

## Sebastian Turner

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### Research Interests

- Galaxy evolution, including: (i) examining the separability of the quenching and the morphological transformation of galaxies, especially in group environments; (ii) constraining the changing balance of astrophysical and cosmological processes that influence galaxies over cosmic time; and (iii) studying the importance of mergers of different types and mass ratios in the evolution of galaxies.
- Application of machine learning techniques to astronomy and astrophysics, including: (i) connecting multi-dimensional feature spaces from simulations with those from observations; and (ii) constraining the relationships between ensembles of directly observable features (e.g. colours) and derived astrophysical parameters.

### Employment

- 02/2021 – present: Senior Analyst at Research England (RE; a council within UKRI)
  - Designing, testing, and running analytical models for the allocation of various streams of government funding to higher education providers in England.

### Education & Experience

- 10/2016 – 01/2021: Astrophysics Research Institute, Liverpool John Moores University, United Kingdom
  - Doctor of Philosophy in Astrophysics
  - Supervisors: Prof. Steven N. Longmore, Prof. Ivan K. Baldry, and Prof. Paulo J. Lisboa
  - Thesis: “Extragalactic Machine Learning: in Theory and in Practice” - explored the use of unsupervised machine learning techniques for the multi-dimensional analysis of large galaxy samples. Clustering of galaxies in five derived astrophysical parameters has highlighted the differential role of environment in galaxy evolution, and has facilitated the validation of cosmological galaxy simulations against observations. A combination of clustering and dimensionality reduction has established the utility of nine bands of ultraviolet-through-infrared photometry for the separation of galaxy subpopulations at low and intermediate redshifts and the study of cosmological trends in galaxy evolution.
- 09/2012 – 07/2016: University of Liverpool & Liverpool John Moores University, United Kingdom
  - Master of Physics with Honours, Class I in Astrophysics
  - Dissertation: “Radial Star Formation Distributions of Galaxies from a Realistic Cosmological Simulation” (supervised by Dr. Robert A. Crain and Prof. Phil A. James) - assessed the star formation prescription of the cosmological, hydrodynamical EAGLE simulations. Radial star formation rate profiles of simulated galaxies were compared with theoretical expectations as well as with observed profiles (see my research placement below). Statistical tests established an excellent agreement of the simulation prescription with both theory and observations.
  - 3<sup>rd</sup> year project (supervised by Prof. Toby Moore): used archival Liverpool Telescope data to study the suitability of a novel “galaxy pairing” method for constraining the influence of foreground galactic extinction on measurements of galaxy photometry.
  - Isaac Roberts Award for Best Astrophysicist, Martin Suggett Award for Best 1<sup>st</sup> Year Astrophysicist
- 06/2015 – 09/2015: research placement at Liverpool John Moores University, with Prof. Phil James.
  - Examined radial profiles of the star formation rates of local disc galaxies. Analyses focused on comparisons of H $\alpha$  and near-ultraviolet images as tracers of star formation, and revealed good agreement between the two. This research formed the basis of the observational component of my 4<sup>th</sup> year undergraduate project (see above).

## Publications

- “Synergies between low- and intermediate-redshift galaxy population classifications revealed with unsupervised machine learning”,  
**Sebastian Turner**, Małgorzata Siudek, Samir Salim, Ivan K. Baldry, Agnieszka Pollo, Steven N. Longmore, Katarzyna Małek, Chris A. Collins, Paulo J. Lisboa, Janusz Krywult, T. Moutard, Daniela Vergani, and Alexander Fritz, submitted to Monthly Notices of the Royal Astronomical Society (5/10/2020).
- “Testing a cosmological galaxy simulation with unsupervised machine learning”,  
**Sebastian Turner**, Ivan K. Baldry, Robert A. Crain, Paulo J. Lisboa, Steven N. Longmore, and Chris A. Collins, in preparation.
- “[Reproducible k-means clustering in galaxy feature data from the GAMA survey](#)”,  
**Sebastian Turner**, Lee Kelvin, Ivan K. Baldry, Paulo J. Lisboa, Steven N. Longmore, Chris A. Collins, Benne W. Holwerda, Andrew M. Hopkins, and Jochen Liske, 2019. Monthly Notices of the Royal Astronomical Society, 482, 126.
- “[Compact galaxies and the size-mass galaxy distribution from a colour-selected sample at  \$0.04 < z < 0.15\$  supplemented by \*ugrizYJHK\* photometric redshifts](#)”,  
Ivan K. Baldry, Tricia Sullivan, Raffaele Rani, and **Sebastian Turner**, 2021. Monthly Notices of the Royal Astronomical Society, 500, 1557.

## Conferences & Events

- 2020: Seminar at National Centre for Nuclear Research, Warsaw, Poland
- 2019: Talk at “The Art of Measuring Galaxy Physical Properties”, Milan, Italy
- 2019: Talk at ESO Artificial Intelligence in Astronomy Workshop, Garching, Germany
- 2019: Talk and poster at National Astronomy Meeting, Lancaster, United Kingdom (won Best Student Poster)
- 2019: Talk at IFAE, Barcelona Institute of Science and Technology, Spain
- 2019: Talk at LJMU Research Week, Liverpool, United Kingdom (won Best Oral Presentation)
- 2018: Seminar at National Centre for Nuclear Research, Warsaw, Poland
- 2018: Attendance and poster at STFC Summer School in A.I. & M.L., London, United Kingdom
- 2018: Talk at LJMU Research Week, Liverpool, United Kingdom
- 2018: Talk and poster at European Week of Astronomy & Space Science, Liverpool, United Kingdom
- 2017: Talk at Galaxy Zoo 10<sup>th</sup> Anniversary Meeting, Oxford, United Kingdom
- 2017: Talk at National Astronomy Meeting, Hull, United Kingdom
- 2017: Pitch presentation at LJMU Research Week, Liverpool, United Kingdom

## Skills

- Computing: Python (incl. Numpy, Scipy, Scikit-Learn, Pandas, Tensorflow), Jupyter, SQL, SAS, MATLAB, R, LaTeX, GAIA, DS9, Github, UNIX, Windows, Microsoft Office
- Machine learning: clustering (incl. k-means, hierarchical clustering, DBSCAN, HDBSCAN, GMMs), dimensionality reduction (incl. PCA, LDA, SOMs, tSNE, UMAP), classification and regression (incl. SVMs, decision trees, random forests, ANNs)

## Other Experience

- 2017 – 2019: Organiser of weekly meetings of the ExGal research group, which included scientific discussions, presentations, and a regular journal club segment.
- 2014 – 2017: Tuition of mathematics and physics to high school and college students in Liverpool. I independently posted advertisements online in order to acquire clients. Tutorials were generally planned out in advance, and varied in their content between examination preparation, homework assistance, and even delivery of new material to the students. Maintaining my schedule of appointments developed my organisation and time-management skills.
- 2016 – 2019: Participation in astrophysics public engagement and outreach activities, organised by my department as well as by myself. These have included university open days, delivery of careers and science talks to students in various year groups at a school, and assistance at a Merseyside Astronomy Day. These activities have improved my ability to communicate scientific ideas at varying levels of expertise.

## References

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