Curriculum Vitae

Hannes Breytenbach

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About me

I'm an emergent researcher in the field of astrophysics with a passion for data science. I have experience in statistical model building and using machine learning to gain valuable insights into data. I also have a keen interest in applying Bayesian reasoning to scientific applications. I'm a proficient Python programmer who loves developing open source applications to solve scientific problems.

I am currently completing my PhD in astrophysics and expect to graduate in June 2018.

Education

2011 - present PhD (Astrophysics) - University of Cape Town (UCT), South African Astronomical Observatory (SAAO)

- Thesis title: *"Quasi-Periodic Oscillations in magnetic Cataclysmic Variable Stars"*
- Supervisors: Dr. David Buckley, A. Prof Patrick Woudt
- Modules: Cataclysmic Variable Stars, Stellar Structures, Advanced General Relativity, Hot Topics in Cosmology, High Energy Astrophysics

2010 BSc Honours (Astrophysics and Space Science) - UCT

- Thesis title: *"The Sferic Count Rate from SANAE-IV, Antarctica"*
- Supervisors: Dr. Andrew Collier
- Modules: General Astrophysics, Electrodynamics, General Relativity, Computational Astrophysics, Galaxies and Large Scale Structure, Observational Techniques, Radio Astronomy

2006 - 2009 BSc (Physics and Astronomy) - University of Pretoria (UP)

- Project title: *"Rutherford Backscattering Spectroscopy and X-ray Diffraction Spectroscopy of Aluminium 100"*
- Supervisors: Prof. Chris Theron
- Modules: Quantum Mechanics, Solid State Physics, Statistical Mechanics, Differential Calculus, Vector Calculus, Partial Differential Equations, Abstract Algebra, Mathematical Modelling

Special Skills

Data & Computing

- *Machine Learning* — Developed algorithms for classification of EEG data for American Epilepsy Society Seizure Prediction Challenge: Model ranked top 15% on Kaggle
  Led a team in Melbourne University AES/MathWorks/NIH Seizure Prediction Challenge: Model ranked top 23% on Kaggle
- *Bayesian Analysis* — Currently developing Bayesian heirarchical model approach for extraction of light curves from astronomical CCD data
- *Software Development* — Contributed code to `pymultinest, astropy, matplotlib`
  Developing and maintaining `pySHOC` library for analysing data from the Sutherland High-speed Optical Camera (SHOC) instrument
- *Signal Processing* — Developed time series analysis & spectral estimation techniques to search for and characterize Quasi-Periodic Oscillations in magnetic Cataclysmic Variable stars
- *Parallel Computing* — Deployed `pySHOC` on SAAO Mensa cluster

Programming

- *Strong:* Python
- *Knowledgeable:* git, C, MATLAB, IRAF, IDL, R, Mathematica, Maple, LabView, LaTeX

Astronomy

- *Proposal Writing* — PI of 2 successful SALT science proposals
- *Observing* — Total of 135 nights of observing on SAAO 1.0m, 1.9m, IRSF and SALT telescopes

Awards and Achievements

2013 - 2016	NRF, Postgraduate Development Programme (PDP) Doctoral Scholarship
2010 - 2012	South African Square Kilometre Array (SKA) Postgraduate Scholarship
2008 - 2009	SKA Undergraduate Bursary Award

Work & Teaching Experience

2009 - 2015 Tutor — UCT, UP

- Tutored various subjects: Biological Physics (1st year), Astronomy (2nd year), Electrodynamics (Hons.)

2007 Dec - Jan Student Data Analyst — HartRAO

- Analysed radio data from astronomical masers to search for variability

Leadership & Involvements

Academic

2017 - present Postgraduate Mentor Astronomy/Physics Dept. UCT

- Advised undergraduate students on postgraduate opportunities

2014 - 2016 Postgraduate Student Representative Astronomy Dept. UCT

- Mediated student issues within Science Faculty
- Served on Science Postgraduate student council

2011 Volunteer Postgraduate Student Representative

- Translated open source High School science textbooks into Afrikaans

Public Talks

2016 January 23 "The Cataclysmic Variables" SAAO Open Night

2016 June 20 "How the universe creates CVs" Hermanus Astronomy Club

Sports & Culture

2010 - 2017 Waaihoek Leader UCT Mountain and Ski Club (MSC)

- Organised and lead numerous international expeditions and multi-day hikes

2014 Chairperson UCT MSC

- Led a committee of 22 people at the head of a society with 800 members
- Managed and spent a budget of ∼R250 000
- Coordinated 5-10 weekly events

2011 - 2015 Committee member UCT MSC

- Fulfilled various portfolio roles including Expeditions, Equipment and Ski

2012 Expedition Leader UCT MSC

- Led Team on MSC expedition to summit Mt Kenya (5 199m)
- Awarded R 14 000 in sponsorship funding

2012 Sports Merit Award UCT

- Led Southern-African team on UIAA Youth expedition to summit the highest mountain in Europe, Mt Elbrus (5 642m)

2011 Sports Performance of the Year Award UCT

- Co-organised mountaineering expedition to summit the Himalayan peak, CB13-A (6 264m)
- Awarded R 30 000 in sponsorship funding
- Article in UCT Campus Sport Magazine

Outreach & Volunteering

2017 Founding Member & Sport Climbing Coach DreamHigher NPO
- Coach Rock Climbing to previously disadvantaged young adults

2013 - 2017 Volunteer SAAO
- Volunteered at SAAO Open Night and various public stargazing events

2012 - 2015 Mountain Search and Rescue Member Mountain Club of South Africa (MCSA)

Professional Development

Conference Attendance

2017 Nov. IAU Symposium 339: Southern Horizons in Time-Domain Astronomy STIAS
- Poster: "Quasi-Periodic Oscillations in magnetic CVs"

2017 Sept. Deep Learning Indaba WITS

2016 July South African Institute of Physics (SAIP) Conference UCT
- Talk: "Quasi-Periodic Oscillations in magnetic CVs"

2015 Sept. The Golden Age of Cataclysmic Variables and Related Objects - III Palermo, Italy
- Talk: "Quasi-Periodic Oscillations in magnetic CVs"

2015 June SALT Science Conference 2015 STIAS
- Poster: "Probing accretion in magnetic CVs through rapid photometry with SALTICAM"

2014 July SAIP Conference UJ
- Talk: "Rapid Variability of magnetic Cataclysmic Variable Stars"

2013 Sept. The Golden Age of Cataclysmic Variables and Related Objects - II Palermo, Italy
- Talk: "Modelling Rapid Variability in Cataclysmic Variable Stars"

2013 July SKA Joint Radio Transients Conference Protea Hotel, Krüger Gate

2012 Dec. SKA Postgraduate Bursary Conference STIAS
- Talk: "Modelling Quasi-Periodic Variability in Dwarf Novae during outburst"

2012 Aug. IAU XXVIII General Assembly Beijing, China
- Poster: "Modelling Quasi-Periodic Variability in Cataclysmic Variable Stars"

2011 Dec. SKA Postgraduate Bursary Conference STIAS
- Poster: "A study of DNOs and QPOs in Cataclysmic Variable Stars"

2011 Mar. Middle-East and African Regional IAU Meeting II (MEARIM-II) Cape Town

2010 - 2008 Nov. SKA Postgraduate Bursary Conference STIAS

Workshop Attendance

2017 Apr. Workshop on Magnetic Accretion SAAO
- Talk: "Observations of Quasi-Periodic Oscillations in magnetic CVs"

2017 Apr. SKA Big Data Africa Summer School Cape Town
- Led tutorial session: "Outlier detection for time series data"

- Led a student team investigating: "Epileptic seizure prediction from EEG data"

2016 Nov. Workshop on Bayesian Analysis in Physics and Astronomy — Stellenbosch

- Led hack project: "Bayesian methods for CCD photometry"

2016 May CDS Tools Workshop — SAAO

2015 Nov. Workshop on using ALMA for science — UCT

2015 Apr. GPGPU programming workshop — UCT

2014 Nov. GADGET Simulations workshop — UCT

2014 Oct. 2^{nd} Machine learning JEDI Workshop — Cape Town

- Developed classification pipeline for American Epilepsy Society Seizure Prediction Challenge

2012 Feb. IAU International School of Young Astronomers (ISYA) — UCT, SAAO

2011 Oct. Workshop on Space Science and Astrophysics — CHPC, CSIR, Pretoria

2010 Dec. Workshop on Convection in stars — UJ

2010 Jan. National Astrophysics and Space Science Program (NASSP) Summer School — UCT & SAAO

Publications

Peer-reviewed

[1] IGR J19552+0044: A new asynchronous short period polar: Filling the gap between intermediate and ordinary polars. By G. Tovmassian, D. Gonzalez-Buitrago, J. Thorstensen, E. Kotze, **H. Breytenbach**, A. Schwope, F. Bernardini, S. V. Zharikov, M. S. Hernandez, D. A. H. Buckley, E. de Miguel, F.-J. Hambsch, G. Myers, W. Goff, D. Cejudo, D. Starkey, T. Campbell, J. Ulowetz, W. Stein, P. Nelson, D. E. Reichart, J. B. Haislip, K. M. Ivarsen, A. P. LaCluyze, J. P. Moore, and A. S. Miroshnichenko. *ArXiv e-prints*, Oct. 2017.

[2] The structure of Chariklo's rings from stellar occultations. By D. Bérard, B. Sicardy, J. I. B. Camargo, J. Desmars, F. Braga-Ribas, J. L. Ortiz, R. Duffard, N. Morales, E. Meza, R. Leiva Espinoza, G. Benedetti-Rossi, M. Assafin, R. Vieira-Martins, F. Colas, J. L. Dauvergne, P. Kervella, J. Lecacheux, L. Maquet, F. Vachier, A. A. Sickafoose, **H. Breytenbach**, A. Genade, et al. *ArXiv e-prints*, June 2017. URL: https://arxiv.org/pdf/1706.00207.pdf.

[3] A VLT-ULTRACAM study of the fast optical quasi-periodic oscillations in the polar V834 Centauri. By M. Mouchet, J. Bonnet-Bidaud, L. Van Box Som, E. Falize, D. A. H. Buckley, **H. Breytenbach**, R. P. Ashley, T. R. Marsh, and V. S. Dhillon. *A&A*, 600:A53, 2017. URL: https://doi.org/10.1051/0004-6361/201630166.

[4] Peculiarities of the accretion flow in the system HL CMa. By A. Semena, M. Revnivtsev, D. Buckley, A. Lutovinov, and **H. Breytenbach**. *Astronomy Letters*, 42(6):379–392, 2016. URL: https://arxiv.org/pdf/1610.00874.pdf.

[5] On the area of accretion curtains from fast aperiodic time variability of the intermediate polar EX Hya. By A. N. Semena, M. G. Revnivtsev, D. A. Buckley, M. M. Kotze, I. I. Khabibullin, **H. Breytenbach**, A. A. Gulbis, R. Coppejans, and S. B. Potter. *MNRAS*, 442(2):1123–1132, 2014. URL: https://academic.oup.com/mnras/article-abstract/442/2/1123/981562/On-the-area-of-accretion-curtains-from-fast.

[6] High-speed photometry of faint cataclysmic variables–VIII. Targets from the Catalina Real-Time Transient Survey. By D. L. Coppejans, P. A. Woudt, B. Warner, E. Körding, S. A. Macfarlane, M. P. Schurch, M. M. Kotze, **H. Breytenbach**, A. A. Gulbis, and R. Coppejans. *MNRAS*, 437(1):510–523, 2014. URL: https://academic.oup.com/mnras/article/437/1/510/1001483/High-speed-photometry-of-faint-cataclysmic.

Conference Proceedings

[1] Quasi-periodic oscillations in magnetic Cataclysmic Variables: Results for V834 Cen. By **H. Breytenbach**, Buckley, D. A. H., Bonnet-Bidaud, J.-M., and Mouchet, M. In *Proceedings of Science*, 2017. URL: https://pos.sissa.it/archive/conferences/255/018/Golden2015_018.pdf.

[2] MASTER-SAAO transient detections: new Cataclysmic Variable discoveries. By D. A. H. Buckley, **H. Breytenbach**, A. Kniazev, M. Kotze, M. Motsoaledi, S. Potter, P. Woudt, V. Lipunov, and E. Gorbovskoy. In *Proceedings of Science*, 2017. URL: https://pos.sissa.it/archive/conferences/255/027/Golden2015_027.pdf.

[3] New Observations of Accretion Phenomena in Magnetic Cataclysmic Variables. By D. Buckley, S. Potter, E. Kotze, M. Kotze, and **H. Breytenbach**. In *EPJ Web of Conferences*, volume 64, page 07005. EDP Sciences, 2014. URL: www.epj-conferences.org/articles/epjconf/pdf/2014/01/epjconf_mag2013_07005.pdf.

Short publications

[1] Classification of MASTER OT J061451. 70-272535.5 as an eclipsing Polar. By D. Buckley, **H. Breytenbach**, A. Kniazev, M. Kotze, M. Motsoaledi, S. Potter, J. Thorstensen, E. Gorbovskoy, V. Lipunov, and P. Woudt. *The Astronomer's Telegram*, 7169:1, 2015. URL: http://www.astronomerstelegram.org/?read=7169.

[2] SALT spectroscopy of the flaring blazar J141922. 55-083832.0. By D. Buckley, **H. Breytenbach**, A. Kniazev, M. Kotze, S. Potter, E. Gorbovskoy, and V. Lipunov. *The Astronomer's Telegram*, 7167:1, 2015. URL: http://www.astronomerstelegram.org/?read=7167.

References

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