including technical specifications, data collection, data analysis and scientific write up of results.
- Projects: Radio astronomy observing the galactic plane, optical imaging of star forming regions in the galaxy and data analysis from the TESS and WASP missions.

## Transferable Skills for Physicists

- Content: Comparison of scientific literature, review article research and write up, Burn Conference Talk, proposal write up and presentation and background work (including career planning and CV advice).
- Science topics: Exoplanetary science (rocky planet research) and Extragalactic astronomy (AGN research).

### Talks

#### Department of Physics and Astronomy Galaxy Journal Club Meeting

Oct 2019

Title: Using spectral fitting and synthesis code in the analysis of the spectroscopic data to model dust in galaxies

Topic: Presentation of summer project goals, results and further work to be done into BAGPIPES spectral fitting code and it's application for modelling dust in galaxies.

#### Burn Conference

March 2019

Title: Diamond Planets? Fact or Fake

Topic: Presentation of Exoplanetary research into carbon rich and rocky terrestrial planets and looking into candidates of planets potentially containing a high abundance of diamond. This was assessed as part of the "Transferable Skills for Physicists" module at University of St Andrews.

### Skills

#### Programming and Data Analysis Tools

- Python (Matplotlib, AstroPy, astroML, Pandas, NumPy, SciPy, BAGPIPES)
- FORTRAN 77 and 90
- SAOImageDS9
- Topcat

#### Data Analysis Skills

- Fitting functions to data and determining maximum likelihood parameters (including  $\chi^2$  minimisation)
- Performing background fits to data (including continuum modelling of spectra)
- Nyquist sampling and periodogram analysis of data (including sampling lightcurves)
- Error propagation (including correlations, orthogonality and co-variance)
- Bayesian analysis and Monte Carlo sampling (including sampling distributions and confidence intervals)

### Honors and scholarships

#### Robertson Trust Scholarship (Robertson Trust)

2016 - 2021

Awarded to University students from financially disadvantaged backgrounds for the duration of their degree for high academic achievement.

### Other interests

Athletics and cross country running, gym exercise, tutoring/teaching, astrophotography