Sebastian Turner

Address:	Astrophysics Research Institute IC2, Liverpool Science Park 146 Brownlow Hill Liverpool, L3 5RF United Kingdom	Email: Alt. Email: Skype: Webpage:	s.turner1@2012.ljmu.ac.uk seb.turne@gmail.com seb.turne astro.ljmu.ac.uk/~aststurn/

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.

Education & Experience

- 2016 – present: Astrophysics Research Institute, Liverpool John Moores University
  - Doctor of Philosophy (pending minor corrections) in Astrophysics
  - Supervisors: Prof. Steven N. Longmore, Prof. Ivan K. Baldry, and Prof. Paulo J. Lisboa.
  - 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.

- 2012 – 2016: University of Liverpool & Liverpool John Moores University
  - Master of Physics with Honours, Class I in Astrophysics
  - Isaac Roberts Award for Best Astrophysicist
  - 4th year project, with Dr. Robert A. Crain and Prof. Phil A. James: Assessed the star formation prescription of the Virgo Consortium's hydrodynamical, cosmological galaxy simulation EAGLE. 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.
  - 3rd year project, with Prof. Toby Moore: Studied the suitability of a novel "galaxy pairing" method for constraining the influence of foreground galactic extinction on measurements of galaxy photometry. Data for this project was collected from the Liverpool Telescope archive.
  - Martin Suggett Award for Best 1st Year Astrophysicist

- 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 Hα 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 4th year undergraduate project (see above).

- 2005 – 2012: Alun School, Mold, Flintshire
  - A/AS Level: 3 A in Chemistry, Mathematics, Physics (won Alun School Physics prize)
2 B in Biology, Further Mathematics
  - GCSE: 9 A*, 2 A, 1 B

Publications

- "Synergies between low- and intermediate-redshift galaxy population classifications revealed with unsupervised machine learning",
  Sebastian Turner, Malgorzata 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",
  I. Baldry, T. Sullivan, R. 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, PL
- 2019: Talk at "The Art of Measuring Galaxy Physical Properties", Milan, IT
- 2019: Talk at ESO Artificial Intelligence in Astronomy Workshop, Garching, DE
- 2019: Talk and poster at National Astronomy Meeting, Lancaster, GB (won Best Student Poster)
- 2019: Talk at IFAE, Barcelona Institute of Science and Technology, ES
- 2019: Talk at LJMU Research Week, Liverpool, GB (won Best Oral Presentation)
- 2018: Seminar at National Centre for Nuclear Research, Warsaw, PL
- 2018: Attendance and poster at STFC Summer School in A.I. & M.L., London, GB
- 2018: Talk at LJMU Research Week, Liverpool, GB
- 2018: Talk and poster at European Week of Astronomy & Space Science, Liverpool, GB
- 2017: Talk at Galaxy Zoo 10th Anniversary Meeting, Oxford, GB
- 2017: Talk at National Astronomy Meeting, Hull, GB
- 2017: Pitch presentation at LJMU Research Week, Liverpool, GB

Skills

- Computing: Python (incl. Numpy, Scipy, Scikit-Learn, Astropy, Pandas), Jupyter, SQL, 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

	Prof. Steven N. Longmore		Prof. Paulo J. Lisboa
Address:	Astrophysics Research Institute IC2 Liverpool Science Park 146 Brownlow Hill Liverpool L3 5RF United Kingdom	Address:	Department of Applied Mathematics Liverpool John Moores University Byrom Street Liverpool L3 3AF United Kingdom
Email:	s.n.longmore@ljmu.ac.uk	Email:	p.j.lisboa@ljmu.ac.uk
	Dr. Malgorzata Siudek		Prof. Ivan K. Baldry
Address:	Institut de F'isica d'Altes Energies The Barcelona Institute of Science and Technology 08193 Bellaterra, Spain	Address:	Astrophysics Research Institute IC2 Liverpool Science Park 146 Brownlow Hill Liverpool L3 5RF United Kingdom
Email:	msiudek@ifae.es	Email:	i.baldry@ljmu.ac.uk