Assistant Prof. Andrew Fowlie

XJTLU, Suzhou, China

Web: https://andrewfowlie.github.io
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Born: 15 July, 1987
Nationality: British

Assistant Prof. in high-energy physics. Obtained Ph.D. in 2013. Specialize in computational methods and statistical analysis of experimental data. Published about 50 papers with over 1500 citations. Over 50 seminars and professional presentations.

Areas of specialization

- International reputation in high-energy physics for innovative Bayesian statistical analyses, including parameter fitting, model selection and software
- Beyond the Standard Model physics, including dark matter, supersymmetry, Higgs and collider phenomenology
- Fine-tuning, naturalness and the hierarchy problem

Experience

2023- Assistant Professor, XJTLU, Suzhou, China

2018-2022 Associate Professor, Nanjing Normal University, Nanjing, China

2015-2018 Post-doctoral researcher, Monash University, Melbourne, Australia
Particle phenomenology with a focus on Bayesian statistics with Prof. Csaba Balázs

2014-2015 Post-doctoral researcher, KBFI, Tallinn, Estonia
Particle phenomenology under Prof. Martti Raidal

2009-2013 Ph.D., University of Sheffield, UK
Supervised by Prof. Leszek Roszkowski

Grants

2023 Research Development Fund (PI), 100,000 RMB
NSFC General Program (CI), 550,000 RMB

2020 ARC Discovery Project (CI), 426,000 AUD

2019 NSFC Chinese Young Scientist Grant (PI), 350,000 RMB

Publications

- *h*-index of 25, over 1,500 citations
- Published as first author in *Nature Reviews Methods Primers*, *Rept. Prog. Phys.* and *Phys. Rev. Lett.*
- See http://inspirehep.net/author/profile/A.Fowlie.1
- Over 50 publications

2024 [1] **Fowlie, A.** The Bayes factor surface for searches for new physics (2024). [arXiv:2401.11710]

2023 [2] Abdallah, W. *et al.* CEPC Technical Design Report – Accelerator (2023). [arXiv:2312.14363]

[3] Athron, P., **Fowlie, A.**, Lu, C.-T., Morris, L., Wu, L., Wu, Y. & Xu, Z. Can supercooled phase transitions explain the gravitational wave background observed by pulsar timing arrays? (2023). [arXiv:2306.17239]

[4] **Fowlie, A.** & Li, Q. Modeling the R-ratio and hadronic contributions to $g-2$ with a Treed Gaussian process. *Eur. Phys. J. C* **83**, 943, DOI: 10.1140/epjc/s10052-023-12110-9 (2023). [arXiv:2306.17385]

[5] Athron, P., Balázs, C., **Fowlie, A.**, Morris, L. & Wu, L. Cosmological phase transitions: From perturbative particle physics to gravitational waves. *Prog. Part. Nucl. Phys.* **135**, 104094, DOI: 10.1016/j.ppnp.2023.104094 (2024). [arXiv:2305.02357]

[6] Ananyev, V. *et al.* Collider constraints on electroweakinos in the presence of a light gravitino. *Eur. Phys. J. C* **83**, 493, DOI: 10.1140/epjc/s10052-023-11574-z (2023). [arXiv:2303.09082]

[7] **Fowlie, A.** Origins of Parameters in Adimensional Models. *Int. J. Theor. Phys.* **62**, 198, DOI: 10.1007/s10773-023-05456-z (2023). [arXiv:2302.04076]

2022 [8] Athron, P., Balazs, C., **Fowlie, A.**, Morris, L., White, G. & Zhang, Y. How arbitrary are perturbative calculations of the electroweak phase transition? *arXiv* (2022). [arXiv:2208.01319]

[9] **Fowlie, A.** *et al.* Nested sampling for physical scientists. *Nature Reviews Methods Primers* **2**, DOI: 10.1038/s43586-022-00121-x (2022). [arXiv:2205.15570]

[10] Athron, P., **Fowlie, A.**, Lu, C.-T., Wu, L., Wu, Y. & Zhu, B. The W boson Mass and Muon $g-2$: Hadronic Uncertainties or New Physics? *arXiv* (2022). [arXiv:2204.03996]

[11] Athron, P., Balazs, C., **Fowlie, A.**, Lv, H., Su, W., Wu, L., Yang, J. M. & Zhang, Y. Global fits of SUSY at future Higgs factories. *Phys. Rev. D* **105**, 115029, DOI: 10.1103/physrevd.105.115029 (2022). [arXiv:2203.04828]

2021 [12] **Fowlie, A.** Neyman-Pearson lemma for Bayes factors. *Communications in Statistics — Theory and Methods* 1–8, DOI: 10.1080/03610926.2021.2007265 (2021). [arXiv:2110.15625]

[13] **Fowlie, A.** Comment on "Accumulating Evidence for the Associate Production of a Neutral Scalar with Mass around 151 GeV". *Physics Letters B* **827**, 136936, DOI: 10.1016/j.physletb.2022.136936 (2021). [arXiv:2109.13426]

[14] Cranmer, K. *et al.* Publishing statistical models: Getting the most out of particle physics experiments. *SciPost Phys.* **12**, 037, DOI: 10.21468/scipostphys.12.1.037 (2022). [arXiv:2109.04981]

[15] Athron, P. *et al.* Thermal WIMPs and the scale of new physics: global fits of Dirac dark matter effective field theories. *Eur. Phys. J. C* **81**, 992, DOI: 10.1140/epjc/s10052-021-09712-6

(2021). [arXiv:2106.02056]

[16] **Fowlie, A.**, Hoof, S. & Handley, W. Nested Sampling for Frequentist Computation: Fast Estimation of Small p-Values. *Phys. Rev. Lett.* **128**, 021801, DOI: 10.1103/physrevlett.128.021801 (2022). [arXiv:2105.13923]

[17] **Fowlie, A.** Comment on "Reproducibility and Replication of Experimental Particle Physics Results". *Harvard Data Science Review* DOI: 10.1162/99608f92.b9bfc518 (2021). [arXiv:2105.03082]

[18] Balázs, C. *et al.* A comparison of optimisation algorithms for high-dimensional particle and astrophysics applications. *JHEP* **05**, 108, DOI: 10.1007/jhep05(2021)108 (2021). [arXiv:2101.04525]

2020 [19] **Fowlie, A.** Objective Bayesian approach to the Jeffreys-Lindley paradox. *Communications in Statistics — Theory and Methods* 1–6, DOI: 10.1080/03610926.2020.1866206 (2020). [arXiv:2012.04879]

[20] **Fowlie, A.** *et al.* Simple and statistically sound recommendations for analysing physical theories. *Rept. Prog. Phys.* **85**, 052201, DOI: 10.1088/1361-6633/ac60ac (2022). [arXiv:2012.09874]

[21] **Fowlie, A.**, Handley, W. & Su, L. Nested sampling with plateaus. *Mon. Not. Roy. Astron. Soc.* **503**, 1199–1205, DOI: 10.1093/mnras/stab590 (2021). [arXiv:2010.13884]

[22] Athron, P. *et al.* Global fits of axion-like particles to XENON1T and astrophysical data. *JHEP* **05**, 159, DOI: 10.1007/jhep05(2021)159 (2021). [arXiv:2007.05517]

[23] **Fowlie, A.**, Handley, W. & Su, L. Nested sampling cross-checks using order statistics. *Mon. Not. Roy. Astron. Soc.* **497**, 5256–5263, DOI: 10.1093/mnras/staa2345 (2020). [arXiv:2006.03371]

[24] Athron, P., Balázs, C., **Fowlie, A.** & Zhang, Y. PhaseTracer: tracing cosmological phases and calculating transition properties. *Eur. Phys. J. C* **80**, 567, DOI: 10.1140/epjc/s10052-020-8035-2 (2020). [arXiv:2003.02859]

2019 [25] Athron, P., Balazs, C., **Fowlie, A.**, Pozzo, G., White, G. & Zhang, Y. Strong first-order phase transitions in the NMSSM — a comprehensive survey. *JHEP* **11**, 151, DOI: 10.1007/jhep11(2019)151 (2019). [arXiv:1908.11847]

[26] **Fowlie, A.** Bayesian and frequentist approaches to resonance searches. *JINST* **14**, P10031, DOI: 10.1088/1748-0221/14/10/p10031 (2019). [arXiv:1902.03243]

[27] Athron, P., Balázs, C., Bardsley, M., **Fowlie, A.**, Harries, D. & White, G. BubbleProfiler: finding the field profile and action for cosmological phase transitions. *Comput. Phys. Commun.* **244**, 448–468, DOI: 10.1016/j.cpc.2019.05.017 (2019). [arXiv:1901.03714]

2018 [28] **Fowlie, A.** Non-parametric uncertainties in the dark matter velocity distribution. *JCAP* **01**, 006, DOI: 10.1088/1475-7516/2019/01/006 (2019). [arXiv:1809.02323]

[29] Athron, P. *et al.* Combined collider constraints on neutralinos and charginos. *Eur. Phys. J. C* **79**, 395, DOI: 10.1140/epjc/s10052-019-6837-x (2019). [arXiv:1809.02097]

[30] Athron, P. *et al.* Global analyses of Higgs portal singlet dark matter models using GAMBIT. *Eur. Phys. J. C* **79**, 38, DOI: 10.1140/epjc/s10052-018-6513-6 (2019). [arXiv:1808.10465]

[31] **Fowlie, A.** A fast C++ implementation of thermal functions. *Comput. Phys. Commun.* **228**, 264–272, DOI: 10.1016/j.cpc.2018.02.015 (2018). [arXiv:1802.02720]

2017 [32] **Fowlie, A.** DAMPE squib? Significance of the 1.4 TeV DAMPE excess. *Phys. Lett. B* **780**, 181–184, DOI: 10.1016/j.physletb.2018.03.006 (2018). [arXiv:1712.05089]

[33] Athron, P., Balazs, C., **Fowlie, A.** & Zhang, Y. Model-independent analysis of the DAMPE excess. *JHEP* **02**, 121, DOI: 10.1007/jhep02(2018)121 (2018). [arXiv:1711.11376]

[34] Ellis, J., **Fowlie, A.**, Marzola, L. & Raidal, M. Statistical Analyses of Higgs- and Z-Portal Dark Matter Models. *Phys. Rev. D* **97**, 115014, DOI: 10.1103/physrevd.97.115014 (2018). [arXiv:1711.09912]

[35] Athron, P., Balazs, C., Farmer, B., **Fowlie, A.**, Harries, D. & Kim, D. Bayesian analysis and naturalness of (Next-to-)Minimal Supersymmetric Models. *JHEP* **10**, 160, DOI: 10.1007/jhep10(2017)160 (2017). [arXiv:1709.07895]

[36] **Fowlie, A.** Halo-independence with quantified maximum entropy at DAMA/LIBRA. *JCAP* **10**, 002, DOI: 10.1088/1475-7516/2017/10/002 (2017). [arXiv:1708.00181]

[37] Di Chiara, S., **Fowlie, A.**, Fraser, S., Marzo, C., Marzola, L., Raidal, M. & Spethmann, C. Minimal flavor-changing Z' models and muon $g-2$ after the R_{K^*} measurement. *Nucl. Phys. B* **923**, 245–257, DOI: 10.1016/j.nuclphysb.2017.08.003 (2017). [arXiv:1704.06200]

2016 [38] Balazs, C., **Fowlie, A.**, Mazumdar, A. & White, G. Gravitational waves at aLIGO and vacuum stability with a scalar singlet extension of the Standard Model. *Phys. Rev. D* **95**, 043505, DOI: 10.1103/physrevd.95.043505 (2017). [arXiv:1611.01617]

[39] **Fowlie, A.** Bayes factor of the ATLAS diphoton excess: Using Bayes factors to understand anomalies at the LHC. *Eur. Phys. J. Plus* **132**, 46, DOI: 10.1140/epjp/i2017-11340-1 (2017). [arXiv:1607.06608]

[40] Bianchini, L., Calpas, B., Conway, J., **Fowlie, A.**, Marzola, L., Veelken, C. & Perrini, L. Reconstruction of the Higgs mass in events with Higgs bosons decaying into a pair of τ leptons using matrix element techniques. *Nucl. Instrum. Meth. A* **862**, 54–84, DOI: 10.1016/j.nima.2017.05.001 (2017). [arXiv:1603.05910]

[41] **Fowlie, A.** & Bardsley, M. H. Superplot: a graphical interface for plotting and analysing MultiNest output. *Eur. Phys. J. Plus* **131**, 391, DOI: 10.1140/epjp/i2016-16391-0 (2016). [arXiv:1603.00555]

[42] **Fowlie, A.**, Balazs, C., White, G., Marzola, L. & Raidal, M. Naturalness of the relaxion mechanism. *JHEP* **08**, 100, DOI: 10.1007/jhep08(2016)100 (2016). [arXiv:1602.03889]

2015 [43] **Fowlie, A.** & Marzola, L. Examining a right-handed quark mixing matrix with b-tags at the LHC. *Nucl. Phys. B* **894**, 588–601, DOI: 10.1016/j.nuclphysb.2015.03.025 (2015). [arXiv:1412.5587]

2014 [44] **Fowlie, A.** & Marzola, L. Testing quark mixing in minimal left–right symmetric models with b-tags at the LHC. *Nucl. Phys. B* **889**, 36–45, DOI: 10.1016/j.nuclphysb.2014.10.009 (2014). [arXiv:1408.6699]

[45] **Fowlie, A.** Is the CNMSSM more credible than the CMSSM? *Eur. Phys. J. C* **74**, 3105, DOI: 10.1140/epjc/s10052-014-3105-y (2014). [arXiv:1407.7534]

[46] **Fowlie, A.** CMSSM, naturalness and the "fine-tuning price" of the Very Large Hadron Collider. *Phys. Rev. D* **90**, 015010, DOI: 10.1103/physrevd.90.015010 (2014). [arXiv:1403.3407]

[47] **Fowlie, A.** & Raidal, M. Prospects for constrained supersymmetry at $\sqrt{s} = 33\,\text{TeV}$ and $\sqrt{s} = 100\,\text{TeV}$ proton-proton super-colliders. *Eur. Phys. J. C* **74**, 2948, DOI: 10.1140/epjc/s10052-014-2948-6 (2014). [arXiv:1402.5419]

2013 [48] **Fowlie, A.**, Kowalska, K., Roszkowski, L., Sessolo, E. M. & Tsai, Y.-L. S. Dark matter and

collider signatures of the MSSM. *Phys. Rev. D* **88**, 055012, DOI: 10.1103/physrevd.88.055012 (2013). [arXiv:1306.1567]

2012 [49] **Fowlie, A.**, Kazana, M., Kowalska, K., Munir, S., Roszkowski, L., Sessolo, E. M., Trojanowski, S. & Tsai, Y.-L. S. The CMSSM Favoring New Territories: The Impact of New LHC Limits and a 125 GeV Higgs. *Phys. Rev. D* **86**, 075010, DOI: 10.1103/physrevd.86.075010 (2012). [arXiv:1206.0264]

2011 [50] **Fowlie, A.**, Kalinowski, A., Kazana, M., Roszkowski, L. & Tsai, Y. L. S. Bayesian Implications of Current LHC and XENON100 Search Limits for the Constrained MSSM. *Phys. Rev. D* **85**, 075012, DOI: 10.1103/physrevd.85.075012 (2012). [arXiv:1111.6098]

[51] **Fowlie, A.** & Roszkowski, L. Reconstructing ATLAS SU3 in the CMSSM and relaxed phenomenological supersymmetry models. *arXiv* (2011). [arXiv:1106.5117]

Talks & seminars

- See all slides at `https://andrewfowlie.github.io/talk/`
- Over 50 presentations and talks

Invited

2024 [1] *The Bayes factor surface for searches for new physics*, NANOGrav New Physics Working Group

[2] *Origins of parameters in adimensional models*, Seminar, Fudan University

2023 [3] *Origins of parameters in adimensional models*, Seminar, Fudan University

[4] *From first order phase transitions to gravitational waves*, The 2023 Shanghai Symposium on Particle Physics and Cosmology,Tsung-Dao Lee Institute

[5] *New physics in the garden of forking paths*, Mini-Workshop on Anomalies at the LHC, Tsung-Dao Lee Institute

[6] *Opening up Nested Sampling*, MaxEnt 2023

[7] *Origins of parameters in adimensional models*, Seminar, Zhejiang University

[8] *Origins of parameters in adimensional models*, Seminar, Shandong University

2022 [9] *Herding cats? — Bayesian and frequentist methods and compromises*, University of Goettingen CATs seminar

2021 [10] *Nested sampling for frequentist computation: fast estimation of small p-values*, ATLAS statistics forum

[11] *Nested sampling for frequentist computation: fast estimation of small p-values*, Purple Mountain Observatory

[12] *Evidence for axion-like particles from XENON1T and astrophysical data*, NCBJ, Warsaw

2020 [13] *Nested sampling cross-checks using order statistics*, Monash University

[14] *Nested sampling cross-checks using order statistics*, Cambridge University

2019 [15] *Strong first-order phase transitions in the NMSSM and methods for finding them*, SJTU-

U. Sydney Workshop on the Electroweak Phase Transition, Tsung-Dao Lee Institute

[16] *Bayesian and frequentist approaches to resonance searches*, Purple Mountain Observatory

2018 [17] *Statistical Analyses of Higgs- and Z-Portal Dark Matter Models*, Nanjing Normal University

[18] *Statistical Analyses of Higgs- and Z-Portal Dark Matter Models*, Melbourne University

Teaching, Lecturing & Supervision

2023 Supervising four FYP students on topics in probability & statistics.
Supervised four SURF summer project students — "Building a Lorenz wheel".
Taught PHY002 physics module.
Taught MTH101 mathematics module.

2022- Supervising student for three-year Master's project, Qiao Li, on measuring contributions to precision observables using Gaussian processes.

2022-2023 Leading statistics and machine learning study group for talented undergraduates.

2019-2022 Post-graduate course (about 25 hours) on physics beyond the Standard Model.

2017-2018 Supervising undergraduate project about the bounce equation and its connection to phase transitions and baryogensis.

2016-2018 Supervised (10%) Ph.D. student, Giancarlo Pozzo, on baryogensis in next-to-minimal supersymmetric models. My role includes QFT tutorials.

2015-2016 Supervised undergraduate Michael Bardsley's summer project. We developed statistical software resulting in a publication.

2015 Six hours of lectures on statistics for physicists at the University of Tartu.

2012-2013 First-year physics tutor, weekly tutorials.

2010-2012 Undergraduate physics problem class assistant.

Other skills & experience

Collaborations

2016- GAMBIT — International collaboration perofmring statistical analyses of models of new physics

2011-2013 BayesFit — Bayesian analyses of supersymmetric models in light of first run of LHC, lead by Prof. Roszkowski

Service

Referee for physics journals: *Nature Communications*, *Physical Review Letters*, *Physical Review D*, *European Physical Journal C*, *Journal of Physics G: Nuclear and Particle Physics*, *Annalen der Physik* , *Nuclear Physics B* and *International Journal of Modern Physics A*, and for statistics journals: *Statistical Papers*.
Editor for *Journal of Nanjing Normal University, Physical Sciences*.

Education and other relevant experience

2009-2013 Ph.D., University of Sheffield, UK
Bayesian Approach to Investigating Supersymmetric Models. Supervised by Prof. Roszkowski. Viva passed with minor corrections, examined by Prof. King (University of Southampton) and Prof. van de Bruck (University of Sheffield).

2009-2010 SISSA, Trieste, Italy
Six-month placement studying advanced topics in particle physics and related subjects.

2005-2009 M. PHYS, University of Durham, UK
First-class four-year undergraduate Master's in Physics. Final-year modules included Advanced Theoretical Physics (82%) and Particle Theory (90%). Master's project, *The Search for Dark Matter at the Linear Collider*, supervised by Prof. Moortgat-Pick (73%).

2006 & 2007 Summer placement at electricity supplier E-ON about numerical simulation of atmosphere with parallel computing.