

# David Gozzard

Department of Quantum Science, The Australian National University

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## Academic Qualifications

- 2014 – 2017     **PhD**  
School of Physics and Astrophysics, University of Western Australia (UWA)  
**Doctoral Thesis:** “A Stabilized Reference Frequency Transfer System for the Square Kilometre Array”
- 2008 – 2013     **Bachelor of Science and Bachelor of Engineering (First Class Honours)**  
Majors: Physics and Mechanical Engineering, UWA  
**Honours Thesis:** “Development of a passive, variable-camber blade for use in linear wind generators”

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## Primary Research Areas

Free-space laser communications to spacecraft and airborne targets including for quantum key distribution. Development of optical phased arrays for space debris mitigation.  
Laser communications, QKD, OPA, space debris.  
PhD research — Delivery of stabilized frequency references through both fibre-optic and free-space links for radio telescopes (the SKA) and the European Space Agency’s ACES mission.  
Metrology, fibre-optics, laser communications.

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## Scholarships and Awards

WA Premier’s Science Awards ExxonMobil Student Scientist of the Year (2017), Postgraduate Students’ Association Fieldwork/Data Collection Award (2015, 2014), Convocation Postgraduate Research Travel Award (2015), Postgraduate Teaching Internship Scheme (2015), UWA Three Minute Thesis — Runner Up (2014), Australian Postgraduate Award (2014), John and Robin de Laeter Tertiary Student Scholarship (2012), Physics Summer Vacation Scholarship (2012), CSBP Prize in Engineering Design (2010), Dreamfit Dreamcatcher Project Management Award (2010), Clough Limited Prize in Engineering (2008).

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## Research Experience

- 2018 – Present     **Postdoctoral Fellow**, Department of Quantum Science, The Australian National University  
Currently developing optical phased array and free-space laser technologies for laser communications to air and spacecraft, quantum key distribution via satellite, and for space debris tracking and pushing. Techniques incorporate fiberized and free-space optics, analogue signal conditioning, and digital signals processing using field-programmable gate arrays.
- 2017 – 2018     **Research Associate**, International Centre for Radio Astronomy Research, The University of Western Australia  
Continued PhD work on the design and testing of a stabilized frequency reference transfer system for the SKA-MID telescope in preparation for the critical design review and beginning of construction in 2018. Explored the first use of actively stabilized continuous-wave optical signal transmission via free-space links through atmospheric turbulence.

- 2014 – 2017      **PhD Candidate**, School of Physics and Astrophysics, The University of Western Australia  
 Developed and tested actively stabilized frequency reference transfer systems for the SKA-LOW and SKA-MID telescopes. Produced systems that exceeded SKA stability requirements, and met all other SKA engineering requirements, at a cost an order of magnitude lower than previous systems for comparable telescopes such as ALMA. The system developed for SKA-MID was selected, in a competitive process, by the SKA Organization to be implemented in the SKA-MID telescope, due to begin construction in 2018. The associated tests also produced the first measurement of stabilized optical and radio-frequency signal transmission over long-distance overhead cables.
- 2013 – 2014      **Summer Research Scholarship Student**, Frequency and Quantum Metrology Group, The University of Western Australia
- 2012 – 2013      Simulated microwave and optical whispering gallery modes in cavities. Designed and tested fibre-optic radio-frequency transfer systems for synchronization of radio telescopes. Assisted with the testing of a novel point-to-multi-point stabilized optical frequency dissemination system design.

### Teaching Experience

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- 2017 – 2018      **Co-supervisor**: UWA Masters students M. Messineo, C. Gravestock, J. Horton
- 2016              **Co-supervisor**: UWA Physics Honours student Simon Stobie
- 2015 – 2018      **Co-supervisor**: UWA School of Physics & Astrophysics summer research students G. Siow, S. Stobie, B. Stone, M. Sheard, T. Pulbrook
- 2015              **Postgraduate Teaching Internship Scheme (UWA)**  
 Attended courses in a competitively selected tertiary teaching training program. Conducted research into the use and application of transformative teaching practices and presented the results at the Teaching and Learning Forum 2016
- 2013 – 2018      **Lecturer, Tutor and Laboratory Demonstrator**, School of Physics and Astrophysics, The University of Western Australia  
 Supervised and graded experimental physics laboratory classes at first- and third-year levels. Held primary responsibility for the third-year optics laboratory projects. Lectured and tutored first-year level courses Modern Physics, Our Universe, and Our Solar System. Prepared teaching materials including lectures, problem sets, and exams.

### Industry Experience

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- 2012              **Work Experience Intern**, Benchmark Engineering Pty Ltd  
 Computer Aided Design for CNC machining and precision milling and turning of components
- 2012              **Shell Training Course UB00: Introduction to the Upstream Business**  
 Training course at The University of Western Australia delivered by Shell staff  
 Completed course on oil and gas field prediction and appraisal from geological, petrophysical and well-bore data
- 2011 – 2012      **Mechanical Engineering Vacation Student**, Momentum Engineering Pty Ltd  
 Developed reference design curves for pipe supports. Used CAESAR, SPACEGASS and PROFIS software to conduct stress analysis of structures.

## Publications

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7. **Gozzard, DR**, Schediwy, SW, Courtney-Barrer, B, Whitaker, R & Grainge, K, (2018). "Simple stabilized radio-frequency transfer with optical phase actuation." *IEEE Photonics Technology Letters*, 30(3), 256-261. doi: 10.1109/LPT.2017.2785363 [arXiv:1705.06734]
6. **Gozzard, DR**, Schediwy, SW & Grainge, K, (2018). "Simultaneous transfer of stabilized optical and microwave frequencies over fiber." *IEEE Photonics Technology Letters*, 30(1), 87-90. doi: 10.1109/LPT.2017.2776243
5. **Gozzard, DR**, Schediwy, SW, Dodson, R, Rioja, M, Hill, M, Lennon, B, McFee, J, Mirtschin, P, Stevens, J & Grainge, K, (2017). "Astronomical verification of a stabilized frequency reference transfer system for the Square Kilometre Array," *The Astronomical Journal*, 154(1). doi: 10.3847/1538-3881/aa6db1 [arXiv:1704.08804]
4. **Gozzard, DR**, Schediwy, SW, Wallace, B, Gamatham, R & Grainge, K, (2017). "Characterization of optical frequency transfer over 154 km of aerial fiber," *Optics Letters*, 42(11), 2197-2200. doi: 10.1364/OL.42.002197 [arXiv:1705.00709]
3. Schediwy, SW, **Gozzard, DR**, Stobie, S, Malan, JA & Grainge, K, (2017). "Stabilized microwave-frequency transfer using optical phase sensing and actuation," *Optics Letters*, 42(9), 1648-1651. doi: 10.1364/OL.38.001648 [arXiv:1705.01169]
2. Grainge, K, Alachkar, B, Amy, S,... **Gozzard, DR**,... Wingfield, N, (2017) "Square Kilometre Array: the radio telescope of the XXI century," *Astronomy Reports*, 61(4), 288-296. doi: 10.1134/S1063772917040059
1. Schediwy, SW, **Gozzard, D**, Baldwin, KGH, Orr, BJ, Warrington, RB, Aben, G & Luiten, AN, (2013). "High-precision optical-frequency dissemination on branching optical-fiber networks," *Optics Letters*, 38(15), 2893-2896. doi: 10.1364/OL.38.002893

## Works in progress

- Gozzard, D. R.**, Schediwy, S. W., Stone, B., Messineo, M. & Tobar, M. (submitted). "Stabilized free-space optical frequency transfer."
- Schediwy, S. W., **Gozzard, D. R.**, Gravestock, C., Stobie, S., Whitaker, R., Malan, J. A., Boven, P., Grainge, K. (in prep). "The Mid-Frequency Square Kilometre Array Phase Synchronisation System."
- Gozzard, D. R.**, Schediwy, S. W., Wallace, B., Gamatham, R. & Grainge, K. (in prep). "Stabilized modulated photonic signal transfer over 186 km of aerial fiber." [arXiv:1706.04244]

## Other Research Outputs

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- Gozzard, DR**, (2017). "Classroom Antarctica: teaching physics on a plane on the way to Antarctica," *Australian Physics*, 54(3), 97-100.
- Gozzard, DR**, (2016). "Notes on calculating the relationship between coherence loss and Allan deviation," Memo, SKA-TEL-SADT-0000619, Square Kilometre Array Organization.
- Gozzard, DR** & Schediwy, S, (2016). "STFR.FRQ.UWA astronomical verification," Tech. Rep. SKA-TEL-SADT-0000524, Square Kilometre Array Organization.
- Schediwy, S & **Gozzard, DR**, (2015). "UWA South African SKA site long-haul overhead fibre field trial report," Tech. Rep. SKA-TEL-SADT-0000109, Square Kilometre Array Organization.
- Gozzard, D** & Schediwy, S, (2015). "Stabilized frequency transfer for the Square Kilometre Array," *Journal of the Royal Society of Western Australia*, 98(2), 143.

## Conference Presentations and Colloquia

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- Australian Institute of Physics Student Conference (WA), UWA Perth (Nov 2017)
- Square Kilometre Array Engineering Meeting (poster session), SKAO Rotterdam (Jun 2017)
- ATNF Colloquium, CSIRO Sydney (Feb 2017), Stabilized frequency transfer for the SKA
- Bolton and Student Symposium, CSIRO Perth (Dec 2016)
- Pietro Baracchi Conference, CSIRO Perth (Nov 2016)

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- Square Kilometre Array Engineering Meeting (poster session), SKAO Stellenbosch (Sept 2016)
  - ICRAR-con, ICRAR Mandurah (Sept 2016)
  - Royal Society of Western Australia Postgraduate Student Symposium, RSWA Perth (Oct 2015)

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### Professional Memberships

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- 2015 – Present     Australian Optical Society
- 2015 – Present     The Optical Society
- 2015 – Present     Australian Institute of Physics

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### Recent Public Talks

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- Telescope Pilot — Astrophiz podcast
- The Science of The Martian — Scitech Space Academy
- To the Edge of the Universe — Pint of Science 2017
- Optical metrology — Vaguely Accurate science podcast
- Pluto: the oddball — Astrofest 2017
- The History of Radio Astronomy — Astronomical Society of WA
- Classroom Antarctica — demonstrated physics experiments on a tour flight to Antarctica
- From here to the edge of the universe — TEDxUWA 2016
- A Matter of Time — Perth Science Festival
- What is Sound? — Flame Challenge 2016

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### Volunteer Activities

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- 2016 – 2018     **Media Officer**  
The Optical Society UWA Student Chapter
- 2015             **Ordinary Committee Member**  
Postgraduate Students' Association, UWA
- 2012             **Mechanical Engineering Representative**  
University Engineers' Club Committee, UWA
- 2011 – 2012     **Volunteer**  
Dreamfit Foundation
- 2003 – 2018     **Surf Life Saving**  
Floreath Surf Life Saving Club

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### Referees

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Dr Sascha Schediwy, International Centre for Radio Astronomy Research, PhD Supervisor  
Tel: +61 8 6488 3430, email: sascha.schediwy@uwa.edu.au

Prof Michael Tobar, University of Western Australia, PhD Supervisor  
Tel: +61 8 6488 3915, email: michael.tobar@uwa.edu.au

Prof Keith Grainge, University of Manchester, SKA SaDT Consortium Lead  
Tel: +44 (0)161 2754690, email: keith.grainge@manchester.ac.uk

Adj Assoc Prof Marjan Zadnik, Curtin University, Teaching mentor  
Tel: +61 438 241 193, email: m.zadnik@curtin.edu.au