



Australian Research Council
Centre of Excellence for
Engineered Quantum Systems

Annual Workshop 2019

4 - 6 December 2019
Novotel Wollongong Northbeach NSW
equs.org

[#teamEQUUS](https://twitter.com/teamEQUUS)

Coogee Workshop
quantum theory workshop
February in SYDNEY

Idea Factory
Student & ECR Workshop
June in NSW

TRL Industry Showcase
June in SYDNEY

ARC mid-term review
November in BRISBANE

Summer School
student conference
30 November - 1 December in QLD

Annual Workshop
whole Centre conference
2 - 4 December in QLD

TRL showcase @ AIP congress
December in ADELAIDE

— 2020 —
calendar

Welcome

Welcome one and all to the ninth EQUUS Annual Workshop! I would particularly like to welcome our overseas guests who have kindly agreed to talk to us on areas that complement and extend our own research interests, and welcome back to the members of our Scientific Advisory Committee and Advisory Committee.

A Centre of Excellence is a collaborative project and depends on the exchange of ideas. Our Annual Workshop is the primary forum for this, from PhD students to CIs. The winning idea for your first postdoc application, next DP or Centre application, may start here.

I encourage you to look beyond your current interests and do not miss an opportunity to learn something new.

Andrew White
Centre Director



PRE-CONFERENCE

Tuesday, December 3

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| 8.00am | Scientific Advisory Committee meeting (invite only)
<i>Norfolk 1 Boardroom</i> |
| 10.15am | Morning tea (invite only) |
| 10.30am | Advisory Committee meeting (invite only)
<i>Norfolk 1 Boardroom</i> |
| 12.30pm | Joint lunch (invite only) |
| 2.00pm | Scientific Advisory Committee and Advisory Committee joint meeting (invite only)
<i>Norfolk 1 Boardroom</i> |
| 7.00pm | Welcome canapes and drinks for all attendees
<i>Admirals Room, Novotel Northbeach</i> |

Research talk times

Invited speakers: 20 minutes plus 10 minutes for Q&A

EQUUS members: 15 minutes plus 5 minutes for Q&A

Laura Greene

Chief Scientist, National High Magnetic Field Laboratory

Laura Greene is the chief scientist at the National MagLab and the Francis Eppes Professor of Physics at Florida State University. Her research is in experimental condensed matter physics with a focus on quantum materials, including topological matter and high-temperature superconductors. As the 2017 president of the American Physical Society (APS), Laura's theme was science diplomacy and human rights. She serves on the Board of Directors of the American Association for the Advancement of Science and is a vice president of the International Union of Pure and Applied Physics. A champion for diversity, she works with teams that promote the success of women and young scientists, particularly in developing countries. She plays many leadership advisory roles for funding agents and institutions and recently was a co-chair of the National Academy's consensus report: "Frontiers of Materials Research: A Decadal Survey." Laura is a member of the US National Academy of Science, and a fellow of the American Academy of Arts and Sciences, the Institute of Physics (UK), the American Association for the Advancement of Science, and the APS. Her recognitions include the APS "2019 Five-Sigma Physicist award for science advocacy, The 2019 Gold Medal Award from the Tallahassee Scientific Society a Guggenheim fellowship, the Lawrence Award for Materials Research, and the Maria Goeppert-Mayer Award. She very recently received the APS Five Sigma Physicist Award for Advocacy. Laura has co-authored over 200 publications and presented over 600 invited and plenary talks.

Ajit Srivastava

Assistant Professor, Emory College of Arts and Sciences

Dr. Ajit Srivastava is a physicist working in the field of light-matter interactions at nanoscale and is currently interested in two-dimensional materials. He is an Assistant Professor in the Department of Physics at Emory University, Atlanta, USA where he runs the Quantum Light-Matter Lab. He completed his Bachelors degree from Indian Institute of Technology, Bombay and subsequently obtained Masters degree from Rice University. He earned a PhD degree in Applied Physics from the Solid State Optical Spectroscopy Lab at Rice University. He worked as Postdoctoral Fellow and later as a Senior Scientist in the Quantum Photonics Group at the Institute of Quantum Electronics, ETH Zurich.

DAY ONE

Wednesday, December 4

6.30	Breakfast starts <i>Windjammers Restaurant</i>		Director's Prize - winner
8.00	Registration		Michael Kewming - Quantum correlations in the Kerr Ising Model
8.20	Workshop opens <i>Hoskins and McCabe</i> MC - Deputy Director Tom Stace		James Witt - Spin-orbit interaction in shallow InAs 2-dimensional electron gases
8.25	Welcome to country	12.30	Lunch <i>Windjammers Restaurant</i>
8.30	Welcome - Director Andrew White		Closed door meeting between SAC and EQUUS PhD students
9.00	Research theme & portfolio updates Chair: Tom Stace		
15 MINUTE TALKS	Quantum Designer Materials with Stephen Bartlett	2.30	Session two Chair: Thomas Volz Ajit Srivastava - Single photons, phonons and spins in atomically thin WSe ₂
	Quantum Enabled Diagnostics and Imaging with Warwick Bowen		Magdalena Zych - New quantum technologies for exploring fundamental physics — and vice versa.
	Quantum Engines and Instruments with Michael Tobar		Terry Ferrelly - Interacting scalar field theory as a quantum circuit
10 MINUTE TALKS	Quantum for Educators with Tom Stace		John McFerran - Atomic clocks and King plots
	Public Engagement with Ben McAllister		
	Equity and Diversity with Andrew White	4.00	Afternoon tea and then freetime
	Mentoring and Career Development with Yuval Sanders	4.15	Planning for Centre review (Cis and SAC/AC only)
	Translation Research Lab with Michael Harvey		
10.35	Morning tea <i>Ballroom Gallery</i>	7.00	Holey Moley: minigolf, arcade games, canapes & drinks. Dinner at own cost.
11.00	Session one Chair: Andrew White Laura Greene - The dark energy of quantum materials		

Janet Anders
Associate Professor, University of Exeter

Janet Anders arrived at the University of Exeter in 2013 and now leads Exeter's Quantum Non-Equilibrium group.

Her research spans quantum thermodynamics, a field at the interface of quantum information theory and classical statistical mechanics, as well as quantum computation and cryptography, optomechanics, and optical levitation. In 2015, Dr Anders was awarded the UK Institute of Physics Bates prize

DAY TWO

Thursday, December 5

6.30 Breakfast available
Windjammers restaurant

9.00 **Session three**
Chair: Matthew Davis
Janet Anders - Thermodynamics in the presence of coherences and strong coupling corrections

Tyler Neely - Spun-up and stirred BEC superfluids

Cyril Laplane - Harnessing atomic forces for the opto-mechanical manipulation of a mesoscopic object

Steve Flammia - Efficient learning of quantum noise

10.30 Morning tea

11.00 **Session four**
Chair: Andrew White
Laura Greene - Leadership skills and networking for women (40 minutes plus 10 minutes questions)

Tim Evans - Scalable Bayesian learning of local Hamiltonians and Lindbaldians

Jacqui Romero - Hiding Ignorance Using Higher Dimensions

12.30 Lunch

Closed door meeting between SAC and EQUUS Postdocs

2.30 Freetime

4.00 Afternoon tea and poster networking session

7.30 Workshop dinner
The Deck, Novotel Northbeach

Elisabetta Barberio
Professor, University of Melbourne

Elisabetta is a member of the Experimental Particle Physics Group at the University of Melbourne. Previously, she was a staff researcher at CERN, the European laboratory of Particle Physics. She was involved with data analysis in the OPAL experiment at Large Electron Positron Collider at CERN. Precision measurements made at this collider have confirmed the theory describing the fundamental particle behaviour to an extraordinary degree of precision.

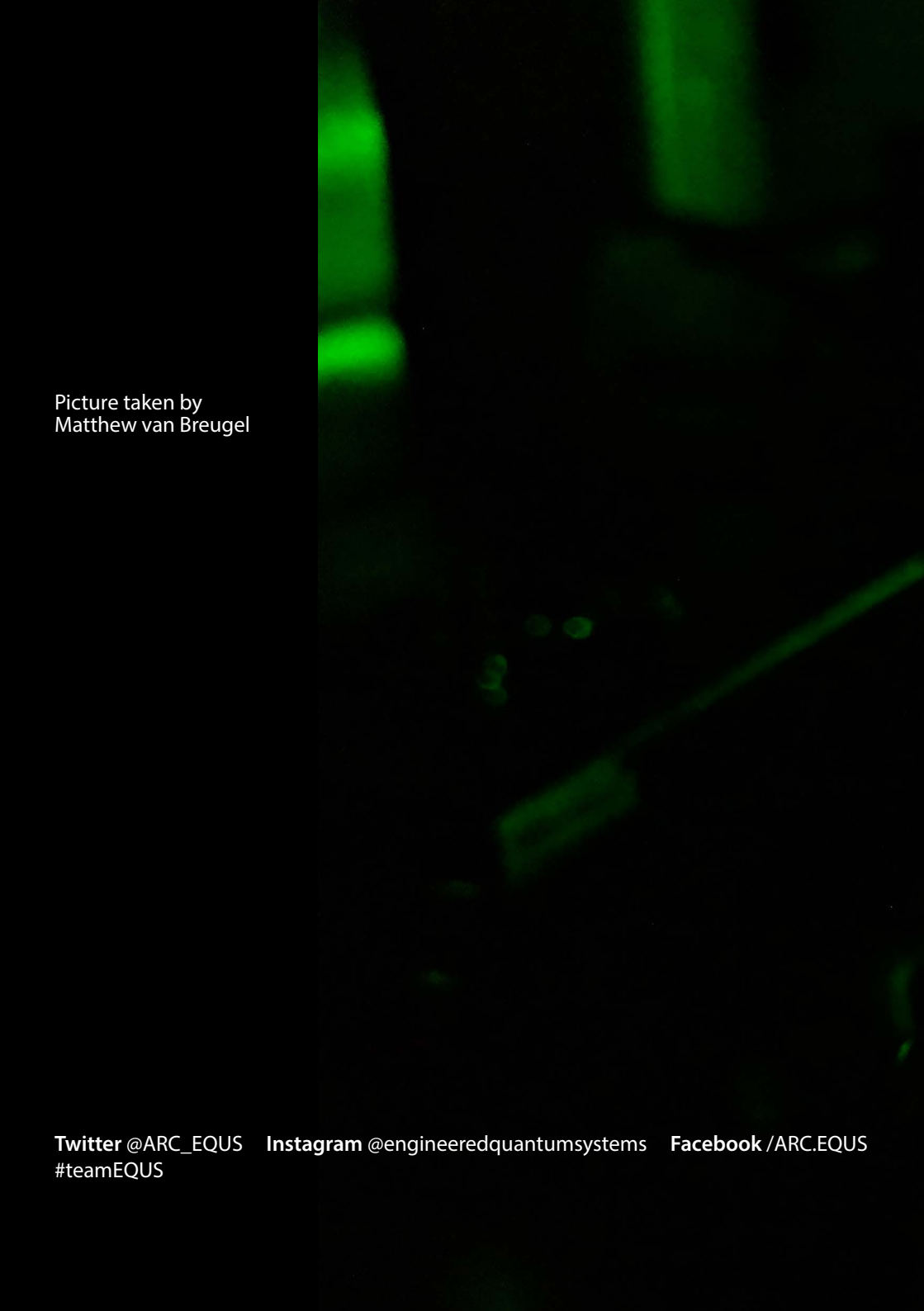
Liang Jiang
Professor, University of Chicago

Liang Jiang is a professor at Pritzker School of Molecular Engineering at the University of Chicago. He theoretically investigates various quantum systems and explores applications of quantum information. His recent research focuses on using quantum control and error correction to protect quantum information from decoherence to realize robust quantum information processing. Jiang received his PhD from Harvard University and his BS from the California Institute of Technology, where he was later a postdoctoral researcher. He also held faculty positions at Yale University, where he was awarded research fellowships from the Alfred P. Sloan Foundation and the David and Lucile Packard Foundation.

DAY THREE

Friday, December 6

	Don't forget to check out by 10.30am today	12.30	Lunch
6.30	Breakfast available <i>Windjammers restaurant</i>		Closed door meeting between SAC and EQUUS Chief Investigators
9.00	Session five Chair: Michael Tobar Elisabetta Barberio - Dark Matter Glen Harris - Probing superfluid helium with light Ben McAllister - Axion Search Update: ORGAN, UPLOAD-DOWNLOAD, Quantum Technologies, and other experiments Argavhan Safavi-Naini - Many-body dynamics in dipolar in dipolar lattic gases	2.00	Workshop wrap-up Chair: Andrew White Winning poster talks Wrap-up from Director
10.30	Morning tea	3.00	Workshop close
11.00	Session six Chair: Steven Flammia Liang Jiang - Achieving the Heisenberg limit in quantum metrology using quantum error correction Gavin Brennen - Scalable preparation of entangled states for sensing and simulation Anatoly Kulikov - Qubit as a quantum probe of control distortions and temperature Alistair Robertson Milne - Noise spectroscopy and robust entangling gates in qubit-oscillator systems		



Picture taken by
Matthew van Breugel

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