GRIFFIN S FOSTER

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EDUCATION

2009-2013 University of Oxford, St. Peter's College

D. Phil
Astrophysics
Thesis: *Large-N Correlator Systems for Low Frequency Radio Astronomy*
Advisors: Prof. Steve RAWLINGS & Dr. Ian HEYWOOD

2003-2007 University of California, Berkeley

Bachelor of Arts
Physics · College of Letters and Science
Astrophysics · College of Letters and Science

RESEARCH HISTORY

Nov 2016–Present Post-doctoral Research Assistant

University of Oxford - Astrophysics
Running observations and analysis of the ALFABURST FRB search instrument. Development and testing of SKA pulsar and FRB search pipelines, with application to Breakthrough Listen observations. Development of machine learning-based anomaly detection methods for Breakthrough Listen SETI data. Beamformer design for commensal MeerKAT observations.

July 2013–Nov. 2016 Post-doctoral Research Fellow

Square Kilometre Array South Africa
Development of novel algorithms for automated calibration and deconvolution imaging with radio interferometric arrays focused on low-frequency arrays and the Square Kilometre Array. Machine learning and modelling for automating large real-time data pipelines. FPGA-based beamformer firmware design for transient and pulsar event searches.
PI: Prof. Oleg SMIRNOV

Oct. 2009–June 2013 D. Phil Student

Oxford SKA Digital Hardware Research Group
FPGA firmware design for pathfinder projects of the Square Kilometre Array. Algorithm design for modelling and calibrating interferometric datasets. Software development for monitor and control of telescope arrays.
PI's: Prof. Steve RAWLINGS & Prof. Michael JONES

Oct. 2009–June 2013 D. Phil Student

SEPnet LOFAR-UK
Design of an FPGA-based, dual-polarization, 96 element correlator for the LOFAR-UK station at Chilbolton Observatory. Development of software to produce calibrated sky maps using international LOFAR stations.
PI's: Prof. Steve RAWLINGS & Dr. Kris ZARB ADAMI

Mar. 2008–Oct. 2009 Research Associate

PAPER Epoch of Reionization Experiment
FPGA-based correlator firmware development. Observations and analysis for tracking low Earth orbit satellites to model antenna beam patterns.
PI's: Prof. Don BACKER & Prof. Rich BRADLEY

Apr. 2007–Oct. 2009 Research Associate

University of California, Berkeley - CASPER
Design and deployment of FPGA-based spectrometer and correlator systems for radio astronomy. Data reduction and analysis of pulsar and transient events from observations using the Allen Telescope Array. Algorithm design for use in Optical SETI experiments.
PI's: Dan WERTHIMER & Prof. Don BACKER & Dr. Mel WRIGHT

TEACHING

Teaching

· NASSP 2016 Fundamentals of Radio Interferometry and Aperture Synthesis Masters'
Course, University of Cape Town, South Africa – Course Organizer and Lecturer

· Synthesis Imaging Workshop 2015, North West University, South Africa – Lecturer

· RATT Interferometry Introductory Course 2015, Rhodes University, South Africa – Lecturer

Advisorship

Rhodes University - co-supervisor to three Ph.D students (two completed, one in progress),
two Master's students (in progress)

Curriculum Development

Developed NASSP Fundamentals of Radio Interferometry and Aperture Synthesis Masters'
Course, lead author on python notebook-based book and problem sets.

TECHNICAL SKILLS

Mathematics

Digital Signal Processing, Linear Algebra, Statistics, Fourier Analysis, Multivariate-Calculus,
Basis set decomposition and transforms, Discrete Mathematics

Computing Languages

Python, PHP, BASH/shell scripting, Matlab/Octave, SQL, HTML/CSS, C, λ, LaTeX

Machine Learning

SVM, Ensemble learning, PCA/SVD, Embedding and dimensionality reduction, Neural
Networks (recurrent), Gaussian Processes

FPGA Design

VHDL, Matlab/Simulink, Xilinx ISE, Altera Quartus

Electronics and Mechanical Lab

Digital hardware setup, board testing, analogue component testing, soldering, can operate
lathes, mills, and presses

PUBLICATIONS

[1] J. Hickish, Z. Abdurashidova, Z. Ali, K. D. Buch, S. C. Chaudhari, H. Chen, M. Dexter, R. S. Domagalski, J. Ford, **Foster, G.**, D. George, J. Greenberg, L. Greenhill, A. Isaacson, H. Jiang, G. Jones, F. Kapp, H. Kriel, R. Lacasse, A. Lutomirski, D. MacMahon, J. Manley, A. Martens, R. McCullough, M. V. Muley, W. New, A. Parsons, D. C. Price, R. A. Primiani, J. Ray, A. Siemion, V. Van Tonder, L. Vertatschitsch, M. Wagner, J. Weintroub, and D. Werthimer. A Decade of Developing Radio-Astronomy Instrumentation using CASPER Open-Source Technology. *Journal of Astronomical Instrumentation*, January 2017.

[2] M. T. Atemkeng, O. M. Smirnov, C. Tasse, **Foster, G.**, and J. Jonas. Using baseline-dependent window functions for data compression and field-of-interest shaping in radio interferometry. *Monthly Notices of the Royal Astronomical Society*, 462:2542–2558, November 2016.

[3] **Foster, G.**, A. Akoto-Danso, M. Atemkeng, L. Bester, T. Blecher, R. Deane, J. Girard, T. Grobler, B. Hugo, G. Jozsa, E. Abebe Kassaye, J. Kenyon, S. Makhathini, M. Mitra, N. Norman, R. Nunhokee, S. Perkins, L. Richter, L. Sebokolodi, O. Smirnov, U. Mbou Sob, and K. Thorat. Fundamentals of radio interferometry, 2016. https://github.com/griffinfoster/fundamentals_of_interferometry.

[4] **Foster, G.**, A. Karastergiou, R. Paulin, T. D. Carozzi, S. Johnston, and W. van Straten. Intrinsic instrumental polarization and high-precision pulsar timing. *Monthly Notices of the Royal Astronomical Society*, 453(2):1489–1502, 2015.

[5] **Foster, G.**, J. Hickish, A. Magro, D. Price, and K. Zarb Adami. Implementation of a direct-imaging and fx correlator for the best-2 array. *Monthly Notices of the Royal Astronomical Society*, 439(3):3180–3188, 2014.

[6] **Foster, G.** *Large-N Correlator Systems for Low Frequency Astronomy*. PhD thesis, University of Oxford, 2013.

[7] A. P. V. Siemion, G. C. Bower, **Foster, G.**, P. L. McMahon, M. I. Wagner, D. Werthimer, D. Backer, J. Cordes, and J. van Leeuwen. The Allen Telescope Array Fly's Eye Survey for Fast Radio Transients. *Astrophysical Journal*, 744:109, January 2012.

[8] A. P. V. Siemion, D. Werthimer, D. Anderson, H. Chen, J. Cobb, J. Cordes, T. Filiba, **G. Foster**, S. Gowda, E. Korpela, M. Lebofsky, A. Little, W. Mallard, L. Spitler, and M. Wagner. Developments in the radio search for extraterrestrial intelligence. In *General Assembly and Scientific Symposium, 2011 XXXth URSI*, pages 1–4, Aug 2011.

[9] **Foster, G.** and K. Z. Adami. Design of a 96 element fx correlator for the lofar-uk station. In *General Assembly and Scientific Symposium, 2011 XXXth URSI*, pages 1–4, Aug 2011.

[10] A. Siemion, G. Bower, M. Dexter, **Foster, G.**, W. Mallard, P. McMahon, M. Wagner, D. Werthimer, and Allen Telescope Array Team. Results from the Fly's Eye Fast Radio Transient Search at the Allen Telescope Array. In *American Astronomical Society Meeting Abstracts #217*, volume 43 of *Bulletin of the American Astronomical Society*, page 240.06, January 2011.

[11] A. Siemion, J. Von Korff, P. McMahon, E. Korpela, D. Werthimer, D. Anderson, G. Bower, J. Cobb, **Foster, G.**, M. Lebofsky, J. van Leeuwen, and M. Wagner. New SETI sky surveys for radio pulses. *Acta Astronautica*, 67:1342–1349, December 2010.

[12] M. Ganeshalingam, W. Li, A. V. Filippenko, C. Anderson, **Foster, G.**, E. L. Gates, C. V. Griffith, B. J. Grigsby, N. Joubert, J. Leja, T. B. Lowe, B. Macomber, T. Pritchard, P. Thrasher, and D. Winslow. Results of the Lick Observatory Supernova Search Follow-up Photometry Program: BVRI Light Curves of 165 Type Ia Supernovae. *Astrophysical Journal*, 190:418–448, October 2010.

[13] A. R. Parsons, D. C. Backer, **Foster, G. S.**, M. C. H. Wright, R. F. Bradley, N. E. Gugliucci, C. R. Parashare, E. E. Benoit, J. E. Aguirre, D. C. Jacobs, C. L. Carilli, D. Herne, M. J. Lynch, J. R. Manley, and D. J. Werthimer. The Precision Array for Probing the Epoch of Re-ionization: Eight Station Results. *Astronomical Journal*, 139:1468–1480, April 2010.

[14] E. J. Korpela, D. P. Anderson, R. Bankay, J. Cobb, **Foster, G.**, A. Howard, M. Lebofsky, G. Marcy, A. Parsons, A. Siemion, J. von Korff, D. Werthimer, and K. A. Douglas. SETI with Help from Five Million Volunteers: The Berkeley SETI Efforts. In K. J. Meech, J. V. Keane, M. J. Mumma, J. L. Siefert, and D. J. Werthimer, editors, *Bioastronomy 2007: Molecules, Microbes and Extraterrestrial Life*, volume 420 of *Astronomical Society of the Pacific Conference Series*, page 431, December 2009.

[15] A. Siemion, G. Bower, J. Cordes, **Foster, G.**, W. Mallard, P. McMahon, J. van Leeuwen, M. Wagner, D. Werthimer, and Allen Telescope Array Team. Results from the Allen Telescope Array: The ATA Fly's Eye Transient Search. In *American Astronomical Society Meeting Abstracts #214*, volume 214 of *American Astronomical Society Meeting Abstracts*, page 601.04, December 2009.

[16] J. von Korff, A. Siemion, E. Korpela, D. Werthimer, P. McMahon, J. Cobb, M. Lebofsky, D. Anderson, B. Bankay, G. Bower, **Foster, G.**, J. van Leeuwen, W. Mallard, and M. Wagner. Astropulse and Fly's Eye: SETI Searches for Transient Radio Signals Using Distributed Computing. In K. J. Meech, J. V. Keane, M. J. Mumma, J. L. Siefert, and D. J. Werthimer, editors, *Bioastronomy 2007: Molecules, Microbes and Extraterrestrial Life*, volume 420 of *Astronomical Society of the Pacific Conference Series*, page 447, December 2009.