# Dr Kevin Aquino

## BSc PhD

Complex Systems Group
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NSW 2006, Australia

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## Current employment

2021 – **Complex systems**                                      School of Physics, University of Sydney, Australia
*Research Fellow*
Employed as a research fellow at the University of Sydney working on modelling and the following roles:
- Employing and developing physiological models to understand resting state fMRI networks
- Supervising Honours, and PhD students (from Monash University and the University of Sydney)
- Training and mentoring Junior postdoctoral fellows

2019 – **Kevin Aquino: Biomedical and Consulting ABN: 56 701 124 137**                    Sydney, Australia.
*Lead consultant*
Self employed as a consultant, specialising in biomedical imaging and data analytics. Clients include:
- In my capacity as a biomedical consultant: A neurology startup in Palo Alto, California, USA.
- In my capacity as a neuroimgaing consultant: Pharmaceutical company based in California, USA.

## Education

2012 **Doctor of Philosophy (Physics)**
University of Sydney
Thesis: *Spatiotemporal Hemodynamics: From Theory to Experiment*
(December) Supervised by Prof. Peter Robinson (principal), Prof. Michael Breakspear (associate), Dr Mark Schira (associate) and Dr Peter Drysdale (associate).

2006 **Bachelor of Science (Honors I)**
University of Sydney,
Thesis: *Wavelet analysis of Brain activity*
Supervised by Prof. Peter Robinson (principal), Prof. Michael Breakspear (associate).

2005 **Bachelor of Science**
University of Sydney,
Majors in Physics and Mathematics.

## Expertise

**Research areas** fMRI, MRI, Spatiotemporal Hemodynamics, Modeling, Neural Field Theory, Data analysis, Image processing, Deconvolution, task-fMRI, & resting-state fMRI.
**Programming:** Proficient in MATLAB, LaTeX & Python. Familiar in C, C++, CSS, & Java.
**Software:** Freesurfer, SPM, FSL, AFNI, mrTools, mrVista.

# Research experience

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| 2017 – 2020 | **Monash University** | Melbourne, Victoria, Australia |

*Research Fellow, Head of Computational Modeling, July 2017 – December 2020*
Worked at the Turner Institute working on large scale brain modelling, de-noising resting state fMRI, imaging analytics at the Neural systems and Behavior lab (Primary Investigator Alex Fornito)

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| 2015 – 2017 | **University of Nottingham** | Nottingham, Nottinghamshire, UK |

*Research Fellow, July 2015 – July 2017*
Worked with Prof. Susan Francis, Dr Karen Mullinger, and Rosa Sanchez-Panchuelo on Laminar fMRI, Ultra-high field neuroimaging and EEG-fMRI at 7T.

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| 2013 – 2015 | **University of Sydney** | Camperdown, NSW, Australia |

*Research Associate, Janurary 2013 – July 2015*
Worked with Prof. Peter Robinson and Dr. Mark Schira on projects with Spatiotemporal hemodynamics, Brain Connectivity, Neural Field Modelling and co-supervised 3 PhD Students.

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| 2012 – 2013 | **Queensland Institute of Medical Research** | Herston, QLD, Australia |

*Research Assistant, July 2012 – January 2013*
Worked under Part time (0.5) with Prof. Michael Breakspear projects on Deconvolution of fMRI data.

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|---|---|---|
| 2012 – 2013 | **University of Sydney** | Camperdown, NSW, Australia |

*Research Associate, July 2012 – January 2013*
Worked under Part time (0.5) with Prof. Peter Robinson on projects with Spatiotemporal hemodynamics.

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| 2005 – 2006 | **The Blackdog institute** | Randwick, NSW, Australia |

Research Assistant to Prof. Michael Breakspear
Casual work to analyse Functional Magnetic Resonance Imaging (fMRI) data, and electrical encephalography (EEG). Also worked on a neural mass model that resulted in a publication.

# Honors and awards

2020     **Australian Research Council Discovery Project**
Awarded $509,561 AUD For project: Modelling brain network development (DP200103509): with Alex Fornito, Gustavo Deco, and Kevin Aquino (CI-C).

2017     **PLOS Early Career Travel Award Program**
Awarded $500 USD to attend ISMRM 2017 in Hawaii see: http://blogs.plos.org/thestudentblog/2017/08/08/how-science-is-communicated-impacts-how-science-is-received-early-career-researchers-share-their-take-on-the-future-of-scicomm/

2016     **Guarantors of Brain Travel Grant**
Guarantors of Brain Travel Grant to attend the Organization for Human Brain Mapping Annual Meeting in Geneva, Switzerland travel Award, £600 GBP.

2013     **Trainee Abstract Travel Award**
Organization for Human Brain Mapping Annual Meeting in Seattle, WA, USA travel Award for abstract: "Spatiotemporal neural dynamics from fMRI: Deconvolution with a spatiotemporal HRF", $700 USD.

2007 – 2010     **Australian Postgraduate Award Scholarship**
Australian government award. Stipend for $20,000 AUD p/a while taking a research degree.

2006     **Science Foundation for Physics, Scholarship No. 3**
Faculty of Science, University of Sydney Prize for $1000 AUD.

2005     **Summer student scholarship**
Neuroscience Institute of Schizophrenia and Allied Disorders (NISAD) award: $2000 AUD, for work on "Multiscale character of evoked cortical activity" with Prof. Michael Breakspear.

2003 – 2005     **Faculty of Science Dean's List of Excellence in Academic Performance**
University of Sydney award for Years 1–3 of the undergraduate degree for having an average of High Distinction (85/100) or greater.

2003 – 2004     **Talented Student Program**
University of Sydney first and second year program for students to undertake in projects in various research groups. First year: electron microscopy unit (Vicki Keast), Second year: Complex Systems (Michael Breakspear).

# Publications

1. Arnatkeviciute, A, Fulcher, B.F, Oldham, S., Tiego, J., Paquola, C., Gerring, Z.F., **Aquino, K.M.**, et al. (2020). Genetic influences on hub connectivity of the human connectome. *BioRxiv, ,* `https://doi.org/10.1101/2020.06.21.163915`.

2. **Aquino, K.M.**, Fulcher B.F., Parkes, L., Sabaroedin, K., & Fornito, A. (2020). Identifying and removing widespread signal deflections from fMRI data: Rethinking the global signal regression problem. *Neuroimage, 212,* 116614.

3. **Aquino, K.M.**, Sokoliuk, R., Pakenham, D., Sanchez, R., Hanslmayr, S., Mayhew, S., Mullinger, K.J., & Francis, S.T. (2019). Addressing challenges of high spatial resolution, UHF fMRI for group analysis of higher-order cognitive tasks; an inter-sensory task directing attention between visual and somatosensory domains.. *Human Brain Mapping, 40,* 1298–1316.

4. Sokoliuk, R., Mayhew, S., **Aquino, K.M.**, Wilson, R., Brookes, M.J., Francis, S.T., Hanslmayr, S., & Mullinger, K.J. (2019). Two spatially distinct posterior alpha sources fulfill different functional roles in attention. *Journal of Neuroscience, 39,* 7183–7194.

5. Parkes, L., Tiego, J., **Aquino, K.M.**, Braganza, L., Chamberlain, S.R., Fontenelle, L., Harrison, B.J., Lorenzetti, V., Paton, B., Razi, A., Fornito, A., Yucel, M. (2019). Transdiagnostic variations in impulsivity and compulsivity in obsessive-compulsive disorder and gambling disorder correlate with effective connectivity in cortical-striatal-thalamic-cortical circuits.. *Neuroimage, 202,* 116070.

6. Tewarie, P.K, Hunt B.A.E, O'Neill, G.C., Byrne, A., **Aquino, K.M.**, Bauer, M., Mullinger, K.J., Coombes, S.C., & Brookes,

M.J. (2018). Relationships between neuronal oscillatory amplitude and dynamic functional connectivity. *Cerebral Cortex, ,* 1–14.

7. Pang, J.C., **Aquino, K.M.**, Robinson, P.A., Lacy, T.C., & Schira, M.M. (2017). Biophysically based method to deconvolve spatiotemporal neurovascular signals from fMRI data. *J. Neurosci. Meth., 308,* 6–20.

8. Pandejee, G.M., Robinson, P.A., Henderson, J.A., **Aquino, K.M.**, & Sarkar, S. (2017). Inference of Direct and Multistep Effective Connectivities from Functional Connectivity of the Brain and of Relationships to Cortical Geometry. *J. Neurosci. Meth., 283,* 42-54.

9. Pang, J.C., Robinson, P.A., **Aquino, K.M.**, & N., Vasan. (2017). Effects of astrocytic dynamics on spatiotemporal hemodynamics: Modeling and enhanced data analysis. *Neuroimage, 147,* 994–1005.

10. Lacy, T.C., **Aquino, K.M.**, & Robinson, P.A. (2016). Shock-like BOLD Responses Induced in the Primary Visual Cortex by Moving Visual Stimuli. *J. R. Soc. Interface, 13 (125),* 20160576.

11. Robinson, P.A., Zhao, X., **Aquino, K.M.**, Griffiths, J.D., Sarkar, S., & Pandejee, G.M (2016). Eigenmodes of Brain Activity: Neural Field Theory Predictions and Comparison with Experiment. *Neuroimage, 142,* 79–89.

12. Pang, J.C., Robinson, P.A., & **Aquino, K.M.** (2016). Response-mode decomposition of spatio-temporal haemodynamics. *J. R. Soc. Interface, 13 (118),* 20160253.

13. Puckett, A., **Aquino, K.M.**, Robinson, P.A., Breakspear, M., & Schira, M.M. (2016). The 3D hemodynamic response function for depth-dependent fMRI of human cortex. *Neuroimage, 139,* 240–248.

14. **Aquino, K.M.**, Robinson, P.A., Schira, M.M., & Breakspear, M. (2014). Deconvolution of neural dynamics from fMRI data using a spatiotemporal hemodynamic response function. *Neuroimage, 94,* 203–215.

15. **Aquino, K.M.**, Robinson, P.A., & Drysdale, P.M. (2014). Spatiotemporal hemodynamic response functions derived from physiology. *Journal of Theoretical Biology, 347,* 118–136.

16. **Aquino, K.M.**, Schira, M.M., Robinson, P.A., Drysdale, P.M., & Breakspear, M. (2012). Hemodynamic traveling waves in Human Visual Cortex. *PLoS - Computational Biology, 8,* e1002435.

17. Drysdale, P.M., Huber, J.P., Robinson, P.A., & **Aquino, K.M.** (2010). Spatiotemporal BOLD hemodynamics from a poroelastic hemodynamic model. *The journal of Theoretical Biology, 265,* 523–534.

18. Freyer, F., **Aquino, K.M.**, Robinson, P.A., Ritter P., & Breakspear, M. (2009). Bistability and non-Gaussian fluctuations in spontaneous cortical activity. *The Journal of Neuroscience, 29,* 8512–8524.

19. Breakspear, M., Bullmore, Ed T., **Aquino, K.M.**, Das, P., & Williams, L. M. (2006). The multiscale character of evoked cortical activity. *Neuroimage, 30,* 1230–1242.

# Oral presentations

1. **Aquino, K.M.** (October 2019). Educational workshop: Pre-processing of MRI: State-of-the-art, challenges and pitfalls. *Annual Meeting of the Organization for Human Brain Mapping: Australian Chapter.*, Newcastle, Australia.

2. **Aquino, K.M.** (June 2019). OHBM. *More than Meets the Eye: Methods for characterizing and removing large-scale structured signals from resting-state fMRI data.*, Morning workshop: The Global Signal Strikes Back: Understanding and Addressing Widespread Signal Fluctuations in fMRI 25th Annual Meeting of the Organization for Human Brain Mapping. Rome, Italy

3. **Aquino, K.M.** (March 2019). More than meets the eye: methods for characterizing and removing large- scale structured signals from resting-state fMRI. *Noosa workshop on Brain Function, Connectivity and Behaviour*, Noosa, Australia.

4. **Aquino, K.M.** (November, 2018). On the intersection between theory and experiment in large- scale brain network modelling. *NeuroEng*, Sydney, Australia.

5. **Aquino, K.M.**, Robinson, P.A., Puckett, A., Breakspear, M., & Schira, M.M. (June 2014). From Visual Stimulus to BOLD Measurements, a complete spatiotemporal model derived from submillimetre fMRI. *Morning workshop: The hemodynamic response and neurovascular coupling: From sources to measures to models, 20th Annual Meeting of the Organization for Human Brain Mapping*, Hamburg, Germany.

6. **Aquino, K.M.**, Robinson, P.A., Schira, M.M., Lacy, T., & Breakspear, M. (November 2013). Spatiotemporal hemodynamics from a physiological model: Deconvolution of fMRI data, and interactions of BOLD responses. *Meeting for the Society for Neuroscience*, San Diego, CA, USA.

7. **Aquino, K.M.**, Robinson, P.A., Schira, M.M., & Breakspear, M. (June 2013). Spatiotemporal neural dynamics from fMRI: Deconvolution with a spatiotemporal HRF. *19th Annual Meeting of the Organization for Human Brain Mapping*, Seattle WA, USA. (Recipient of the trainee abstract travel award).

8. **Aquino, K.M.**, Schira, M.M., Robinson, P.A., & Breakspear, M. (February 2013). A physiologically plausible spatiotemporal model of BOLD allows deconvolution of hemodynamic and neuronal response components. *ANS 2013: the 33rd Annual Meeting of the Australian Neuroscience Society*, Melbourne, VIC, Australia.

9. **Aquino, K.M.** (December 2012). Spatiotemporal Neural Dynamics from fMRI: Deconvolution using a spatiotemporal hemodynamic response function. *Brain Modes, Large-scale models of the brain*, Queensland Institute of Medical Research, QLD, Australia.

10. **Aquino, K.M.**, Schira, M.M., Robinson, P.A., Drysdale, P.M., & Breakspear, M. (December 2011). Spatiotemporal Hemodynamics: From theory to Experiment. *5th Australian Workshop on Computational Neuroscience*, University of Western Sydney, NSW, Australia.

# Poster presentations

1. **Aquino, K.M.**, Sanchez-Panchuelo, R. S., Mullinger, K.J., Hanslmayr, S., Mayhew S., Sokoliuk, R., & Francis, S.T. (April 2017). Top-down modulation in a directed sensory attention task. *25th Annual meeting for the International Society of Magnetic Resonance Imaging in Medicine*, Poster No. 5368, Honolulu, HI, USA..

2. **Aquino, K.M.**, Sanchez-Panchuelo, R. S., Mullinger, K.J., Hanslmayr, S., Mayhew S., Sokoliuk, R., & Francis, S.T. (June 2016). In vivo segmentation of layer IV in primary visual cortex using anatomy. *22nd Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 1256, Geneva, Switzerland.

3. Lacy, T.C., **Aquino, K.M.**, Robinson, P.A.,& Schira, M.M. (June 2015). Induction of Hemodynamic Shocks by Moving Stimuli in the Primary Visual Cortex. *21st Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 3739, Honolulu, Hawaii, USA.

4. **Aquino, K.M.**, Lacy, T.C., Robinson, P.A.,& Schira, M.M. (June 2015). Using models to design fMRI experiments – not just fit data. *21st Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 3729, Honolulu, Hawaii, USA.

5. Puckett, A. M., **Aquino, K.M.**, Isherwood, Z.,& Schira, M.M. (June 2015). Laminar Differences in Retinotopic Maps: Measured and Modeled. *21st Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 4049, Honolulu, Hawaii, USA.

6. Robinson, P.A., Zhao, X., **Aquino, K.M.**, Griffiths, J.D., Sarkar, S., & Pandejee G.M (June 2015). Neural Field Theory of Eigenmodes of Brain Activity. *21st Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 3870, Honolulu, Hawaii, USA.

7. Puckett, A., **Aquino, K.M.**, Robinson, P.A., Breakspear, M., & Schira, M.M. (June 2014). Laminar analysis: The spatiotemporal profile of the BOLD response changes with depth. *20th Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 2062, Hamburg, Germany.

8. **Aquino, K.M.**, Robinson, P.A., Puckett, A., Breakspear, M.& Schira, M.M. (June 2014). From Visual Stimulus to BOLD Measurements, a complete spatiotemporal model derived from sub millimetre fMRI. *20th Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 1702, Hamburg, Germany.

9. **Aquino, K.M.**, Robinson, P.A., Schira, M.M., & Breakspear, M. (June 2013). Spatiotemporal neural dynamics from fMRI: Deconvolution with a spatiotemporal HRF. *19th Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 1752, Seattle, WA, USA. (Recipient of the trainee abstract travel award).

10. **Aquino, K.M.**, Breakspear, M., Robinson, P.A., & Schira, M.M. (November 2011). Disambiguating between neural and hemodynamic effects. *Annual meeting for the Society for Neuroscience*, Poster No. 619.12/YY4, Washington, DC, USA.

11. Schira, M.M., Breakspear, M., Paxinos, G., & **Aquino, K.M.** (November 2011). High resolution characterisaton of spatiotemporal point spread of BOLD: Vascular versus neuronal spread in human V1 and V2. *Annual meeting for the Society for Neuroscience*, Poster No. 271.14/JJ5, Washington, DC, USA.

12. **Aquino, K.M.**, Drysdale, P.M., & Breakspear, M. (June 2010). A spatiotemporal HRF derived from physiology. *16th Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 2456, Barcelona, Spain.

13. Drysdale, P.M., Huber J.P., Robinson, P.A., & **Aquino, K.M.** (June 2010). Spatiotemporal BOLD hemodynamics from a poroelastic hemodynamic model. *16th Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 1080, Barcelona, Spain.

14. **Aquino, K.M.**, Schira, M.M., Drysdale, P.M., Robinson, P.A., & Breakspear, M. (June 2010). BOLD travelling waves in primary visual cortex. *16th Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 2460, Barcelona, Spain.

15. **Aquino, K.M.**, Robinson, P.A., Schira, M.M., Drysdale, P.M., & Breakspear, M. (June 2008). Characterization of physiologic and neural fluctuations in sensory-evoked fMRI of the primary visual cortex. *14th Annual Meeting of the Organization for Human Brain Mapping*, Poster No. 491, Melbourne, VIC, Australia.

# Teaching & supervision

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| 2019 | **PhD Primary supervisor** | Supervising student YuChi at Monash University. |
| 2018 – | **Honours Primary supervisor** | Supervised Honours students Anna Earl,Alex Wulff, and Jia Lee in their 4th year psychology projects at Monash University. |
| 2017 – | **Associate supervisor** | Associate supervisor to PhD candidates: Kristina Sabaroedin, Sid Chopra, and Ashlea Segal |
| 2016 | **Undergraduate Teaching** | Assisted in teaching 4th year undergraduate physics module : Image processing at the University of Nottingham. Involved in marking student presentations as well as creating and supervising 2 student projects (2 students per project). |
| 2016 | **Modeling Seminar Series** | Co-organized and gave 2 Lectures of a Modeling seminar series at the Sir Peter Mansfield Imaging center. Six lectures were scheduled with an attendance of ≈20 members that included staff from around the Univeristy of Nottingham. |
| 2013 – | **Associate Supervisor** | Honors Student (4th year) Thomas Lacy (2013), PhD Candidate Thomas Lacy (from 2014), PhD Candidate James Pang (from 2015, submitted 2018), and PhD candidate Grishma Mehta-Pandejee (completed 2018) |
| 2014 | **First year informatics course: INFO 1903** | Guest Lecture: "Hemodynamics: from Theory to experiment." |
| 2011 – 2013 | **Supervisor** | Third year Physics special project students: Thomas Lacy (2011) & Nikhil Vasan (2013). |
| 2011 – 2012 | **Teaching Assistant** | Redesign of Computational Physics module in Physics II. |
| 2010 – 2012 | **Laboratory Supervisor** | Physics II, Computational Physics. |
| 2006 – 2009 | **University Tutor** | Computational Physics II, Physics I, and Computational Science (First year course). |

# Academic Service

1. Organized an educational course to teach Dynamic Causal modelling and ordinary differential equations. Lectures were made online at `https://www.youtube.com/watch?v=q-yypnHgCII` and have reached over 100 hours of viewing time.

2. Gave pre-processing seminars at the Sir Peter Mansfield Imaging Centre, University of Nottingham (2016,2018) attended by $\approx 50$ staff and student members.

3. Organizer of Complex systems seminar series. (2013–2015)

4. Webmaster, Complex Systems group `http://physics.usyd.edu.au/complex-systems/` (2015)

5. Reviewer: Neuroimage, Neural Networks), Frontiers in Neuroscience, Human Brain Mapping (Conference Abstracts), Human Brain mapping, PLoS Computational Biology, Journal of Neuroscience Methods, & Science Advances.

6. Volunteer for University of Sydney Open day.