

# Thomas MacDonald

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## Employment

- June 2020–June 2022 **Postdoctoral fellow**, *Australian Centre of Excellence in Exciton Science, School of Physics, UNSW Sydney*  
Postdoctoral research project on exciton spin physics and excitonic logic. Combined experimental work on spin physics of multiexcitonic processes (electron spin resonance), theoretical modelling of those processes, and theoretical discussions and proposals of multiexcitonic processes as a route to performing logical operations and computation.
- Conducted independent research within the McCamey group
  - Shared supervision of Honours and PhD research students
- 2015–2018 **Technical assistant**, *NMR Facility, Mark Wainright Analytical Centre, UNSW Sydney*
- Produced training and reference manuals for analytical techniques used within UNSW
  - Produced documentation supporting an application for national accreditation
- 2015 **Student assistant**, *Mass Spectrometry facility, University of Sydney*  
Sample analysis and basic maintenance of instruments
- 2014–2015 **Laboratory Demonstrator**, *Department of Chemistry, University of Sydney*  
Trained students in laboratory practice while maintaining a safe environment

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## Education

- Jan 2016–Mar 2020 **PhD in Chemistry**, *UNSW Sydney, Australia*  
PhD in chemistry working with Associate Professor Jonathan Beves. Major themes of research included the use of diffusion NMR spectroscopy to study supramolecular and physical chemistry of active molecules, including design and implementation of new experimental techniques and data processing routines. Control of molecular properties using external stimuli, particularly light. Design of all-photon molecular logic devices.
- **Thesis:** *Controlling Molecular Motion*. Submitted March 2020, corrections accepted May 2020, conferred June 2020. Available at <http://handle.unsw.edu.au/1959.4/67164>.
  - **UNSW Dean's Award** for Outstanding PhD Thesis. Awarded to candidates that "...produce a thesis that requires only minimal corrections, receives outstanding and/or excellent levels of achievement for all examination criteria, and in the opinion of both examiners is in the top 10% of PhD theses they have examined".
  - Awarded **RTP Scholarship** to fund research
  - Authored papers for publication in peer-reviewed scientific journals including four first-author publications; see below for details
  - Presented at national and international research conferences
- 2018, April - August **PhD Exchange**, *University of Groningen, Groningen, Netherlands*  
Conducted research into new molecular photoswitches and switchable guest-binding at the University of Groningen under supervision of Dr. Sander Wezenberg and Prof. Ben Feringa.

2011–2014 **Bachelor of Science (Honours)**, *University of Sydney*, Australia

Honours in Chemistry supervised by Assoc. Prof. Matthew Todd

- **Thesis:** *Development of Routes to Access and Functionalise [1,2,4]Triazolo[4,3-a]pyrazine Amides as Antimalarial Compounds*  
Available in full at [dx.doi.org/10.6084/m9.figshare.1301073](https://dx.doi.org/10.6084/m9.figshare.1301073)
- **First class Honours** in Chemistry.
- **Other courses taken:** Physics, Mathematics, Engineering, Linguistics, German

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## Skills

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| Management           | ▪ Design and execution of projects, either in a group or independently in support of team goals   |
| Scientific/technical | ▪ <b>Magnetic Resonance</b> spectroscopy. Solid theoretical understanding of spin resonance, and strong experimental experience in both <b>NMR</b> and <b>ESR</b> spectroscopy. Capable NMR user with specialist skills in pulsed gradient diffusion NMR (see publications) and integration of external electronics (eg light sources) into NMR experiments. Experienced in experimental ESR including sample preparation, acquisition of laser-pumped transient CW spectra, pulsed ESR including pulse sequence implementation, data processing (own scripts written in Python), and experimental simulation (Easyspin package in Matlab).<br>▪ <b>Physical organic chemistry</b> and mathematical modelling of reaction networks, supramolecular association, and molecular photophysics.<br>▪ <b>Organic synthesis</b> including bench chemistry, photochemistry, air- and water-sensitive reactions, and purification (chromatography, crystallisation, HPLC) |
| Computer skills      | ▪ Capable Windows and Linux user<br>▪ Data analysis (Python, Matlab, Origin, Excel). Experience with common Python data analysis and visualisation modules such as numpy, pandas, scipy, and matplotlib<br>▪ Document preparation (MS Office, LaTeX) and design of publication-quality technical figures and illustrations (Python matplotlib, Adobe Illustrator, Adobe Photoshop)  |
| Communication        | ▪ Highly literate with good attention to detail in written and oral communication<br>▪ Experienced in producing academic research outputs (journal articles, conference presentations)<br>▪ Networking and collaboration with others, whether in-person at conferences or through online social media   |

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## Personal interests

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| Computers       | Servers and networking, archival and analysis of online content, home media servers.   |
| Music and dance | Singing, dancing, playing with various folk music and dance groups at festivals and events around NSW and Australia. I have also previously played trombone with classical and jazz groups, and sung with the Sydney Philharmonia Chorus accompanying the Sydney Symphony Orchestra in concerts. |
| Other interests | Film, bushwalking, sailing, travel   |

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## Research Publications

- 2021 **An All-Photonic Molecular Amplifier and Binary Flip-Flop**  
T. S. C. MacDonald, T. W. Schmidt, J. E. Beves, *J. Phys. Chem. Lett.* **2021**, *12*, 4, 1236–1243
- 2021 **Comment on “Boosted molecular mobility during common chemical reactions”**  
J.-P. Günther, L. L. Fillbrook, T. S. C. MacDonald, G. Majer, W. S. Price, P. Fischer, J. E. Beves, *Science* **2021**, *371*, 6526
- 2020 **Controlled Diffusion of Photoswitchable Receptors by Binding Anti-electrostatic Phosphate Oligomers**  
T. S. C. MacDonald, B. L. Feringa, W. S. Price, S. J. Wezenberg, J. E. Beves, *J. Am. Chem. Soc.* **2020**, *142*, 47, 20014–20020
- 2019 **Enhanced Diffusion of Molecular Catalysts is Due to Convection**  
T. S. C. MacDonald, W. S. Price, R. D. Astumian, J. E. Beves, *Angew. Chem. Int. Ed.* **2019**, *58*, 18864–18867.
- 2019 **Time-Resolved Diffusion NMR Measurements for Transient Processes**  
T. S. C. MacDonald, W. S. Price, J. E. Beves, *ChemPhysChem* **2019**, *30*, 923–930.
- 2016 **Photochromic Switching Behaviour of Donor-Acceptor Stenhouse Adducts in Organic Solvents**  
N. Mallo, P. T. Brown, H. Iranmanesh, T. S. C. MacDonald, M. J. Teusner, J. B. Harper, G. E. Ball, J. E. Beves, *Chem. Commun.* **2016**, *52*, 13576–13579.

## Conference presentations

- 2021 **Australian Institute of Physics (AIP) Summer Meeting, Brisbane, Australia (Virtual)**  
Accepted oral presentation: *Direct Measurements of Singlet Fission Spin Dynamics by 2D Nutation Spectroscopy*.
- 2021 **ISMAR-APNMR 2021, Japan (Virtual)**  
Accepted oral presentation: *Direct Measurements of Singlet Fission Spin Dynamics by 2D Nutation Spectroscopy*.
- 2020 **Royal Australian Chemical Institute (RACI) Supramolecular Conference, Australia (Virtual)**  
Oral presentation: *An All-optical Molecular Amplifier*. Awarded one of two prizes for best talk.
- 2020 **RACI Supramolecular Conference, Brisbane, Australia**  
Oral presentation: *Photoswitchable antielectrostatic anion assemblies in solution*.
- 2019 **RACI Inorganic Conference, Wollongong, Australia**  
Poster presentation: *Enhanced diffusion of active catalysts*. Awarded 1st prize in poster competition.
- 2017 **RACI Centenary Congress, Melbourne, Australia**  
Poster presentation on DASA photoswitches.
- 2016 **MASC 2016, Edinburgh, United Kingdom**  
Poster presentation on Donor-Acceptor Stenhouse Adduct (DASA) photoswitches.
- 2014 **RACI National Congress, Adelaide, Australia**  
Poster presentation on the open source development of new triazolopyrazine antimalarials.