Honours Information Booklet

School of Mathematical and Physical Sciences

Table of Contents

Welcome to Honours!

The Honours year is a transformative chapter in your scientific journey. It's where your learning converges with real-world inquiry, where theory meets practice, and curiosity becomes contribution.

This is your opportunity to work on questions of deep scientific significance, whether fundamental or applied, as part of a dynamic research team. You'll collaborate with leading researchers - supervisors, postdoctoral fellows, PhD students, and external partners, on projects that have the potential to shape our understanding of the world.

Along the way, you'll develop advanced skills in critical thinking, scientific communication, and the defence of ideas. You'll learn to navigate ambiguity, challenge assumptions, and contribute meaningfully to knowledge creation.

We hope this booklet sparks your curiosity and offers a glimpse into the vibrant research culture of the School of Mathematical and Physical Sciences. More importantly, we hope it inspires you to take the next step - to ask questions, explore boldly, and consider where an Honours year could take you.

Prof Alexander Solntsev
Associate Head of School (Research)
School of Mathematical and Physical Sciences

General Information

This section describes the following awards:

C09168 – Bachelor of Science (Honours): includes Physics, Chemistry, Forensics and others

C09129 - Bachelor of Mathematical Sciences (Honours)

The Bachelor of Science (Honours) and Bachelor of Mathematical Sciences (Honours) offer training in research, enable students to conduct independent research and deepen their knowledge. Honours is available for high performing undergraduate science students in a range of fields in chemistry, environmental sciences, mathematics, forensic science and physics.

Honours programs provide students with a unique opportunity to undertake original research and gain in-depth knowledge in a particular field of science complementary to their bachelor study. Honours students have access to staff that are leading researchers and experts in their field. The program adds a new dimension to the skills students acquired during their undergraduate years and enhances their immediate employment prospects and future career potential. Honours also provides a pathway for students interested in pursuing postgraduate studies at Master's and PhD level and enhances graduate's career and study options.

Why UTS Science?

UTS Science, one of Australia's leading university science faculties, is committed to scientific advancement that creates a more sustainable world. When students study with UTS, they join a university that delivers global impact in STEM education and research and a faculty that produces scientists with the power to transform the profession.

More information on the course can be found in UTS Handbook.

Admission requirements

Applicants must have completed a UTS recognised bachelor's degree in a relevant discipline at an appropriate level. Our Honours program is normally open to students who have attained at least a credit average over the final two-thirds of the undergraduate program.

The English proficiency requirement for international students or local applicants with international qualifications is: Academic IELTS: 6.5 overall with a writing score of 6.0; or TOEFL: paper based: 550-583 overall with TWE of 4.5, internet based: 79-93 overall with a writing score of 21; or AE5: Pass; or PTE: 58-64 with a writing score of 50; or C1A/C2P: 176-184 with a writing score of 169.

Eligibility for admission does not guarantee offer of a place.

For further inquiries please email to the program directors within your specific discipline:

- Physics – Prof Milos Toth Milos.Toth@uts.edu.au
- Chemistry – A/Prof Tristan Rawling Tristan.Rawling@uts.edu.au
- Forensic Science – Prof Dennis McNevin Dennis.McNevin@uts.edu.au
- Mathematics – Dr Hanyu Gu Hanyu.Gu@uts.edu.au

The course comprises 48 credit points of study across two academic stages. The major component of the course is a research project that extends over the full duration of the 9-month course and normally takes the form of an experimental or theoretical/computational investigation. The project is undertaken within one of our science-based research-active groups at UTS. Projects may also be undertaken in collaboration with an external partner, and this is subject to approval. Projects are chosen by the student, using this booklet as a guide, although first preferences cannot always be accommodated due to restrictions to ensure a fantastic student experience with supervision. As part of the project, students undertake a critical review of the existing literature in their research area and develop a research plan for the year.

The results of the project are presented in an oral seminar and in a written thesis, both of which are formally assessed. Students may enrol in the course for Autumn or Spring intake. Other professional development activities and seminars are scheduled throughout the year and will be advertised via the Canvas subject sites.

Commencing your project

Your project accounts for most, or all, of your study load for the academic year and will involve active experimental/theoretical work, data analysis, reading literature, and writing and other forms of communication. UTS safe work practices and the Faculty of Science after hours work procedures encourage you to complete your laboratory work during core office hours (weekdays 8 am – 6 pm) whenever possible. If you do need to perform experimental work out-of-hours, you should discuss any arrangements with your supervisor to make appropriate arrangements and ensure our policies for OHS are in place.

There is no set number of hours you need to be on campus or weekly timetable for research. A standard 24cp session is approximately 420 hours of study (including self-directed work). We recommend 48cp students be research-active 5 days per week. What you gain from your Honours year is proportional to the effort you are willing to make. Most research groups have regular progress meetings that involve project updates and paper reviews or presentations. The Centre for Forensic Science also holds regular research seminars and meetings that are compulsory for research students. Honours in physics includes a journal club that is assessable and compulsory for all students.

You are expected to work with your supervisor to prepare a project plan in the initial weeks of semester. Laboratory inductions and the risk management plan should be completed during the first two weeks of your project as these processes are essential for gaining security access. Your supervisor can provide you further guidance on how to schedule and complete your induction and risk management plan. Each research thesis subject will have a Canvas subject site that will be updated with the subject outline and research support materials. It will also be the primary route of contact for the Honours director to update you on upcoming seminars, events, and assessments.

Please note that the supervisory panels listed for each project are indicative only. Your supervisory panel may change closer to the commencement of your project.

FAQs

Is there any coursework in Honours?

Some disciplines have a component that addresses important, relevant topics such as a journal club, presentation skills, and writing skills. Others will require additional techniques and skills to be learnt to get the most from your project. Any informal professional development, research skill, and seminars will be advertised to your cohort.

Do all of my undergraduate subjects have to be above a credit/distinction?

No. We assess your eligibility based on your weighted average mark, so a challenging subject or difficult semester may not affect your eligibility.

What documents do I need for the application?

You will need to attach the following documents to your application form:

- Confirmation of supervisor (usually a PDF of an email)
- Project proposal
- EHS certification by external supervisor (if relevant/already available)
- Human or animal ethics approval (if relevant/already granted)

There are several other compulsory fields that need to be filled out before submitting your application. Your supervisor will inform you about any funding or other approvals that are required for your project. Please select “pending” for any specific approvals that are needed but not yet available (e.g. EHS risk assessment, biosafety, ethics).

What happens after I submit my application?

Honours offers are a multi-step process. SAU send your application to the faculty for assessment:

1. The application is assessed by the Head of School or delegate.
2. Approved applications are then forwarded to the Program Director.
3. Program Directors assess your eligibility for your chosen program.
4. This decision is passed back to SAU, who either offer you a place or decline your application.
5. You accept your offer and enrol for the next intake (Autumn or Spring).

This process usually takes several weeks because the applications have to be assessed by multiple people across the university.

FAQs

How are projects allocated?

We encourage prospective Honours students to meet with as many academic supervisors to talk about available projects that interest them. Supervisors may discuss a project with more than one student to find the person who best fits the research area. Supervisors will contact the successful student and provide a 'confirmation of supervision' email for you to attach to your application form.

What happens if I can't find a project?

This is rare but it does sometimes happen. Sometimes we don't have enough projects or supervisors available to accommodate everyone wishing to enrol in Honours. Program Directors will do their best to accommodate your interests.

I'm having issues with the online application form.

Please get in touch with the relevant Program Director. We can help with limited troubleshooting and report any issues to SAU. If it's not something we can help with then Student Centre is your best option for advice.

Are there fees or scholarships for Honours students?

Domestic Honours: The Honours program is a Commonwealth Supported Place degree and eligible for HECS-HELP.

International Honours: The subject fees are the same as a standard undergraduate course and change yearly.

There are no scholarships available from the school or the faculty. Some supervisors offer Honours scholarships from their research funds. Students should enquire with potential supervisors about these. In all cases, the Faculty provides a research budget for project consumables for each Honours project.

For more information, head to https://cis.uts.edu.au/fees/course-fees.cfm.

FAQs

I have a job outside of uni. What do you mean by "research active 5 days a week"? Does that mean I'm in the lab all week?

Honours research is a full-time commitment. "Research active" means working on any aspect of your project: literature searching and reading, assignments, lab work, data analysis and interpretation, and group meetings. You'll find that your time spent on-campus will change month-to-month depending on your experiments, what tasks are required. Most students find that the middle of their project is the most lab-intensive period (May – September). How much time you spend really depends on your time management skills and project type.

Can I work as a tutor while doing my Honours year?

Indeed, Honours students are eligible and encouraged to teach as a tutor/lab demonstrator for one activity within the 1st year undergraduate subject relevant to their qualification. The tutors need to receive written approval from their Honours supervisor and be paired for teaching with more experienced casual academic staff member. Other conditions may apply and be advised by your supervisor. This is a great professional development activity that also pays well. We encourage all our Honours students to undertake some form of casual employment in our labs, tutes or workshops depending on the discipline.

Chemistry Supervisors

Dr Morgan Alonzo

Lecturer
Program Director of Bachelor of Science (Chemistry)
and (Flexible, Physical Sciences)
Chemistry

Morgan completed her PhD at UTS on the development of new methods for the identification of new psychoactive substances in seized illicit materials. Her research in this field of forensic chemistry and forensic toxicology led to ongoing international industry collaboration and commercialisation of a presumptive test for the drug class, synthetic cathinones.

Morgan is a lecturer within the chemistry discipline with current research interests in the identification and analysis of illicit drugs, new psychoactive substances, and their metabolites.

Keywords: forensic chemistry; illicit drugs; new psychoactive substances (NPS); organic synthesis; drug analysis; sensor devices

Honours programs: Bachelor of Science (Honours) - Chemistry, Forensic Science, Master of Philosophy (Forensic Science).

I supervise Honours projects on:

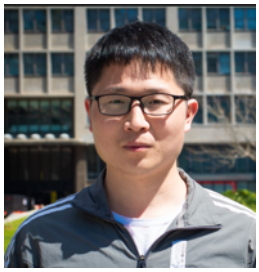
- The development of colorimetric screening tests for the presumptive identification of drugs in seized material.
- The development of portable electroanalytical methods for the analysis of drugs in different matrices.
- The investigation of the metabolism of new psychoactive substances and the identification of suitable markers for monitoring.
- The investigation of the impurity profiles of illicit drugs synthesised using alternate pathways and precursors.

What methods or research skills will you learn?

- Organic synthesis (general lab techniques, extraction, distillation, performing reactions under inert atmosphere).
- Chemical characterisation (FTIR, ^{1}H and ^{13}C NMR, UV-Vis).
- Sample preparation, analytical method development and validation (GC-MS, LC-QTOF-MS, LC-QqQ-MS).
- Electrochemical methods (potentiostat, three-electrode cell, screen printed carbon electrodes)

I currently co-supervise projects with:

Prof Shanlin Fu, A/Prof Scott Chadwick, Prof Andrew McDonagh and Dr Marie Morelato.



Dr Guochen Bao

Chancellor's Research Fellow
Chemistry
guochen.bao@uts.edu.au

Dr Guochen Bao is Chancellor's Research Fellow (CRF) at the School of Mathematical and Physical Sciences, Faculty of Science, University of Technology Sydney (UTS), with expertise in organic synthesis, analytical chemistry, spectroscopy, hybrid nanomaterials, nanophotonics characterisations, and biomedical engineering. He received his Dual PhD degrees in 2020 at Hong Kong Baptist University (in Chemistry) and in 2021 at UTS (in Nanomaterials and Nanophotonics), respectively. Then, he worked as a postdoctoral researcher at the School of Civil and Environmental Engineering and the Institute for Biomedical Materials and Devices at UTS, respectively. Currently, Guochen works as Chancellor's Research Fellow and leads the research focusing on developing hybrid materials, with desired functions, and optical and nanophotonics properties, and integrating these new functionalities into molecular/nano-probes and functional devices for ultrasensitive bioassay, biomedical imaging, and precise therapy.

Guochen's research excellence is evidenced by a growing number of publications in highly regarded journals. His work has been mostly published in top and prestigious journals, including Light: Science & Applications, Nature Photonics, Nano Letters, ACS Nano, Coordination Chemistry Reviews, Analytical Chemistry, Advanced Science, and Angewandte Chemie. This has resulted in a high average impact factor (>15) in his leading papers. His equal first-author paper on responsive microrobots is featured on the cover page of the high-quality journal ACS Nano. His knowledge and views on hybrid lanthanide nanoparticles resulted in the first/corresponding authored review papers in the respected journal Coordination Chemistry Reviews (2021 & 2022). He also shared scholarly opinions as the first author of a "News & Views" article in Nature Photonics.

Keywords: lanthanide probes; upconversion materials; biological imaging; near-infrared probes; therapy

Honours programs: Bachelor of Science (Honours).

I supervise Honours projects on:

- Molecular probes for cancer therapy.
- Hybrid photon upconversion materials for biomedical applications
- Novel molecular NIR responsive probes.

What methods or research skills will you learn?

- Organic synthesis and characterisation
- Synthesis of upconversion nanoparticles
- Spectroscopy (UV-vis, fluorescence)
- Analytical chemistry
- Cell imagin

A/Prof David Bishop

Associate Professor
Analytical Chemistry
David.bishop@uts.edu.au

The focus of my research is on using technology for difficult analytical challenges in a diverse range of disciplines, particularly in the biological and environmental sciences. I am a principal researcher in the application of laser ablation-ICP-MS for imaging biological samples in the field of metallomics, and developing hyphenated technologies for environmental and biological applications. For example, in collaboration with researchers at UCLA I developed surrogate biomarkers for the terminal childhood illness Duchenne muscular dystrophy, and a method I validated for the analysis of organotin compounds in environmental samples is currently being used by a large multinational environmental contracting laboratory.

Keywords: analytical chemistry, laser ablation imaging, environmental contaminants analysis

Honours programs: Bachelor of Science (Honours) in Chemistry

I supervise Honours projects on:

- Development of novel tags for conjugation to antibodies that allows the spatial quantification of biomolecules.
- Laser ablation imaging of heavy and essential metals in various biological tissues.
- Investigating the presence of neurotoxins implicated in MND in Australian waterways and blue-green algal species.
- Analysis of environmental contaminants such as heavy metals (Hg, Ag, Pb, etc) and persistent organic pollutants (PFAS, PCBs, etc) in biological matrices.

What methods or research skills will you learn?

- LA-ICP-MS, LC-MS/MS, GC-MS
- Sample preparation
- Method development and validation
- Data analysis

Our team:

- Dr Thomas Lockwood, Monique Mello, Siobhan Peters, Rosemary Bergin

I collaborate with:

- Professor Andrew McDonagh
- Professor Jiajia Zhou
- Dr Dayanne Bordin
- Professor Ken Rodgers (SoLS)
- Professor Simon Mitrovic (SoLS)
- Associate Professor Jon Wanagat (University of California Los Angeles)
- Associate Professor Roger Pamphlett (University of Sydney)
- Professor Richard Banati (ANSTO/University of Sydney)

Dr Dayanne Bordin

Lecturer
Analytical Chemistry
Dayanne.Bordin@uts.edu.au

Dayanne's areas focus on applying mass spectrometry and separation science to address pressing challenges in early cancer detection, health monitoring and the sustainable use of natural resources. She collaborates on developing novel biomarkers for early detection of pancreatic cancer with the Garvan Institute of Medical Research and investigates e-cigarette chemicals' effects on lung health with the Woolcock Institute of Medical Research. Her interest lies in using analytical chemistry to solve complex challenges in health and environmental issues. Dayanne also applies her expertise to bridge research and practical applications, driving innovation in diagnostics, public health, and sustainability.

Keywords: Analytical Chemistry, sample preparation, biomarkers, separation techniques, mass spectrometry.

Honours programs: Bachelor of Science (Honours) in Chemistry

We supervise Honours projects on:

- **Early Cancer Detection:** Biomarker discovery for early detection of cancers.
- **E-Cigarette Research:** Investigating aerosol chemistry and its effects on human health.
- **Automated Analytical Workflows:** Developing fully automated sample preparation and detection methods for forensic, clinical, and environmental applications.
- **Bioimaging & Surface Profiling:** Mapping metals and molecules in tissues with advanced imaging techniques and optical profilometry.
- **Sustainable use of Cyanobacteria:** Unlocking biofuel, pharmaceutical, and carbon capture potential in far-red photosynthetic cyanobacteria.
- **Marine Ecosystem Health:** Examining climate change's impact on ocean chemistry and food webs.

What methods or research skills will you learn?

- Sample preparation techniques
- Chromatographic techniques (GC, LC, and IC);
- Spectroscopic, Mass Spectrometric Analysis and Optical Profilometry (MS, HRMS, UV, DAD, fluorescence)
- Hyphenated techniques (LA-ICP-MS, IC-ICP-MS, GC-ICP-MS);
- Method development, validation and data analysis

Our team:

- Distinguished Professor Philip Doble, Dr Janice McCauley, Oliver Royle, Jack McGrath, Hujiayi Ling, Honours and interns

I co-supervise/collaborate with:

Distinguished Prof Brian Oliver (SOLS); Prof Irina Kabakova; A/Prof David Bishop; Dr Maiken Ueland; A/Prof Katherina Petrou (SOLS); Garvan Institute of Medical Research; Woolcock Institute of Medical Research.

Prof Phil Gale

Deputy Dean, Faculty of Science
Organic and Biomolecular Chemistry
philip.gale@uts.edu.au

Phil's research interests are in the design and synthesis of receptors for molecular guests and in particular, anions. These compounds have applications as future treatments for cancer and diseases like cystic fibrosis. Phil's group makes new drug-like receptors and then measures their binding and anion transport properties in lipid bilayer membranes. For example, cystic fibrosis is caused by faulty chloride transporters in lung epithelial cells. We are developing compounds that could replace the function of the faulty channels and help tackle the symptoms of the disease. Alternatively, our compounds can disrupt the pH gradients across cell membranes, and we have explored their ability to cause apoptosis in cancer cells.

For more information about Phil please see:

https://profiles.uts.edu.au/Philip.Gale
https://galeresearchgroup.com
https://en.wikipedia.org/wiki/Philip_A._Gale

Keywords: supramolecular chemistry; organic synthesis; medicinal chemistry; molecular recognition; cell membranes.

Honours programs: Bachelor of Science (Honours).

I supervise Honours projects on:

- Development of new anion receptors using hydrogen bonding and other non-covalent interactions. We're developing new macrocycles for selective anion binding.
- Switchable anion transporters. We're developing new anion transporters that can be switched on by an external stimulus. For example, the transporter could be designed to switch on in the conditions found in a tumour and so selectively disrupt cancer cells.
- Targetable anion transporters. We are making fluorescent anion transporters that target specific sub-cellular components, such as the mitochondria or the nucleus, to discover how influencing these systems will affect cells.

What methods or research skills will you learn?

- Organic synthesis – You will be trained in a broad range of synthetic skills while making your own novel receptors and transporters.
- Measuring binding – you'll use various spectroscopic techniques (NMR, UV/vis and fluorescence) to find out how well your receptors bind to guests.
- Lipid bilayer transport – you'll use vesicle systems which imitate a cell membrane to measure transport across lipid bilayer membranes.

Our Team:

- Dr Dan McNaughton, Billy Ryder, Alex Gilchrist, Patrick Wang, Raed Mostafa.

I collaborate with:

- Tristan Rawling, Charles Cranfield

Dr Andrew Giltrap

Lecturer,
Chemistry
andrew.giltrap@uts.edu.au

Andrew joined UTS at the start of 2025 having spent 5.5 years working in the UK with Prof. Ben Davis, firstly at the University of Oxford and then at the Rosalind Franklin Institute. Here, Andrew worked at the cutting edge of chemical biology, using fundamental organic chemistry principles to make biological discoveries. He had a specific focus on developing late-stage methods for protein functionalisation (with applications in PTM discovery, and radiolabeling) as well as understanding the fundamental mechanisms behind the biosynthesis of protein N-glycosylation. Prior to this, Andrew completed his PhD in organic chemistry with Prof. Richard Payne at the University of Sydney. Andrew's research at UTS focuses on the development of novel chemical tools to probe and modulate biological systems applied to therapeutics and drug discovery. Specifically, he will develop new methods for protein modification and the synthesis of cyclic peptide antibiotics.

Keywords: organic chemistry, peptide chemistry, chemical biology, medicinal chemistry, antibiotics, antimicrobials

Honours programs: Chemistry

I supervise Honours projects on:

- **Synthesis of antimicrobial cyclic peptides.**
  Antimicrobial resistance is a significant global health emergency with bacteria and other micro-organisms are increasingly resistant to conventional therapies. This project will involve the chemical synthesis and biological evaluation of cyclic peptides against pathogenic bacteria, in particular *Mycobacterium tuberculosis*.
- **Developing new ways to uncover protein-sugar interactions in biology.**
  Carbohydrates (sugars) are essential for numerous biochemical and physiological processes. Uncovering new sugar proteins interactions could help shed light on these processes. This project will develop new methods for install electrophilic sugars into peptides and proteins for biological discovery.

What methods or research skills will you learn?

- Synthetic organic chemistry
- Solid-phase peptide synthesis
- Compound characterisation (^{1}H and ^{13}C NMR, mass spec)
- Cell culture

We collaborate with:

- Setting up our collaborations but ideally with
- Dr Daniel Tuipulotu (SOLS)
- Dr Ole Tietz (Macquarie University)
- Prof. Ben Davis (University of Oxford)

Dr Yuyang Gu

Research Fellow, DECRA Fellow
Chemistry
Yuyang.Gu@uts.edu.au

I am a Postdoctoral Research Fellow and Discovery Early Career Researcher Award (DECRA) Fellow (starting Dec 2025) at the School of Mathematical and Physical Sciences, Faculty of Science. My expertise lies in inorganic synthesis, nanophotonic characterisations, and super-resolution imaging. I received my B.S. and Ph.D. in chemistry from Fudan University in 2015 and 2020, respectively. From 2021 to 2024, I worked as a postdoctoral researcher at the National University of Singapore under Prof. Xiaogang Liu. To date, I have published more than 20 peer-reviewed papers in high-impact journals—including *Nature Photonics, Coordination Chemistry Reviews, ACS Nano, and Advanced Science*—which have received over 900 citations. Currently, I lead lanthanide-related biophotonics research, focusing on manipulating the nanophotonic properties of nanomaterials and nanochips to drive breakthroughs in super-resolution imaging and advanced intracellular applications.

Keywords: Super-resolution imaging; lanthanide-doped nanocrystals; energy migration; optical cavity

Honours programs: Bachelor of Science (Honours)

I supervise Honours projects on:

- Lanthanide nanoparticle energy migration studies: exploring new materials and systems to design and quantify complex energy migration networks;
- Nanophotonic applications of lanthanide-doped nanocrystals: using purpose-designed nanoscale migration systems for microlasers and optical enhancement;
- Super-resolution imaging methodology development: including structured illumination microscopy (SIM) and single molecule localization microscopy (SMLM) related methods;
- Design of novel optical cavities for super-resolution imaging.

What methods or research skills will you learn?

- Wet chemical synthesis of lanthanide doped nanomaterials, use of Schlenk lines;
- Characterization (TEM, XRD, UV-vis, luminescence, lifetime microscopy);
- Simulation methods (FDTD, kinetic models, Monte Carlo models);
- Optical construction for super-resolution imaging (SIM and SMLM).

I collaborate with:

- Professor Dayong Jin
- Professor Jiajia Zhou
- Dr. Leo Zhang
- Dr. Ying Zhu

For more information about Yuyang please see:

https://profiles.uts.edu.au/Yuyang.Gu

Prof Steven Langford

Head, School of Mathematical and Physical Sciences
Organic Chemistry, Clean Energy
Steven.langford@uts.edu.au

Steve has a strong international reputation as an organic chemist, using concepts from Nature to build functional materials for diverse use including in materials science, optoelectronics and sensors. He is a recognised leader in naphthalene diimide (NDI) chemistry and its applications to semiconductor and energy transduction/storage solutions by exploring architecture, morphology and electronics. His current interests are in the sensing of ammonia and water as important sources for the hydrogen economy, investigating organic materials in flow batteries and finding sustainable solutions for waste cellulose.

Keywords: Naphthalene diimide, sensor, semiconductor, energy, carboxymethylcellulose
Honours programs: Bachelor of Science (Honours)

I supervise Honours projects on:

- The development of chemistry of NDIs, core-substituted NDIs and hetero-NDIs (multiple projects):

  The agility and structural diversity within our synthetic processes indicate an innate ability to design and tune, provide structural control, better energy matching and processability. Enhancing this chemistry toward optical and electronic tunability and information processing is paramount for application.

- The development of organic flow batteries:

  Organic flow batteries based on NDIs and hetero-NDIs will be developed and evaluated for the first time. Demonstrating simple yet effective organic FB's is a major goal. They will be fabricated and the device parameters, such as power density, energy efficiency and charge-carrying capacity will be optimized through electrode and electrolyte modification, charging and overcharging protocols.

- Novel conducting sheets based on NDIs:
  The *nucleophilic* chemistry of NDIs will be adopted to investigate new π-conjugated, *n*-channel 2D polymers as 'graphene alternatives' using solid-state polymerisation techniques. Quantum confinement in single or few-layer thick 2D organic sheets is expected to lead to emergent phenomena, in addition to applications in flexible optoelectronics, including thin-film chemiresistive devices.

What methods or research skills will you learn?

- How to make stuff: Using methodology developed within the group
- How to measure stuff: Use of NMR, UV-Vis, fluorescence to time-resolved techniques. Imaging using SEM, TEM, XRD.

Our team:

- Dinushi Munasingha Mudiyanselage, PhD Student
- Oliver Royle, Hons Student
- Fred Marlton, Chancellors Research Fellow
- Asif Mahmood, Chancellors Research Fellow
- Sujeewa De Silva, Lecturer Materials Science

Dr Hao Liu

Associate Professor, ARC Future Fellow
Electrochemistry, Clean Energy
Hao.Liu@uts.edu.au

Dr Hao Liu joined UTS in 2012 as a Chancellor's Postdoctoral Fellow. He is current an ARC Future Fellow and Associate Professor in Chemistry discipline at UTS. Dr Liu interests in the synthesis of nanostructured materials and their applications in the fields of lithium-ion batteries, sodium-ion batteries, lithium–sulfur batteries, lithium-oxygen batteries, supercapacitors and electrocatalysts. He has developed the synthesis and applications for one-dimensional, mesoporous, core-shell structured and composite materials for energy storage and conversion. His innovative work has been cited more than 12000 times, with an h-index of 57 (ISI Web of Science). He has attracted more than $6.4 million funding as a CI. He is one of "2018 Highly Cited Researchers" selected by Clarivate Analytics

Keywords: lithium-ion batteries, sodium-ion batteries, lithium–sulfur batteries, lithium-oxygen batteries, supercapacitors, electrocatalysts.

Honours programs: Bachelor of Science (Honours), Master of Research (Chemistry)

I supervise Honours projects on:

- Cathode Precursor Production Pilot Plant
  The aim of this project is to develop a series of novel cathode materials with high operation voltage, high specific capacity, high energy/power density and excellent retention for practical lithium ion batteries.

What methods or research skills could you learn?

- Synthesize cathode materials with optimised chemical compositions and crystal structures via doping, coating and phase regulation strategies.
- Investigation of the electrochemical performance of novel cathode material for lithium ion batteries by electrochemical measurements.
- Physical, chemical and structural characterizations of cathode materials through microscopies.
- Fabricating prototype pouch cells of lithium-ion batteries.
- Battery theories and technologies.

Our team:

- Hao Tian, Research associate
- Yuhan Xie, PhD student
- Tao Huang, PhD student
- Xu Yang, PhD student

I co-supervise projects with:

- Guoxiu Wang
- Steven Langford
- Michael Cortie
- Zhenguo Huang
- Future Battery Industry CRC

Dr Asif Mahmood

Chancellor's Research Fellow
Materials Chemistry, Clean Energy
Asif.Mahmood@uts.edu.au

Asif Mahmood received his MS degree in Materials and Surface Engineering from the National University of Science and Technology, Islamabad, Pakistan, in 2011 and a PhD degree in Materials Science and Engineering from Peking University, Beijing, in 2016. Currently, he is working as a Chancellor's Research Fellow at UTS. Before joining UTS, he worked at Southern University of Science and Technology for 2 years and at the School of Chemical and Biomolecular Engineering, the University of Sydney, for three years. His research interests include nanomaterials for electrochemical processes and rechargeable batteries. He has published over 70 research articles in high-quality peer-reviewed journals including Energy Environ. Sci., (Impact Factor#33), Adv. Mater., (Impact Factor#27.398), Angew. Chem. Int. Ed., (Impact Factor#12) and Adv. Energy Mater. (Impact Factor#24.8) etc. His research has attracted a large number of citations (Times cited ~7000, H-index 39). He has won several awards including an Exceptional Award for Academic Innovation, Peking University International Students Academic Award and Excellent Foreign Student Scholarship. Lately, he was recognised as the Higher Education Rising Stars 2020 by The Educator in Australia.

Asif's research program focuses on development of nanoporous materials for energy conversion and storage applications. The porous material includes metal-organic frameworks (MOFs), carbonaceous nanomaterials, metal-carbon hybrids etc. while the applications include rechargeable batteries (Li-ion, Na-ion), supercapacitors, hydrogen production etc. The development of nanoporous materials improves the electrochemical contact area of the electrode/electrolyte, thereby enhancing the energy storage capability and stability.

Keywords: nanoporous materials, energy conversion and storage, environmental sustainability, rechargeable batteries, supercapacitors, hydrogen production

I supervise Honours projects on:

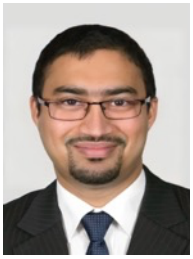
- Understanding of charge storage process on nanoporous materials
- Use structure-property relationship to harness enhanced electrochemical activities
- Designing nanoporous materials for energy storage devices with high energy density

What methods or research skills could you learn?

- Learn how to designing and tuning the porous structure
- Learn how to synthesise the highly porous nanostructures
- Learn about key characterisation tools: SEM, XRD, BET, TEM, Electrochemical workstation, charge-discharge units

Our team:

- Centre for Clean Energy Technology



Dr Parvez Mahmud

Senior Lecturer, Faculty of Science
Energy and Sustainability
Parvez.Mahmud@uts.edu.au

Dr Parvez Mahmud is an expert in life cycle assessment (LCA) and the sustainable design of energy systems. His research interests include clean energy generation, conversion and storage, sustainable and eco-design, material flow analysis (MFA), waste management, circular economy, and life cycle engineering. He has been actively collaborating with several national and international professional organizations and industries, and is sought worldwide to deliver keynote speeches and lectures at workshops and conferences.

Keywords: energy; sustainability; life cycle assessment; circular economy; waste management.

Honours programs: Bachelor of Science (Honours), Master of Research (Chemistry).

I supervise Honours projects on:

- Sustainable energy systems: integrating life cycle assessment for design optimization.
- Life cycle assessment of battery materials for circular and sustainable energy systems.
- Accelerating the decarbonization of hydrogen production through sustainable innovation.
- Circular economy enhancement through material exchange collaboration.
- Environmental impact assessment and techno-economic analysis of a hybrid microgrid system.

What methods or research skills will you learn?

- You will be trained in a range of life cycle software and databases, including OpenLCA, SimaPro, GREET, Ecoinvent, and Nexus for sustainable design of energy systems.
- Circular Economy/Material Exchange Platform that enables brands and suppliers to collaborate on sustainable material sourcing and circular economy practices.
- Techno-Economic Analysis – you'll use HOMER Energy and RETScreen tools to handle a wide range of energy system configurations and objectives. This supports complex optimization algorithms and provides detailed insights into the techno-economic feasibility of renewable energy projects.

Our team:

- PhD Students: Muhammad Wajahat, Muhammad Adil, Md. Nouman, Saima Hasan, Sirjana Adhikari, Afsana Jerin

I collaborate with:

- Prof Guoxiu Wang
- Prof Damien Giurco
- Prof Jahangir Hossain
- Prof Zhong Lin Wang
- Prof Abbas Kouzani
- Prof Jun Chen
- Prof Amanda Ellis

Dr Fred Marlton

Chancellor's Postdoctoral Research Fellow
Chemistry
Frederick.marlton@uts.edu.au

Fred's research aims to understand the structure-property relationships of functional materials. He currently researches ferroelectric perovskites, which are used in a wide range of modern technologies, such as sonar devices or actuators in robotics. His particular focus is about determining how features on the atomic-scale affect their physical properties for applications in solid-state cooling. The atomic structure is determined by diffraction methods and requires the use of large-scale international facilities. This includes ANSTO's Australian Synchrotron and the Australian Centre for Neutron Scattering (ACNS).

Keywords: Ferroelectrics, functional materials, diffraction, atomic structure, nanotechnology

Honours programs: Bachelor of Science (Honours)

I supervise Honours projects on:

- Understanding structural disorder and phase transitions in perovskites for solid-state cooling.
- Investigating halide perovskites for semiconductor applications.
- Solid-state materials for battery applications (in collaboration with CCET).

What methods or research skills will you learn?

- Solid-state synthesis and ceramics processing.
- X-ray and Neutron diffraction. Students may have the opportunity to conduct experiments at the Australian Synchrotron in Melbourne and/or ACNS at Lucas Heights.
- Atomic structure modelling from diffraction data using the software Topas.
- Python coding for data analysis and visualization.
- Physical property measurements.
-

I collaborate with:

- Karunadasa Lab, Stanford University
- Prof Guoxiu Wang and the Centre for Clean Energy Technology (CCET)
- Prof Steven Langford
- The Australian Synchrotron and ACNS
- Oak Ridge National Laboratory USA
- Diamond Light Source, UK
- A/Prof John Daniels and A/Prof Neeraj Sharma at UNSW
- Prof Chris Ling and Prof Brendan Kennedy at USyd.

Dr Janice McCauley

Lecturer
Analytical Chemistry

Janice.McCauley@uts.edu.au

I have a PhD in Chemistry from UOW where I worked on characterization of biological systems. As part of an industry collaboration to develop wound healing products, I then worked on the structural and compositional analysis of algal sulphated polysaccharides and biological evaluation using 2D/3D scratch assays with human dermal fibroblast primary cell lines.

At UTS, I continued working on IP-protected, industry-focused bioproducts within C3. I was Chief Investigator for an initiative with Young Henrys Brewery and Meat and Livestock Australia to reduce emissions in the brewing and livestock industries. This project involved collaboration with researchers at the University of Sydney and Queensland Animal Science Precinct (QASP) to develop animal feed products that reduce gas emissions and improve ruminant digestion.

My research areas include: (1) developing analytical techniques to detect analytes in complex biological systems, with a focus on monitoring cell–cell and cell–environment interactions, and (2) using algal biotechnology to develop new materials for biological and environmental applications.

Keywords: Environmental biotechnology, analytical chemistry, bioproducts, sustainability, algae, microfluidics, environmental chemistry, cell biology, tissue culture, pollutant mitigation.

Honours programs: Bachelor of Science (Honours) in Chemistry

We supervise Honours projects on:

- Investigating GC column selectivity for integration into CE to separate complex mixtures.
- Using cell models to study disease & toxicity, supported by analytical techniques.
- Extraction, purification, & reformulation of bioproducts & biological evaluation using cell, enzyme or microbial-based assessments.

What methods or research skills will you learn?

- Tissue culture & *in vitro* assays using mammalian cells, including cell imaging techniques
- Algal cultivation and photosynthetic efficiency measurements
- Analytical chemistry techniques (e.g., LC-MS/MS, GC-MS, CE-UV/LIF)
- Sample preparation and purification
- Method development, validation, and statistical analysis of data.

Our team

- Distinguished Professor Philip Doble, Dr Dayanne Mozaner Bordin, Oliver Royle, Jack McGrath, Hujiayi Ling, Honours and interns

I collaborate with

- Dr Unnikrishnan Kuzhiumparambil (Climate Change Cluster, C3)
- Professor Alex Vieira Chaves (University of Sydney)
- Dr Sarah Meyer (SCIEX)

Prof Andrew McDonagh

Professor
Synthetic Chemistry
Andrew.McDonagh@uts.edu.au

I completed my PhD at ANU on the synthesis of organometallic complexes for nonlinear optical properties. I spent 2 years as a postdoctoral researcher at the University of Bristol and then at UNSW working on the synthesis and optical properties of coordination complexes. At UTS I worked as an ARC post-doctoral fellow and then as an ARC research fellow.

More recently my research has focused on two main areas; (1) synthesis of inorganic complexes that have interesting and useful properties (2) the synthesis and characterisation of gold nanoparticles that sinter to form gold films.

Keywords: synthetic chemistry, inorganic chemistry, nanoparticles

Honours programs: Chemistry

I supervise Honours projects on:

- Inorganic complexes that can be used as metal tags for attachment to antibodies for mass-spectrometry imaging.
- Inorganic gold complexes that may take different isomeric forms.
- Gold nanoparticles that form gold films when heated.

What methods or research skills will you learn?

- Synthetic chemistry
- Chemical characterisation (^{1}H and ^{13}C NMR, mass spec)
- Other physical characterisation techniques as required.

Our team:

- Paige Summers, Truong Nguyen, Anthony Thai, Alexandra Mercieca,Ioannis Kohilas, Chloe Chan, Aleksander Sipka,

We collaborate with:

- Dr Alexander Angeloski (UTS)
- Assoc Prof. Tristan Rawling
- Assoc Prof. David Bishop
- Prof. Phillip Doble
- Many others

Dr Matthew Phillips

Associate Lecturer
Medicinal Chemistry
Matthew.Phillips-1@uts.edu.au

I completed my PhD at UTS in 2024, focusing on the design and synthesis of cyclic molecules, and evaluating their *in vitro* antibacterial properties, with a focus on developing protease inhibitors with antichlamydial properties. During my PhD, I have worked on several industry projects in molecular biology and microbiology. These include protein expression and purification for antibody production, and *in vitro* assessment of lateral flow strips as rapid tests for sexually transmissible infections.

My current focus of research is developing new isocoumarin-based compounds to act as potential protease inhibitors and reactive electrophilic warheads for covalent interaction with biologically relevant structures.

Keywords: synthetic chemistry, medicinal chemistry, molecular characterisation; protease inhibitors; covalent drugs

Honours programs: Chemistry

I supervise Honours projects on:

- Exploration of synthetic strategies toward the synthesis of new isocoumarin-based compounds, and characterisation of their hydrolytic properties

What methods or research skills will you learn?

- Synthetic chemistry and chemical purification
- Chemical characterisation (^{1}H and ^{13}C NMR, 2D NMR, mass spec)
- Design of biologically relevant assays, including hydrolysis kinetic studies by NMR and/or UV-Vis spectroscopy
- Other physical characterisation techniques as required.

Our team:

- Dr. Matthew Phillips

We collaborate with:

- Prof. Andrew McDonagh
- A/Prof. Tristan Rawling

A/Prof Tristan Rawling

Associate Professor, Discipline Leader
Medicinal Chemistry
Tristan.rawling@uts.edu.au

Tristan completed his PhD at UTS on the synthesis of metal complexes for solar cells under the supervision of the world-renowned chemist, A/Prof. Andrew McDonagh. He then spent 4 years as a postdoctoral researcher at the University of Sydney where he worked on the development of anticancer fatty acids. He moved back to UTS where he continued his work on the development of fatty acid derived drugs as anticancer and analgesic agents. In recent years his research has focused on drugs that target membranes and mitochondria. Mitochondria are the powerhouse of the cell ;) and are structurally and functional different in cancer cells, making them potential targets for anticancer drugs and weight loss agents.

Keywords: medicinal chemistry, chemical biology, anticancer drugs, mitochondria, weight loss drug

Honours programs: Chemistry

I supervise Honours projects on:

- **Development of transmembrane proton transporters as potential weight loss drugs**
  2,4-Dinitrophenol (DNP) is a proton transporter (protonophore) that was used in the 1930s as an extremely effective weight loss drug. Patients could lose 1.5kg per week on an unrestricted diet, however there was a small problem- one of the side effects was death. Can we design, synthesise and test new protonophores that maintain the weight loss effects of DNP, but without the side effects?

- **Studying the anticancer and mitochondrial effects of ionic liquids**
  Ionic liquids (ILs) were supposed to be 'green solvents', a safe and environmentally friendly alternative to organic solvents, however it was discovered they kill cells by an unknown mechanism. Our group suspects ILs kill cells by disputing mitochondrial membranes. Can we use this insight to develop safe ILs, or potent cell killing ILs that can be used as anticancer agents?

What methods or research skills will you learn?

- Synthetic organic chemistry
- Compound characterisation (^{1}H and ^{13}C NMR, mass spec)
- Cell culture
- Cell-based assays (MTS cell viability, ATP etc)

Our team:

- Meryem-Nur Duman, Ritik Roy, Edward York, Ethan Pacchini, Freddy Ha

We collaborate with:

- A/Prof. Charles Cranfield (UTS)
- Prof. Philip Gale (USyd) and research team
- Prof. Megan O'Mara (UQ)

Dr Sandeep Kumar Singh

Senior Lecturer, School of Mathematical and Physical Sciences, Faculty of Science
sandeep.singh@uts.edu.au

Dr. Singh's research mainly focusses on nanoparticle-based drug delivery systems, which include a wide range of innovative approaches such lipid-based drug delivery systems, self-nanoemulsifying drug delivery systems, nano-emulsions, and nano-capsules. While designing carrier systems we use the Quality by Design approach to thoroughly examine and optimize influential formulation parameters that ensure efficacy and reliability of dosage forms. Furthermore, we explore Gastroplus® (predictive modelling software) to conduct *in silico* pharmacokinetic studies before delving into actual *in vivo* bioavailability studies. This approach saves time and cost in conducting clinical studies. Dr. Singh has guided 40 undergraduate students, 27 postgraduate students, and 9 PhD scholars for their research till date.

For more information about Singh please see:

www.linkedin.com/in/sandeep-kumar-singh-b5b78b225

Keywords: Lipid Nanoparticles; Novel Drug Delivery Systems; Pharmacokinetics; Quality by Design; *In Silico* Pharmacokinetics Simulation, Bioavailability Studies.
Honours programs: Bachelor of Advanced Science (Honours).

I supervise Honours projects on:

- Development and characterization of novel drug delivery system of drugs facing bioavailability issues.
- Conducting *In silico* pharmacokinetic (PK) studies to predict PK parameters.
- Exploring formulation by design approach to optimize robust formulation that meets the criteria of regulatory bodies.

What methods or research skills will you learn?

- Designing drug delivery systems using 'Design and Expert Analysis software'.
- Strategies to improve bioavailability issues of drugs belonging BCS II and IV.
- Methods to enhance the solubility and permeability of drugs.
- Characterization of nanoparticles using microscopy, particle size analyzer (DLS), DSC, FTIR, X-RD.
- Stability studies of prepared formulations
- *In silico* pharmacokinetics predictions.
- Dissolution and release studies along with mathematical modeling.
- Compartment, non-compartment and physiological based pharmacokinetics modelling.

I collaborate with:

- Dr. Tristan Rawling, Dr. Steven Langford, Dr. Irina Kabakova
- CDRI Lucknow India, RMRI Patna India, BIT Mesra, India, ICT Mumbai India,
- Pukyong National University, South Korea; University of Helsinki, Finland; King Saud University; University of Bradford, UK; The University of New Mexico.

Dr Bing Sun

Senior Lecturer, ARC Future Fellow
Energy storage, Electrochemistry, Battery Technology, Materials Science

bing.sun@uts.edu.au

Dr Bing Sun is currently an ARC Future Fellow in the Centre for Clean Energy Technology and Chemistry discipline in MaPS at UTS. His research interests span the interdisciplinary fields of electrochemistry, nanotechnology, functional materials and energy storage and conversion. His current research focuses on the synthesis and mechanism study of electrode materials for Li-, Na-, and Zn-ion batteries; the design of efficient catalysts for Li- and Na-air batteries; and the development of advanced thin film fabrication techniques for interface engineering, aimed at controlling metal alloy corrosion in energy storage systems and biodegradable products.

Keywords: lithium/sodium-ion batteries, lithium-metal batteries, solid-state batteries, zinc-ion batteries, supercapacitors, nanomaterials, and atomic layer deposition technique.

Honours programs: Bachelor of Science (Honours), Master of Research (Chemistry)

I supervise Honours projects on:

- Electrolyte engineering for aqueous zinc-ion batteries.
  The aim of this project is to explore suitable electrolyte additives to improve the cycling stability and energy/power density of aqueous zinc-ion batteries.
- Atomic-scale surface modification for high-energy-density electrode materials.
  The aim of this project is to use atomic layer deposition techniques to modify the surface of high-capacity cathode materials to improve their (electro)chemical performance for lithium-ion batteries.

What methods or research skills could you learn?

- Material synthesis skills using a wide range of techniques, including sol-gel, solid-state, hydrothermal, electrospinning, electrodeposition, microwave-assisted reactions, spray pyrolysis, chemical vapor deposition, and atomic layer deposition.
- Material characterization skills using SEM/FESEM, XRD, AFM, Raman spectroscopy, infrared (IR) spectroscopy, UV-Vis spectroscopy, and TGA/DTA techniques.
- Be proficient in the operation of electrochemical equipment, including battery testers and electrochemical workstations.
- Capable of fabricating coin cells and prototype pouch cells of lithium-ion batteries.

I collaborate with:

- Prof Guoxiu Wang and Prof Hao Liu from Centre for Clean Energy Technology
- Prof Paul Munroe from UNSW
- Prof Daniel Schröder and Dr Katja Kretschmer from TU Braunschweig
- Dr Xiaodan Huang from University of Queensland

Dr Maiken Ueland

Director AFTER
Analytical Chemistry, Forensic Science
Maiken.ueland@uts.edu.au

Maiken's main research areas are human decomposition chemistry with special focus on biomarkers in tissue and odour and their use in criminal investigations, including locating missing persons and estimating time since death. Her interest lies in using analytical chemistry to solve complex questions for legal investigations, climate change and health. Maiken also uses her knowledge in odour analysis in the investigation of wildlife crime and conservation.

For more information about Maiken's work please see:

https://profiles.uts.edu.au/Maiken.Ueland

https://twitter.com/MaikenLand

Keywords: Analytical chemistry, search and detection, forensic taphonomy, sensor technology

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- Improving the detection of victims in Mass disasters
- Developing and testing electronic nose technology
- Determining time since death using advanced analytical methods
- Developing methods to detect and prevent the illegal wildlife trade

What methods or research skills will you learn?

- GC-MS, GC×GC-TOFMS, GC-MS/MS, ATR-FTIR, electronic noses
- Sample preparation and analysis
- Advanced statistical analysis
- Field work

Our team:

- Sandali Alahakone, Bridget Thurn, Matthew Bolton, Emily Sunnucks, Kainat Fatima, Honours and interns

I co-supervise/collaborate with:

Barbara Stuart, Greta Frankham, Steven Su, David Suggett, Dennis McNevin, Matt Padula, Jen Matthews, Mackenzie de la Hunty, Scott Chadwick, the Australian Museum, law enforcement agencies, Australian Defence

Dist Prof Guoxiu Wang

Distinguished Professor, Director of the Centre for Clean Energy Technology,
Materials Chemistry, Electrochemistry, Battery Technology
Guoxiu.Wang@uts.edu.au

Professor Guoxiu Wang is a UTS Distinguished Professor, Director of the Centre for Clean Energy Technology, and an ARC Industry Laureate Fellow. He is a renowned materials scientist and chemist with internationally recognised expertise in battery technologies, materials chemistry, electrochemistry, and energy storage. His research focuses on a broad range of energy storage systems, including lithium-ion, lithium-air, sodium-ion, and lithium-sulfur batteries, as well as supercapacitors, hydrogen storage materials, graphene, and MXenes. Professor Wang has published over 700 peer-reviewed journal articles, which have attracted more than 70,000 citations on Web of Science and over 88,000 on Google Scholar, with an H-index of 145 and 163, respectively. He has been recognised as a Highly Cited Researcher by Clarivate Analytics for seven consecutive years (2018–2024), and in both the Chemistry and Materials Science categories in 2018 and 2022–2024. He is also a recipient of the Research.com Materials Science Leader in Australia Award from 2022 to 2024.

Keywords: Lithium-ion batteries; Sodium-ion batteries; Supercapacitors; Green hydrogen production; 2D materials.
Honours programs: Bachelor of Science (Honours), Master of Research (Chemistry)

I supervise Honours project on:

- **Solid-state lithium batteries using phase-stabilised electrolytes.** The overall goal of the project is to develop advanced solid-state lithium batteries with high energy density for applications including portable electronic devices, electric vehicles, and electricity storage.

What methods or research skills could you learn?

- Synthesising solid-state electrolyte materials with optimised chemical compositions and crystal structures
- Physical, chemical and structural characterization of solid-state electrolyte materials by SEM, TEM and XRD.
- Electrochemical evaluating and testing the performances of solid-state electrolyte materials in lithium batteries.
- Investigating the formation and characteristics of interfaces between lithium metal anode and solid-state electrolyte, and cathode and solid-state electrolyte through in-situ instrumental analysis.
- Unravelling lithium-ion conduction mechanisms in solid-state electrolytes and the interfaces between electrodes and solid-state electrolytes through the combination of theoretical and experimental research.
- Fabricating prototype solid-state lithium batteries using atomic-layer deposition (ALD) nanofabrication technique.
- Electrochemical testing and modelling of prototype solid-state lithium batteries.

I co-supervise projects with:
A/Prof. Andrew McDonagh, Prof. Steven Langford, A/Prof. Hao Liu, Em Prof. Michael Cortie and Assoc. Prof. Zhenguo Huang (FEIT)

Dr Nana Wang

Senior Lecturer, ARC Future Fellow, Faculty of Science
Materials Chemistry, Clean Energy
nana.wang@uts.edu.au

Dr. Nana Wang is an ARC Future Fellow whose research focuses on the development of sodium-ion batteries for efficient energy storage—particularly under low-temperature conditions—as well as advanced solid-state batteries. Her work aims to design and optimize solid-state electrolytes with enhanced ionic conductivity and stability to ensure reliable battery performance. Nana's group investigates multifunctional electrode materials and electrolytes, exploring their structural evolution and electrochemical behavior to address challenges such as sluggish ion transport and electrode-electrolyte compatibility in extreme environments. She has published over 120 articles in prestigious international journals, including Nature Communications, Angewandte Chemie, etc., which have collectively attracted over 7,800 citations, with an h-index of 51. Her pioneering research supports Australia's net-zero emissions strategy, contributing not only to fundamental advancements in chemistry and engineering but also to the industrial development of next-generation energy storage and conversion technologies.

Keywords: solid-state batteries; sodium-ion batteries; low-temperature energy storage; solid electrolytes; electrode design.

Honours programs: Bachelor of Science (Honours).

I supervise Honours projects on:

- Solid-state batteries. Development of high-performance solid state electrolytes and to enhance energy density and cycle stability. Investigating interfacial stability between solid electrolytes and electrodes to mitigate degradation mechanisms and improve long-term performance.

- Low-temperature sodium-ion batteries. Design of novel electrodes and electrolytes to improve electrochemical kinetics and durability in extreme environments.

What methods or research skills will you learn?

- Materials synthesis: Hands-on training in the fabrication of solid electrolytes and electrode materials with controlled composition and microstructure.

- Advanced characterization: Use of techniques such as XRD, SEM, TEM, XPS to analyze material properties and interface evolution.

- Electrochemical testing: Application of galvanostatic cycling, impedance spectroscopy, and electrochemical measurements to evaluate battery performance.

I collaborate with:

- Professor Guoxiu Wang and the Centre for Clean Energy Technology (CCET),
- Prof Andrew McDonagh
- Professor Steven Langford

Dr Jinni Yan

Lecturer
Analytical Chemistry
jingya.yan@uts.edu.au

Jinni has extensive experience in multi-omics techniques, Jinni has extensive experience in multi-omics techniques to effectively dissect and understand molecular mechanisms that underlie disease pathophysiology. Her research focuses on biomarker discovery and translational studies for a broad spectrum of serious childhood diseases across various human biological matrices. She has led safety studies and clinical trials, providing real-world evidence to inform treatment decisions and guide therapeutic expectations for neuroinflammatory and neurodevelopmental disorders in clinical practice.

Keywords: metabolomics, lipidomics, biomarker discovery, mass spectrometry, biochemistry, clinical toxicology, childhood epilepsy, neurodevelopmental disorders, neuroinflammation

Honours programs: Bachelor of Science (Honours) in Chemistry

I supervise Honours projects on:

- Development of comprehensive biomarker panels used for improving diagnosis and identifying shared pathways and targets for therapeutic development
- Evaluate the biological effect of current and emerging therapies, to ultimately offer a personalised model of care.
- Streamline the therapeutic pipeline from preclinical studies to clinical trials to improve clinical outcomes and quality of life for children and adolescents

What methods or research skills will you learn?

- Analytical method development and validation
- Chromatographic separation techniques such as gas chromatography (GC) and liquid chromatography (LC)
- Spectroscopic analysis techniques such as mass spectrometry (MS), tandem mass spectrometry (MSMS), high resolution MS, ultraviolet (UV), infrared (IR) and nuclear magnetic resonance (NMR) spectroscopy
- Sample Preparation techniques
- Multi-omics approaches (metabolomics, lipidomics, bioinformatics, gut microbiome profiling)

I collaborate with:

- Prof. Shanlin Fu (UTS), Dr Maiken Ueland (UTS), Prof. Brian Oliver (UTS), Professor Russell Dale (USYD), Prof. Michelle Farrar (UNSW)

Dr Jinqiang Zhang

Chancellor's Research Fellow, ARC DECRA Fellow
Chemistry, Material Science, Clean Energy Technology
Jinqiang.Zhang@uts.edu.au

Dr Jinqiang Zhang is an expert in materials design and mechanism research for clean energy technologies including energy storage and conversion systems. His research interests spread across a wide range of materials and applications, such as functional redox organic molecules, atomically dispersed catalysts, and hybrid branched materials for lithium-air batteries, lithium-ion batteries, lithium-sulfur batteries, zinc batteries, electrochemical water splitting, fuel cells, CO_2 capture and reduction. He has published over 90 articles in prestigious international journals including Nature Catalysis, Nature Nanotechnology, Nature Synthesis, Nature Communications, Science Advances etc., which have attracted over 11500 citations with an h-index of 57. His pioneering works underpin the Australian Government's net zero emission, contributing to not only the fundamental research in chemistry and engineering, but also the industrial development of energy storage and conversion technologies.

Keywords: Organic functional molecules; atomically dispersed catalysts; energy storage; energy conversion; batteries; electrocatalysis; CO_2 capture and reduction.

Honours programs: Bachelor of Science (Honours).

I supervise Honours projects on:

- Development of new functional organic materials with redox capability for lithium-air batteries with low over-potentials and high durability.
- Development of single atom catalysts and atomic clusters for hydrogen production and fuel cells.
- Development of functional Cu-based catalysts for CO_2 reactive capture.

What methods or research skills will you learn?

- Organic synthesis – functional organic molecule design and synthesis.
- Inorganic synthesis – atomically dispersed catalysts on various substrates.
- System design and modification – batteries, water splitting, CO_2 capture/reduction
- Advanced characterisations – SEM, XRD, BET, TEM, XAS, FTIR, Raman etc.

I collaborate with:

- Prof Guoxiu Wang and Prof Hao Liu from Centre for Clean Energy Technology
- Prof Steven Langford
- Prof Andrew McDonagh
- Prof Rose Amal (UNSW)
- Prof Edward Sargent (Northwestern University)
- Prof David Sinton (University of Toronto)

Dr Yufei Zhao

Lecturer, Faculty of Science
Electrochemistry, Clean Energy
yufei.zhao@uts.edu.au

Yufei's research interests are in the design and synthesis of highly efficient electrocatalysts, e.g., atomically dispersed catalysts, precious metal alloys, high entropy materials, perovskite oxides, etc., for energy conversion reactions, including water splitting, fuel cells, CO_2 reduction reactions. Yufei's group works on atomically dispersed catalysts, which possess the maximised atom efficiency and tunable electronic properties. Carefully designing and tailoring the coordination environment can maximise the efficiency of the atomically dispersed catalysts for boosted electrochemical performances in energy conversion reactions. For instance, in-situ exfoliated MXene coupled with Pt single atoms showed high hydrogen generation performance with a mass activity more than 40 times higher than the commercial Pt/C, while the epoxy-rich Fe single atoms boosted the oxygen reduction kinetics. For more information about Yufei please see:
https://profiles.uts.edu.au/Yufei.Zhao
https://scholar.google.com.au/citations?user=SJr3o7IAAAAJ&hl=en

Keywords: green hydrogen production; fuel cell; electrocatalysts; materials chemistry.
Honours programs: Bachelor of Science (Honours).

I supervise Honours projects on:

- Hydrogen evolution reaction. Design and development of low Pt electrocatalysts for hydrogen evolution reaction. We are developing Pt single atom catalysts and Pt atomic clusters with altered coordination environments for boosted catalytic performance.
- Acidic water oxidation. We are developing different strategies to engineer RuO_2 to enhance the corresponding stability in acidic and oxidation conditions.
- Alkaline seawater oxidation. We are working on layered double hydroxides (LDH), such as NiFe-LDH, CoFe-LDH, to resist serious corrosion and undesirable chloride oxidation during seawater oxidation process.

What methods or research skills will you learn?

- Nanomaterials synthesis – You will be trained in a broad range of synthetic skills while making your own novel electrocatalysts.
- Materials characterisation – you'll use various characterisation techniques (SEM, TEM, HAADF-STEM, XPS. Raman, etc.) to understand the atomic structure and surface chemical states of the synthesised electrocatalysts.
- Electrochemical performance test – you'll use three-electrode and two-electrode systems to evaluate the electrochemical performance of the electrocatalysts for the above-mentioned energy conversion reactions.

I collaborate with:
Professor Guoxiu Wang and the Centre for Clean Energy Technology (CCET), A/Professor Tristan Rawling (UTS), Professor Steven Langford (UTS), Professor Rose Amal (UNSW)

Dr Xiaobo Zheng

DECRA Fellow
Materials Chemistry, Clean Energy
XiaoboZheng.Zheng@uts.edu.au

Dr. Xiaobo Zheng received his PhD degree in the Institute of Superconducting and Electronic Materials from the University of Wollongong in 2020. Currently, he is working as a DECRA Fellow at UTS. Dr. Zheng's research interests primarily focus on the development of advanced energy storage materials and devices, as well as the investigation of material surface and interface properties, including the design of next-generation alkali metal-ion batteries, metal-air batteries, and fuel cells, and the synthesis of novel electrocatalysts such as two-dimensional and single-atom catalysts. Dr. Zheng has published 48 SCI papers in top-tier journals, including Science Advances, Nature Communications, and Angewandte Chemie. His work has accumulated over 5,200 citations, achieving an H-index of 31, with 16 papers listed as ESI Highly Cited Papers (top 1%) and 17 publications in Nature Index journals. Additionally, he has contributed to one book chapter and holds two authorized national invention patents.

Keywords: Interface chemistry, functional materials, single-atom(cluster) catalysts, 2D materials, hydrogen production, metal-air batteries, alkaline-ion batteries

I supervise Honours projects on:

- Regulating Interfacial Chemistry for High-Energy Zinc-Air Batteries
  This project aims to address the knowledge gap in the zinc-air batteries based on the fundamental understanding and controlling of interfacial chemistry of the air cathode and the Zn anode, simultaneously bringing ZABs with high energy density, high safety and reliability, and long-life expectancy into reality.

What methods or research skills could you learn?

- Synthesize single-atom/cluster materials with tailored electronic and coordination structure
- Investigation of the interface chemistry and catalytic mechanisms through combined advanced structural characterizations and DFT calculations
- Physical, chemical and structural characterizations of functional materials.
- Various *In-situ* spectroscopic characterizations such as *in-situ* XAS and Raman

I collaborate with:

- Prof Guoxiu Wang and the Centre for Clean Energy Technology (CCET)
- Australian Synchrotron
- University of Wollongong, Tsinghua University, RMIT

Forensic Sciences Supervisors

A/Prof Scott Chadwick

Associate Professor, Associate Head of School Teaching and Learning, Forensic Science
Scott.Chadwick@uts.edu.au

Scott completed his PhD at UTS in 2013. His research focused on fingermark detection techniques in the near-infrared region, which involved developing new reagents for developing fingermarks on difficult surfaces, where conventional techniques are unsuccessful. Scott currently supervises students across a range of forensic disciplines including fingermark detection, chemical criminalistics, document examination, forensic intelligence and organic chemistry.

Keywords: Fingermark detection, chemical criminalistics, document examination, ballistics, intelligence

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- Understanding the effect of substrate properties on fingermark detection success rates
- Improving existing fingermark detection processes for normal and difficult surfaces
- Sequencing of fingermark detection methods and chemical analysis
- Impurity profiling of illicit drug synthesis

What methods or research skills will you learn?

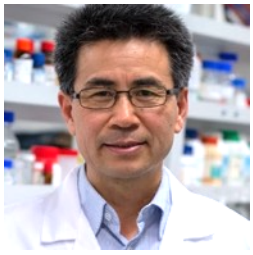
- Collection and visualisation of latent fingermarks
- ATR-FTIR, GC-MS, NMR
- Fingermark evaluation and quality assessment
- Synthetic chemistry skills

Our team:

- Matthew Bolton – MSc Student
- Ciara Devlin – PhD Student
- Harrison Fursman – PhD Student
- Lumikki Ree – PhD Student
- Joel Waszczuk – PhD Student
- Harrison Woodward – PhD Student

I co-supervise projects with:

Morgan Alonzo, Mackenzie De la Hunty, Andrew McDonagh, Marie Morelato, Claude Roux, Xanthe Spindler, NSW Police Force, Australian Federal Police.



Prof Shanlin Fu

Professor
Forensic Science
shanlin.fu@uts.edu.au

I am heading the Drugs and Toxicology Group at the Centre for Forensic Science (CFS), running an active research program with the primary goal of developing sensitive methods for clinical diagnosis, therapeutic drug monitoring and drugs of abuse testing. Our research team aims to answer three main questions: i) what drugs of abuse are out there in the illicit drug market and how do we identify them? ii) how do we know if someone is using these drugs? iii) what happens once these drugs get into our body? You can find out more about our research activities and outputs from my UTS staff profile.

Keywords: forensic toxicology, forensic chemistry, poisons, drugs of abuse, new psychoactive substances
Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

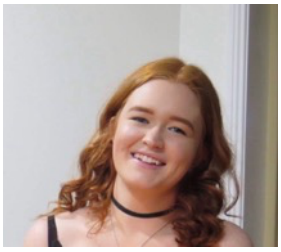
- Developing test methods for screening drugs of abuse including NPS in seized materials for in-field application by the law enforcement agencies
- Developing test methods for quantifying the levels of drugs of abuse including NPS in biological matrices for clinical or medico-legal purposes
- Synthetic route investigation of illicit drugs manufactured in a clandestine laboratory
- Understanding the metabolism of NPS and identifying suitable markers for monitoring substance abuse
- Investigating the stability and degradation profile of drugs of abuse in various matrices including post-mortem specimens.

What methods or research skills will you learn?

- Drug analyte extraction techniques such as liquid-liquid extraction (LLE) and solid phase extraction (SPE)
- Chromatographic separation techniques such as gas chromatography (GC) and liquid chromatography (LC)
- Spectroscopic analysis techniques such as mass spectrometry (MS), tandem mass spectrometry (MSMS), high resolution MS, ultraviolet (UV), infrared (IR) and nuclear magnetic resonance (NMR) spectroscopy
- Analytical method development and validation
- Chemical reactions

I collaborate with:

- UTS researchers with expertise in forensic science and in analytical chemistry
- Law enforcement agencies such as Australian Federal Police, NSW Police Force
- Forensic science service providers such as NSW Forensic and Analytical Science Service; Australian Racing Forensic Laboratory, Racing NSW
- Education/Research organisations such as Shanxi Medical University, China; University of Sydney; University of Canberr



Dr Teneil Hanna

Associate Lecturer, Forensic Science
Teneil.hanna@uts.edu.au

Teneil completed a PhD at UTS investigating new methods to evaluate fingermark quality. She joined the UTS academic staff in 2024 as an associate lecturer. Her research interests focus on fingermark fundamentals as well as automation and integration of AI systems into quality evaluation protocols and trace examination. She supervises both Honours and PhD students in fingermark detection, 3D printing examination, crime scene equipment advancement and integration of AI into forensic practice. Her contacts and positive approach will see her develop industry and research orientated projects for students who feel supported and excited to produce thought-provoking outputs for the forensic field.

Keywords: Fingermark Detection; Artificial Intelligence; Marks/Impression Evidence; Microtraces; Crime Scene Examination; 3D Printing; Motor Vehicle Trace Examination

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- Fingermarks
  - Development techniques on porous/non-porous substrates and new methods
  - Automation of fingermark quality evaluation
  - Fingerprint comparison evaluation
  - Fingermark fundamentals
- AI; integration into hypotheses formulation on crime scenes, automation of trace interpretation
- Microtraces: Glass, Fibres, Paint collection and analysis
- Car examination: assessing new methods of fingermark analysis on car surfaces, new methods for photography of car scenes, paint chip collection and evaluation methods

What methods or research skills will you learn?

- Analytical skills; GC-MS, FTIR
- Fingermark development techniques: Indanedione-Zinc, Ninhydrin, Powdering, Physical Developer, Cyanoacrylate fuming, Rhodamine 6G
- Experimental design
- How to work effectively, and communicate with industry
- Optical microscopy
- Machine learning/deep learning programming

I collaborate/co-supervise with:

- NSW Police Forces
- Australian Federal Police (AFP) Forensics
- UTS Academics (Professor Claude Roux, Dr Scott Chadwick, A/Prof Xanthe Spindler, Dr Paula Tarttelin Hernandez)
-

Dr Mackenzie de la Hunty

Lecturer, Forensic Science
Mackenzie.delaHunty@uts.edu.au

Mackenzie completed a PhD at UTS investigating ways to develop fingermarks on paper that has been wet or in high humidity, before taking up a role as a Scholarly Teaching Fellow at UTS. She then moved to Canberra to work at the Australian Federal Police (AFP) primarily in the Forensics Training Team as a member, and then Team Leader from 2019-2022. She is now back at UTS as a Lecturer and is excited to get back into the world of research. Her contacts and positive approach will see her develop industry-relevant projects for students who feel supported and excited to produce great research outputs.

Keywords: Fingermarks; Fire Investigation; Bomb Scene Examination; LiDaR; Microtraces;

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

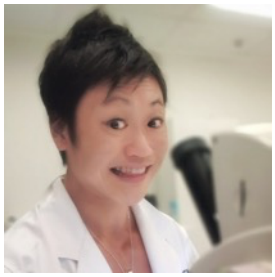
- Fingermarks
  - Development on porous substrates
  - Development on items from hazardous scenes (fire, bomb)
  - Residue composition, fundamentals and simulants
- Fire investigation: detection and analysis of ignitable liquid residues in scenes of arson
- Microtraces: Glass, Fibres, Paint collection and analysis
- Light Detection and Ranging (LiDaR) mapping for Crime Scenes

What methods or research skills will you learn?

- Analytical skills; GC-MS, FTIR
- Fingermark development techniques: Indanedione-Zinc, Ninhydrin, Powdering, Physical Developer
- Emulsion Chemistry: Fingermark residue simulant development
- Experimental design
- The use of LiDaR
- How to work effectively, and communicate with industry

I collaborate/co-supervise with:

- Australian Federal Police (AFP) Forensics
- NSW Fire & Rescue (NSWF&R)
- NSW Rural Fire Service (NSWRFS)
- ACT Fire & Rescue (ACTF&R)
- UTS Academics (Professor Claude Roux, Dr Scott Chadwick, Dr Maiken Ueland)



Dr Victoria Lau

Associate Lecturer
Forensic Science
Victoria.Lau@uts.edu.au

Victoria completed a PhD at UTS modelling the transfer and persistence of textile fibres and improving their evaluation. She continued as a research assistant at CFS prior to joining the UTS academic staff as Associate Lecturer in 2025.
Her research focuses on microtrace and pattern evidence — particularly how physical traces behave in real-world scenarios and how they can be more effectively recovered, analysed, modelled and evaluated. She takes an interdisciplinary approach to research, drawing on engineering, computing and data science to address current and future challenges in forensic science, strengthen the value of trace materials and improve practice. She is particularly interested in understanding fundamental transfer and persistence mechanisms, applying 3D modelling and reconstruction, using 3D printing for research and training, and developing computational and AI-assisted tools to support forensic evaluation.
Keywords: trace evidence, forensic interpretation, chemical criminalistics, microtraces, impression traces, forensic statistics
Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)
I supervise Honours projects on:

- Investigating transfer, persistence and prevalence of microtraces
- Developing and refining methods for the detection, recovery and characterisation of physical traces including textile files, paint, glass and other microtraces
- Exploring how substrate and environmental factors affect trace evidence detection and recovery
- Applying digital and 3D modelling techniques to reconstruct trace mechanisms and forensic scenarios
- Creating computational and AI-assisted tools for evidence interpretation and forensic evaluation

What methods or research skills could you learn?

- Design and execution of experimental studies on trace transfer and persistence
- Detection, recovery and analysis of textile fibres and other microtraces using optical and spectroscopic methods
- 3D visualisation and printing for research, training and demonstrative purposes
- Data handling, statistical analysis and modelling, data visualisation, dashboarding and application programming

I collaborate / co-supervise with:

- Dist. Prof. Claude Roux, A/Prof. Xanthe Spindler
- Forensic and Analytical Science Service
- Forensic Science South Australia
- UWS BMRF and National Imaging Facility

Prof Dennis McNevin

Professor
Forensic Science
dennis.mcnevin@uts.edu.au

Dennis began his career in forensic science in 2003 in the laboratories of the Australian Federal Police in Canberra where he recovered DNA from shed hairs. Since then, he has held academic positions at the Australian National University, the University of Canberra and now at UTS. His research focuses on forensic genetics, or the use of genetics in the service of the legal system. He has pioneered the use of new DNA sequencing technologies in Australia and infers the biogeographical ancestries and phenotypes of DNA donors for Australian police agencies. Dennis was recently seconded to the Australian Federal Police National DNA Program for Unidentified and Missing Persons as a genomics expert.

Keywords: DNA, genetics, genomics

Honours programs: Bachelor of Science (Honours), Master of Philosophy in Forensic Science

I supervise Honours projects on:

- Population genetics
- Genetic kinship
- Recovery of trace DNA
- Extraction of DNA from environmentally challenged biological materials
- Preservation of DNA
- New DNA sequencing technologies
- Probabilistic genotyping
- Inference of biogeographical ancestry and phenotype from DNA
- Forensic proteomics

What methods or research skills will you learn?

- Analytical skills:
  - DNA profile interpretation
  - Population genetic analysis
  - Genetic kinship analysis
  - Probabilistic genotyping
  - Ancestry and EVC inference
  - Bioinformatics
- Laboratory skills:
  - Molecular biology
  - Working in a DNA-free environment
  - Quantitative polymerase chain reaction (qPCR)
  - DNA fragment analysis
  - Massively parallel sequencing

I collaborate with:

- Australian Federal Police Forensics
- NSW Police Force
- NSW Health Pathology Forensic & Analytical Science Service
- Victoria Police Forensic Services Department
- Forensic Science Queensland
- Forensic Science South Australia
- PathWest
- A/Prof Georgina Meakin, A/Prof Jodie Ward, A/Prof Matt Padula, Dr Maiken Ueland, Dr Alicia Haines

A/Prof Georgina Meakin

Associate Professor
Forensic Science
Georgina.Meakin@uts.edu.au

Georgina joined the UTS Centre for Forensic Science in October 2019, having spent six years teaching and researching at University College London's Centre for the Forensic Sciences. Building on her prior experience as a Forensic Scientist at The Forensic Institute in Glasgow (2010-2012), Georgina continues to provide advice and consultancy in casework in the UK, USA, and various other countries. This casework tends to underpin the research that Georgina and her students conduct, with research focusing on investigating the transfer, persistence, prevalence and recovery (TPPR) of DNA and other trace evidence. Georgina is particularly interested in research that directs the recovery and preservation of DNA at the crime scene and informs the interpretation and evaluation of trace DNA in casework.

Keywords: trace DNA, forensic interpretation, crime scene investigation, biological criminalistics
Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- DNA TPPR and interpretation/evaluation employing either laboratory or computer-based methods
- Transfer and persistence of DNA on touched/worn items within scenarios of relevance to various crime types
- Consideration of DNA recovery and preservation at the crime scene
- Detection and recovery of trace DNA and fingermarks and their relationship
- Investigation of trace DNA for intelligence purposes

What methods or research skills might you learn?

- DNA recovery using swabs, tapelifts and other methods
- DNA extraction using a commercial kit and the Automate Express
- DNA quantification using a commercial kit and RT-PCR instrument
- DNA profiling using a commercial kit and Genetic Analyzer
- Various software programs (e.g. GeneMapper, LRmix, Hugin, etc.)
- Systematic review and meta-analysis skills

Our team:

- PhD students: Rachael Hoffman, Anshu Upadhayay, Helen Roebuck, Yingxiu Guo, Penny Wildman

I co-supervise with:

- Claude Roux, Dennis McNevin, Xanthe Spindler, Marie Morelato & Alicia Haines
- Bianca Szkuta (Deakin University)
- Ali Sears, Jen Raymond, Annemarie Nadort, James Daubney & Caitlin Almada (NSW Police Force)
- Matt Bolton & Caroline Driscoll (AFP)
- Roland van Oorschot (Victoria Police Forensic Services Department)

Dr Marie Morelato

Senior Lecturer
Program Director Bachelor of Forensic Science
Forensic Science
Marie.Morelato@uts.edu.au

Marie Morelato completed her Bachelor and Master degree in Forensic Science at the School of Criminal Justice of the University of Lausanne (Switzerland) in 2009. After completing her studies, she worked in the Wallis State Police (Switzerland) as a forensic scientist before moving to Australia to complete a one-year project on Gunshot residues at the UTS in collaboration with the Australian Federal Police (AFP).

In 2015, she completed her PhD on drug intelligence at UTS. The project was a collaboration between the AFP, the University of Lausanne and UTS. In 2016, she obtained the Chancellor's Postdoctoral Research Fellowship from UTS. Her research involves the use of illicit drug data in an intelligence perspective. She is now a senior lecturer in forensic science and the course director of the Bachelor of Forensic Science.

Keywords: forensic science, forensic intelligence, illicit drug, document fraud, utility

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- Analysis of illicit drug specimens using portable near infrared technology
- Trafficking of illicit goods on cryptomarkets
- Utility of Trace DNA
- Analysis of used injecting paraphernalia
- Detection and monitoring of New Psychoactive Substances on online drug forums and google trends
- Forensic intelligence in handwriting
- Analysis of illicit drugs in wastewater

What methods or research skills will you learn?

- The use of forensic science beyond the Court
- How to understand criminal activities based on the study of different data sources
- Analysis of large datasets

Our team:

- Ciara Devlin, PhD student
- Harrison Fursman, PhD student
- Rachael Hoffmann, PhD student

I collaborate with:

- Claude Roux
- Scott Chadwick
- Georgina Meakin
- Anjali Gupta
- Australian Federal Police
- New South Wales Police Force
- Forensic and Analytical Science Service
- Medically supervised injecting centre

Dr Paula Tarttelin Hernandez

Lecturer, Forensic Science
Paula.TarttelinHernandez@uts.edu.au

Paula joined UTS in July 2024, after having worked as a Lecturer in Forensic Investigations at Coventry University in the UK since 2018. She completed her PhD at UCL in 2017, which involved the development of gas sensors to investigate their feasibility in detecting illicit drug markers in security settings. She has previously interned with the National Crime Agency in London to gain greater insight into the strategies used by governmental agencies to disrupt illegal markets and those used by drug traffickers to conceal illegal drugs. Her research interests include the detection and disruption of illegal trafficking markets through intelligence development, the understanding of drug trends, the fabrication of inexpensive and portable sensor technology to detect trace vapours relevant to criminal activities, and contributing to a better understanding of the global strategies that can be adopted by practitioners in the field to maximise evidence collection and preservation and intelligence development on organised criminal activities.

Keywords: sensor technology, detection of illegal materials, forensic intelligence, crime scene investigation, trace interpretation.

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- Understanding decision-making processes during crime scene processing and management.
- Investigation and application of Generative AI tools to support crime scene processing and reconstruction.
- Drug/drug marker detection using sensor or lab-benched technologies (e.g. in vapour form or when deposited through fingermarks).
- Trace evidence persistence and dynamics.

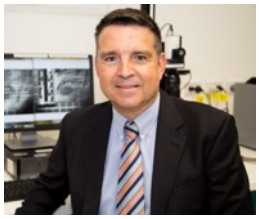
What methods or research skills will you learn?

- GenAI tools to support various crime scene-related processes.
- Analytical techniques for the analysis of volatile materials
- MOS sensor design and fabrication, sensor material characterisation (e.g. XRD, SEM, EDAX, Raman Spectroscopy, FTIR), sensor data processing using Support Vector Machines and interpretation of data.
- Critical reviews and paper writing in preparation for publication.

I collaborate with:

In the past I have collaborated with:

- Claude Roux, Marie Morelato, Xanthe Spindler, Teneil Hanna, Dayanne Bordin, Shanlin Fu
- New South Wales Police Force
- Australian Federal Police
- UCL Chemistry and UCL's Security & Crime Science Department.
- West Midlands Police & National Crime Agency, London



Dist Prof Claude Roux

Director UTS Centre for Forensic Science
Forensic Science
Claude.Roux@uts.edu.au

My research activities cover a broad spectrum of forensic science, including microtraces and chemical criminalistics, documents, fingerprints, forensic intelligence and the contribution of forensic science to policing and security. My professional motivation has been driven by my vision of forensic science as a distinctive academic and holistic research-based discipline. For this reason, I love working at the interface between several enabling science & technology disciplines or between STEM and humanities. Many of my former Honours students now work in forensic science practice, including the current AFP Chief Forensic Scientist. I work collaboratively with many of my colleagues and supervise an enthusiastic group of research students currently working on a multitude of forensic science problems that span from fingermark detection to drug and DNA intelligence, chemical criminalistics/microtraces, criminalistics and questioned document examination.

Keywords: microtraces, fingermark detection, forensic interpretation, forensic intelligence, chemical criminalistics, impact and effectiveness of forensic science.

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- Improving the evaluation of forensic traces, including their transfer, persistence and prevalence
- Improving existing fingermark detection processes for normal and difficult surfaces
- Improving detection, recovery and characterization of many different traces including physical traces, microtraces, document materials (e.g. ink), illicit or sensitive materials (e.g. explosives, drugs)
- Improving the exploitation of traces to better feed intelligence, investigation and court processes

What methods or research skills could you learn?

- Detection, collection and visualisation methods (vary depending on the trace)
- Instrumental techniques used in trace characterization, e.g. optical microscopy, ATR-FTIR, microspectrophotometry and other spectroscopic techniques, GC/MS
- How to design and undertake transfer and persistence experiments and population studies
- How to combine forensic results into an evaluative framework, prioritise trace types and examinations and better exploit casework data to be more effective

Our team:

- PhD Students: Victoria Lau, Matt Saunders, Lutfi Asad, Harrison Fursman, Rachael Hoffmann, Joel Waszczuk, Analisa Chiaravalle

I co-supervise projects with:

- Xanthe Spindler, Scott Chadwick, Marie Morelato and Georgina Meakin
- Australian Federal Police
- NSW Police Force
- NSW Forensic & Analytical Sciences Service
- Uniting Medically Supervised Injecting Centre

A/Prof Xanthe Spindler

Honours Program Director
Forensic Science
Xanthe.Spindler@uts.edu.au

Xanthe completed a PhD at the University of Canberra investigating ways to improve the detection of latent fingermarks before moving to UTS to continue her work as a postdoctoral fellow and later as a lecturer. My research program focuses on improving the recovery and value of forensic traces to enhance crime detection and resolution, with specific focus on fingermark detection and chemical criminalistics. Xanthe supervises a collaborative and enthusiastic group of research students working on a multitude of forensic science problems that span from fingermark detection and fingerprint identification to criminalistics and questioned document examination.

Keywords: fingermark detection, forensic interpretation, microtraces, fingerprint, chemical criminalistics

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Forensic Science)

I supervise Honours projects on:

- Understanding the effect of substrate properties on fingermark detection success rates
- Improving existing fingermark detection processes for normal and difficult surfaces
- Developing fingerprint-based methods for wildlife detection and monitoring
- Detection and recovery of fingermarks and trace DNA
- Transfer and persistence of microtraces in different scenarios

What methods or research skills could you learn?

- Collection and visualisation of latent or blood fingermarks
- ATR-FTIR, microspectrophotometry, and other spectroscopic techniques
- Optical microscopy
- How to design transfer and persistence experiments
- DNA recovery and extraction

Our team:

- Victoria Lau, PhD student
- Matt Saunders, PhD student
- Lutfi Asad, PhD student

I co-supervise projects with:

- Claude Roux
- Scott Chadwick
- Amber Brown
- Georgina Meakin
- Anjali Gupta
- NSW Police Force
- Australian Federal Police

Physics Supervisors

A/Prof Matthew Arnold

Associate Professor
Physics
Matthew.Arnold-1@uts.edu.au

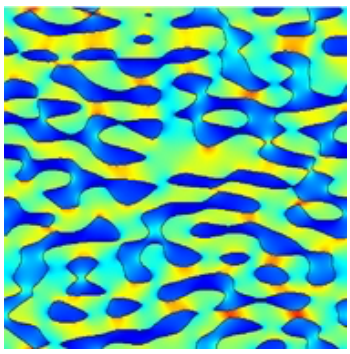
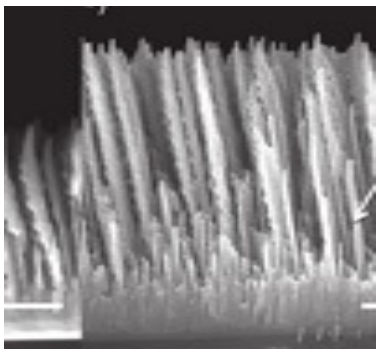
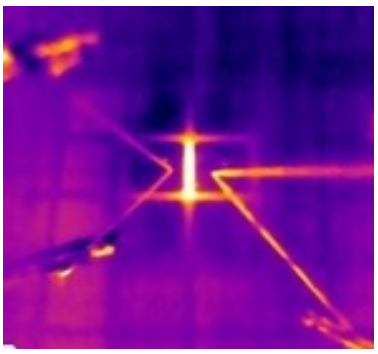
Matt is interested in complex physical systems and their electromagnetic capabilities, and enjoys all aspects of research including simulation, design, construction, and testing. He works in small teams on projects combining diverse areas of science and engineering, and has mentored research students who work in many different sectors and countries.

Keywords: electromagnetics, photonics, emergent phenomena, multiphysics

Honours programs: Bachelor of Science (Honours) in Physics

I supervise Honours projects on:

- Electromagnetic properties of quasi-random structures
- Developing physically self-assembled systems for applications
- Conduction avalanches in dynamic devices & analog computing

What methods or research skills will you learn?

- Electromagnetic simulation
- Spectroscopy & ellipsometry
- Advanced physical deposition
- Multiphysics experimental design
- Network analysis & machine learning
- Electron & light microscopy

Our team:

Angelo Vitaliti (PhD student), Ed Saribatir (PhD student)

I will co-supervise projects with:

- Cuong Ton That, Chris Poulton, Irina Kabakova, Alex Solntsev (UTS)
- David Cortie (ANSTO)
- Oscar Nieves (CSIRO)

Dr Chaohao Chen

ARC DECRA Fellow | UTS Chancellor's Research Fellow,
Physics
Chaohao.chen@uts.edu.au

Dr Chaohao Chen is a Chancellor's Research Fellow and ARC DECRA Fellow at the School of Mathematical and Physical Sciences (MaPS), University of Technology Sydney. He specialises in nanophotonics, nanomaterials, and nanofabrication, with a focus on developing Computational High-resolution and Electro-optical Nanodevices for ultrasensitive infrared sensing and biomedical imaging. After completing his PhD at UTS in 2020, he undertook postdoctoral research at the Australian National University before returning to UTS to lead interdisciplinary research at the intersection of optics, nanotechnology, and computational imaging. His contributions are evidenced by the peer-reviewed journal articles as first or corresponding author, featured in premier international journals such as *Nature Communications*, *Advanced Materials* (x2), *Nano Letters*, and *Advanced Science*. He also has published one book chapter, six conference proceedings, three News & Views articles (in *Nature Photonics*, *Light: Science & Applications*, and *Advanced Photonics*), and seven patents. His work has garnered significant recognition, with nine publications featured as journal cover articles, 88% published in top 5% CiteScore journals, and over 90% in Q1 journals (Web of Science), achieving an average impact factor above 15.

Keywords: nanophotonics; computational imaging; infrared sensing; optoelectronics

Honours programs: Bachelor of Science (Honours) in Physics.

I supervise Honours projects on:

- Mid-infrared imaging with visible detectors at room temperature
- Electrically Pumped On-Chip Super-Resolution Imaging
- Ghost infrared imaging with III-V semiconductor photodetectors
- Electrically Tuneable Photodetectors for Broadband Infrared Hyperspectral Imaging

What methods or research skills will you learn?

- Confocal microscopy, super-resolution microscopy, infrared and visible spectroscopy and optical system alignment
- Micro- and nanofabrication, materials and optoelectronics device characterization techniques
- Spectrum and imaging reconstruction algorithm

We collaborate with:

- Prof Igor Aharonovich, Prof Milos Toth, Dr Mehran Kianinia (MaPS)
- Dr. Peter Su, Dr. Helen Xu, Dr Ying Zhu (FEIT)
- Prof. Lan Fu, Prof. Hoe Tan (Research school of Physics, ANU)

For more information about Chaohao please see:

https://profiles.uts.edu.au/chaohao.chen

Dr Sujeewa De Silva

Lecturer
Physics
Sujeewa.DeSilva@uts.edu.au

Sujeewa De Silva is currenlty a lecturer in the school of Mathematical and Physical Sciences (MaPS), and she was appointed to this position in 2017 having joined UTS in 2014 as a postdoctoral fellow.

Sujeewa's research is focused on the applications of precious metals and their alloys and compounds in Plasmonics and nanotechnology. Her projects will be looking at the dielectric function of materials as it controls the localized surface plasmon resonances and its surface optical properties.

Keywords: Plasmonics, metals and intermetallic compounds, metals/ metal oxide nanostructures and thin films, superconductors and electronic materials

Honours programs: Bachelor of Science (Honours)

I supervise Honours projects on:

- Understanding the optical properties of thin films and nano structures of various metals and intermetallic compounds
- Improving plasmonics by fine tuning the dielectric properties of metals via doping
- Developing nano-porous films for various applications such as sensors, supercapacitors etc.

What methods or research skills could you learn?

- Thin film fabrication using magnetron sputtering
- Ellipsometry and other spectroscopic techniques for optical measurements
- Scanning electron microscopy and EDS for morphology and elemental analysis
- Structural characterization of materials using XRD
- Structural refinements using suitable software

Our team:

- Fatima Matar, PhD student

I co-supervise projects with:

- Michael Cortie
- Annette Dowd
- Matthew Arnold
- Danica Solina
- Cuong Ton-That
- Steven Langford
- Dinushi Munasingha
- David Cortie (ANSTO)

Dr Annette Dowd

Senior Lecturer, Associate Head of School (Education and Students)
Physics
Annette.Dowd@uts.edu.au

Dr Dowd also has interests are in the area of development optical and structural characterisation techniques for nanostructured materials, particularly biomaterials and advanced materials. She collaborates with chemists and biologists to gain new understanding about their systems using nuclear and synchrotron techniques. She is also interested in the development of innovative laboratory-based activities to enhance student learning in mathematics and science.

Keywords: biomaterials, nanotechnology, spectroscopy, modelling, science education

Honours programs: Bachelor of Science (Honours) in Physics

I supervise Honours projects on:

- Coral and shell microanalysis to evaluate the impact of environment on growth
- Structural analysis of bioinspired molecules
- Synthesis of high surface area nanoporous sponges as supercapacitors
- VR platform development to enhance learning of multidimensional concepts in maths and physics
- Radiotherapy simulation

What methods or research skills will you learn?

- X-ray diffraction, X-ray fluorescence, synchrotron techniques
- Infrared and visible spectroscopy, capacitance spectroscopy
- Density functional theory modelling (CRYSTAL)
- VR, Unity, MATLAB
- Monte Carlo modelling of radiation (Geant4)

I co-supervise projects with:

- Matthew Arnold
- Sujeewa de Silva
- Camille Dickson-Deane
- Climate Change Cluster, UTS
- Human Health, Australian Nuclear Science and Technology Organisation
- πLab, Faculty of Engineering and IT
- Institute of Molecular Sciences, University of La Trobe
- Many other nice people at UTS and beyond

Prof Irina Kabakova

Professor of Physics
Irina.Kabakova@uts.edu.au

I am an Optical Physicist working in the field of Advanced Microscopy/Spectroscopy and run a *Brillouin Microscopy Lab* at UTS. Brillouin Microscopy is a new field of research that unites optics with acoustics and looks at mechanical properties of materials at the microscale. In this way the mechanical parameters of the materials are read out by using only a focused beam of light, making it into a versatile and safe technique to use with biological materials such as tissues and cells. We explore how pathological processes in cells and tissues represent themselves in changes in tissue elasticity. These findings are key to understanding disease progression at the microscale as well providing means for early disease diagnostics.

Keywords: microscopy, spectroscopy, Brillouin light scattering, light-sound interactions, quantum optics, quantum spectroscopy

Honours programs: Bachelor of Science (Honours) in Physics and Chemistry

I supervise Honours projects on:

- **Optimisation of Brillouin microscopy setups for fast imaging of biological materials.** Although very useful, Brillouin microscopy can be a very slow measurement when we need to map large areas/samples. Instrument optimisation by signal multiplexing and signal enhancement techniques can help this problem.
- **Machine learning techniques for Brillouin data.** Using machine learning, AI and signal processing techniques enable us to get more information from existing data thus guiding data analysis and interpretation process.
- **Applications of Brillouin microscopy to study respiratory, fibrotic diseases and cancers.** Studying cellular processes and their connection to disease from a mechanical point of view can lead to deeper understanding of the disease and treatment improvements.
- **Complex systems and emergent phenomena.** Complex systems exhibit emergent phenomena by which new properties of the whole system emerge from interaction of its parts. Such interactions drive many cellular processes, e.g. cell division, and is fundamental to existence of life.
- **Quantum spectroscopy and sensing**

  We apply non-classical states of light (entangled photon pairs) to create new light frequencies which are typically difficult to create otherwise. We then use the principle of quantum correlated light to achieve spectroscopy and imaging of samples.

What methods or research skills will you learn?

- Confocal microscopy, optical system alignment, interferometry
- Brillouin microscopy, FTIR and quantum microscopy
- Data processing including line shape fitting, statistical analysis, clustering and other methods, matlab programming

Our team:

- Dr Hadi Mahmodi (Technical Officer)
- Dr Isa Ahmadalidokht, Dr Aritra Paul (postdoctoral fellows)
- Mahya Mohammadi, Madeline Hennessey, Ashutosh Khaswal (PhD students)

I collaborate with:

- Matthew Arnold (MaPS), Chris Poulton (MaPS), Alex Solntsev (MaPS), Carmine Gentile (FEIT), Peter Su (FEIT).
- Garvan Institute of Medical Research
- Woolcock Institute of Medical Research
- University of Sydney, Macquarie University, University of Queensland, RMIT University, University of Wollongong, University of Adelaide

Dr Mehran Kianinia

UTS Vice Chancellor Fellow
Physics
Mehran.kiainia@uts.edu.au

Mehran completed PhD at University of Technology Sydney investigating optically active point defects in solid state materials such as diamond and hexagonal boron nitride. His research is focused on study of quantum emitters for application in quantum technology. He is currently focusing on quantum optics with two dimensional materials. Mehran supervises a team of PhD and honours students working on spectroscopy of quantum emitters at cryogenic temperature (4K) and confocal microscopy of quantum sensors for magnetic sensing at atomic scale.

Keywords: quantum optic, single photon emitter, optically detected magnetic resonant, spin defect, quantum sensing.

Honours programs: Bachelor of Science (Honours) in Physics

I supervise Honours projects on:

- **Cryogenic spectroscopy of quantum emitters**
  The project involves study of single photon sources and perform one and two photon interference measurement.

- **Quantum sensing at atomic scale**
  The project involves optical control of single electron bound to a point defect and use it to sense magnetic field from nucleus of nearby atoms.

- **Two dimensional devices**
  The project involves fabrication of electro optical devices using atomically thin (2D) materials.

What methods or research skills will you learn?

- Understanding the process of making quantum emitters.
- Spectroscopy of quantum emitters using confocal microscopes.
- Cryogenic measurement of quantum emitter
- Performing quantum experiments such as quantum interference
- Photolithography and electron beam lithography and clean room.
- Scanning electron microscopy and atomic force microscopy
- Two-dimensional materials transfer and device fabrication.

Our team:

- Simon White (Post doc)
- Jake Horder (PhD)
- Ivan Zhigulin (PhD)
- Ben Whitefield (Honours)

I co-supervise with:

- Prof Igor Aharonovich
- Prof Milos Toth

A/Prof Nathan Langford

Associate Professor,
Circuit Quantum Science group (CirQuS)
nathan.langford@uts.edu.au

After completing a PhD in photonic quantum information processing at the University of Queensland, Nathan worked as a postdoctoral research fellow in top quantum science groups across Europe, including at the University of Vienna, University of Oxford, and Technical University of Delft, before joining UTS as a lecturer and ARC Future Fellow. Nathan's research in superconducting quantum circuits focusses on developing and testing improved quantum algorithms and experimental hardware for quantum computing applications like quantum simulations and control. Nathan runs a dynamic, friendly research group (CirQuS) that works in the exciting new Millikelvin Quantum Science laboratory covering areas from nanofabrication, cryogenics, microwave electronics to precision measurement, quantum theory and advanced quantum modelling.

Keywords: quantum computing, quantum simulation, superconducting microwave quantum circuits, quantum tomography, cryogenic quantum devices

Honours programs: Bachelor of Science (Honours), Master of Science (Research), Bachelor of Mathematical Sciences (Honours), Bachelor of Engineering (Honours)

We supervise Honours projects on:

- Understanding the performance limits of real-world digital quantum simulators
- Designing and fabricating microwave quantum electronic devices and interfaces
- Developing advanced control techniques for superconducting quantum systems
- Design and fabrication of millikelvin quantum-limited amplifiers
- Superconducting thin-film fabrication and characterisation
- Superconducting qubit design and characterization
- Quantum system tomography
- Simulation and modelling of quantum experiments and devices

What methods or research skills could you learn?

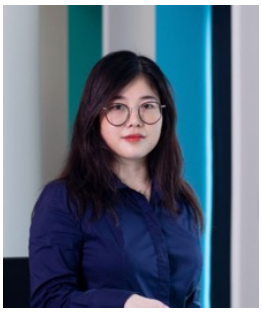
- Experimental techniques: nanofabrication, cryogenics, microwave measurements and analysis, experiment computer control, advanced data acquisition and analysis, hardware design and assembly, electronics, experiment engineering
- Theory techniques: electromagnetic simulations, experimental quantum modelling, software development, theory of quantum computing, simulations, control and tomography, also novel phenomena like quantum chaos and phase transitions

Our CirQuS team:

- PhD students: A Manatuly, G Gemisis, A Di Lonardo, T Srivipat

We collaborate and/or co-supervise with:

- Harley Scammell: on theory and quantum dynamics of quantum phase transitions
- Chris Poulton: on electromagnetic simulations and modelling of microwave circuits
- James Brown: on statistical methods in quantum computing & system tomography
- Other fellow members of the UTS Centre for Quantum Software and Information
- Quantum experiment and theory colleagues across the Sydney Quantum Academy



Dr Jiayan Liao

Position: NHMRC EL1 Fellow | Chancellor's Research Fellow
Discipline: Luminescence Biomaterials
Website: https://profiles.uts.edu.au/Jiayan.Liao;
https://scholar.google.com.au/citations?user=L1Josa4AAAAJ&hl=en
Email: Jiayan.Liao@uts.edu.au

Dr Jiayan Liao completed her PhD at UTS. She is currently a NHMRC EL1 Fellow and Chancellor's Research Fellow at Faculty of Science. Her experience covers nanomaterials, polymer-based bio-/nano- interface engineering, analytical chemistry, and instrumentation development. She has published over 80 peer-reviewed papers, including Nature Photonics, Nature Nanotechnology, Advanced Materials, ACS Energy Letters, Nano Letters, Laser & Photonics Reviews and JPCL, et al. Integrating cutting-edge nanotechnology with point-of-care testing strategy, Dr Liao aims to develops a non-invasive, highly sensitive diagnostic tool capable of detecting multiple cancer markers, such as nucleic acid and protein biomarkers, thereby transformative approach to bioanalytical analysis.

Keywords: Functional nanomaterials, Surface Functionalization, Microscopic imaging, Nanotechnology, Cancer Biomarkers Detection, Lateral Flow Immunoassay.

Honours programs: Bachelor of Science (Honours), Master of Research (Chemistry)

I supervise Honours projects on:

Advanced Early Cancer Detection Method: A Novel, One-Stop, nanotechnology-based Point-of-Care System

The diagnosis of cancer remains one of the most significant challenges in modern medicine. Despite the development of various diagnostic approaches over the years, the search for more effective and targeted treatments continues. In recent years, nanotechnology has emerged as a promising avenue for early cancer diagnosis using nanoparticles with unique properties. Among these, upconversion nanoparticles (UCNPs) have shown great potential due to their ability to convert low-energy photons into high-energy emissions, making them ideal candidates for sensitive early diagnosis. In this research project, we aim to develop a novel and highly sensitive tool for early cancer detection. The proposed project will involve the synthesis, modification, and thorough characterization of targeting UCNPs, followed by the detection of biomarkers using established laboratory procedures. The utilization of UCNPs without photobleaching represents a significant advancement over conventional probes, which often suffer from photobleaching, background fluorescence, and low chemical stability. This research holds the promise of revolutionizing cancer diagnosis and treatment through the utilization of innovative and precise nanotechnology-based approaches.

What methods or research skills will you learn?

- Synthesizing upconverted fluorescent nanoparticles as nanoprobes.
- Structure/optical characterization of nanoprobes: TEM/XRD/ imaging system.
- Surface functionalization of probes: FIRT, DLS, Zeta potential, NTA.
- Bioimaging and detection: Test strip preparation device, nanoprobes-based lateral flow assay, confocal/wide-field fluorescence microscopy system.

We collaborate with:

- Prof. Dayong Jin, A/Prof Yuen Yee Cheng (MaPS)
- Prof. Deborah Marsh (School of Life Sciences), Dr Ying Zhu (FEIT)
- Dr Hien Duong (Faculty of Medicine and Health, USYD)

Dr Gungun Lin

Senior lecturer | Faculty of Science
Institute for Biomedical Materials & Devices
gungun.lin@uts.edu.au

Dr. Lin is a senior lecturer and ARC DECRA fellow at the Institute for Biomedical Materials and Devices. He received multi-national and multi-disciplinary training in China, Germany, and Australia. He obtained his PhD degree from Chemnitz University of Technology in Germany.

His research interests encompass fundamental and applied aspects of functional micro- and nanomaterials, as well as Micro-electro-mechanical System (MEMS) technologies for biomedical fields. Specifically, his focus lies in investigating structure-property relationships (e.g., magneto-electrical and mechanics) of responsive micro- and nanostructures in complex environments, aiming to advance new-generation biosensors, bio-manipulation, and medical micro-robotic technologies. Dr. Lin's expertise spans materials and device physics and chemistry, micro- and nanofabrication, as well as micro & nanotechnology and analytical chemistry.

Keywords: Bio-MEMS, Micro-robots, Magnetic Tweezers, Lab on a Chip, Biosensing

Honours programs: Bachelor of Science (Honours) in Physics

I supervise Honours projects on:

- Developing high-dimensional magnetic tweezers for smart manipulation of biomolecules and cells
- Studying the dynamics of micro-particles in microfluidics for enhanced bio-purification and sorting
- Design, fabrication and characterization of smart and soft magnetic micro-robots
- Developing hydrogel-based biosensors for detection of emerging biomarkers (ctDNA, mRNAs and EVs)

What methods or research skills will you learn?

- Micro- and nanofabrication (lithography, thin-film deposition etc.)
- Materials characterization techniques (electron microscopy and spectroscopy etc.)
- Software programming and system automation
- Microscopy, cell culture and analytical (bio-conjugation) chemistry methods
- Data processing and analytics

Our team:

- Zelyu Chen (PhD student), Weihong Liang (PhD student), Ethan Marsland (Honours student)
- Jawairia Khan (Research associate)

I collaborate/co-supervise projects with:

- Prof. Jiajia Zhou (MaPS), Prof. Dayong Jin (MaPS), A/Prof. Yuen Yee Cheng (MaPS)
- Prof. Majid Warkiani (FEIT), Prof. Bingyang Shi (FEIT), Dr Ying Zhu (FEIT)

Prof Charlene Lobo

Professor
Physics
Charlene.lobo@uts.edu.au

I am a Professor of Physics and have a research group working in the field of fabrication and properties of advanced and emerging materials such as phosphorene, graphene, hexagonal boron nitride, and boron hydrogen clusters and nanoparticles. My group explores the applications of these materials in new technologies for optoelectronics, green energy, wearable devices, and quantum communications, among other areas.

Keywords: nanofabrication, electron and ion beam techniques, device engineering, two-dimensional materials, emerging materials.

Honours programs: Bachelor of Science (Honours) in Physics

I supervise Honours projects on:

- Applications of emerging and advanced materials (eg. in optics, photonics, quantum technologies, energy storage).
- Development of new materials for green energy technologies (eg. energy efficient devices, hydrogen storage technologies).
- Design and fabrication of wearable sensors and devices (eg. for biomedical applications).

What methods or research skills could you learn?

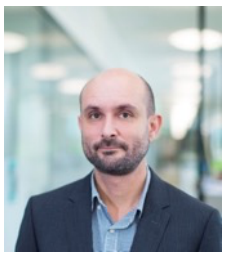
- Material and device fabrication (eg. exfoliation, device engineering, electron and ion beam microscopies).
- Optical spectroscopies (eg. Raman spectrometry, photoluminescence, cathodoluminescence, ATR-FTIR, UV-VIS, X-ray photoelectron spectroscopy).
- Electrical characterization (eg. photocurrent, Hall effect, I-V characterization, electrical excitation and analysis methods).

My team:

- Ivan Zhigulin, Parya Reyhanian, Dominic Scognamiglio (PhD students)
- Yanan Huang (Research assistant)

I co-supervise projects with:

- UNSW Dept. of Materials Science and Engineering (Nagajaran Valanoor and others)
- RMIT university (Sumeet Walia and others)
- ANU Dept. of Electronic Materials Engineering (Lan Fu and others)
- UTS FEIT and Business School (Zhenguo Huang, Simon Darcy, Helen Xu and others)
- Other MAPS and SOLS staff (including Igor Aharonovich, Milos Toth, Chris Poulton)



Prof Chris Poulton

Professor
Physical Sciences
Chris.Poulton@uts.edu.au

Chris is either a theoretical physicist or an applied mathematician, depending on your point of view. His main research area is the interaction of light and sound on the nanoscale. He does a lot of numerical research, building mathematical models that describe waves in complex materials. He works with experimental physicists at UTS and at the University of Sydney, as well as in Germany.

Keywords: Photonics, Nonlinear optics, Electromagnetic waves, Elastic waves

Honours programs: Bachelor of Mathematical Sciences (Honours), Bachelor of Science (Honours)

I supervise Honours projects on:

- **Waves at the extremes of nonlinear optics**
  Metals are interesting materials in wave physics – not only are they highly reflective, but they also support waves that travel along edges. Interestingly, there is another family of waves that travel along edges: these are Rayleigh waves, which are mechanical vibrations that often arise in earthquakes. At very high frequencies and on the nanoscale these two types of waves can interact – this project will explore what happens when they do.

- **Ultra-long-wavelength waveguides**
  Everybody knows that optical fibres can be used to guide light. However weird things happen when the frequency of the light becomes really small. This project will examine and get to the bottom of this weirdness, looking at waveguides for both light and sound.

What methods or research skills will you learn?

- Advanced optical physics
- Advanced Electromagnetic theory
- Elasticity theory
- Numerical modelling of complex systems
- Programming (Python or Matlab)

Collaboration within the School:

I usually work and supervise students with:

- A/Prof. Matthew Arnold, Prof. Irina Kabakova, Prof. Alex Solntsev, A/Prof. Mikhail Lapine, A/Prof. Nathan Langford

External Collaborators:

- Prof. Michael Steel (MQ), Dr Mikolaj Schmidt (MQ)
- Dr Moritz Merklein (U.Syd)
- Prof. Markus Schmidt (Jena, Germany)
- Prof. Birgit Stiller (Max Planck, Germany)

Dr Harley Scammell

Senior Lecturer
Physics
harley.scammell@uts.edu.au

Harley is a theoretical condensed matter physicist who joined UTS in 2023 as a Senior Lecturer. He completed his PhD in Theoretical Physics at the University of New South Wales in 2017, focusing on Quantum Phase Transitions. He went to Harvard University (2018-2020) as a Fulbright Postdoctoral Fellow to research quantum and topological phases of matter. In 2020, Harley joined the ARC Centre of Excellence in Future Low-Energy Electronic Technology as a postdoctoral researcher to explore the theoretical underpinnings of future quantum technologies.

Harley's research focuses on two-dimensional materials, topological condensed matter, quantum phase transitions, unconventional superconductivity and qubit architecture. He uses a combination of analytical formalisms such as diagrammatic quantum field theory, statistical mechanics, and lattice gauge field theories, along with argumentation from group representation theory. In addition, he utilises numerical techniques, including Monte Carlo simulations, exact diagonalisation, and machine learning, to supplement his research. His work aims to uncover fundamental aspects of these systems and phenomena, as well as explore novel functionalities that could be harnessed for future quantum technologies.

Keywords: quantum phase transitions, topological matter, strongly-correlated electrons, two-dimensional materials, quantum technology.

Honours programs: Bachelor of Science (Honours), Master of Science (Research), Bachelor of Mathematical Sciences (Honours).

Eligibility: You must have completed a research internship with Harley prior to Honours or have otherwise demonstrated strong technical skills and motivation.

I supervise Honours projects on:

- Quantum phase transitions and topological order in two-dimensional systems
- Quantum mechanics of unsupervised machine learning

What methods or research skills will you learn?

- Theory of quantum critical phenomena
- Theory of topological states of matter
- Numerical modelling of quantum systems

I collaborate with:

- University of New South Wales
- Harvard University
- Columbia University
- University of Stuttgart

Dr Danica Solina

Lecturer
Mathematics/Physics
Danica.Solina@uts.edu.au

Danica completed a PhD in 2002 at the University of Technology Sydney on the X-ray reflectivity of multilayers for use as monochromators before taking a post-doc in Germany at the GKSS Research Centre, now called Helmholtz-Zentrum Hereon. At GKSS, she expanded her skills to include neutron scattering of magnetic systems that include antiferromagnetic (AFM) materials. AFMs are used in the creation of spin valves which are used in magnetic data storage systems.

Danica's present work extends her research on antiferromagnets into the realm of AFM Spintronics with gold-manganese her system of choice. She also has a number of side projects for fun such as trying to grow tetrataenite through deposition, and the ion beam adaption of magnetic systems for use in sensors.

Keywords: SAXS, XRR, Magnetic Materials, Spintronics, Thin Films

Honours programs: Bachelor of Science (Honours) in Physics

I supervise Honours projects on:

- Comparative study of RefNX, GenX3 and SimulReflec for the simulation of X-ray Reflectivity data at UTS.
- X-ray Reflectivity (XRR) study on single and bilayer film systems.
- XRR study on diffusion of layer film systems.
- Development of Small Angle X-ray Scattering (SAXS) for nano-scale films at UTS
- Study of nanoparticles for the use in boron neutron capture therapy.

What methods or research skills might you learn?

- X-ray Scattering Techniques
- Modelling of reflectivity data
- Deposition of thin films
- Scanning Electron Microscopy/EDS
- Neutron Scattering

People I work with:

Dr. Sujeewa De Silv
Prof. Michael Cortie
Dr. James Bishop
Dr. Fehmida Kanodarwala
Assoc. Prof Matthew Arnold
Dr. David Cortie (ANSTO)
Dr. Anton Le Brun (ANSTO)
Dr. Kirrily Rule (ANSTO)

Prof Alexander Solntsev

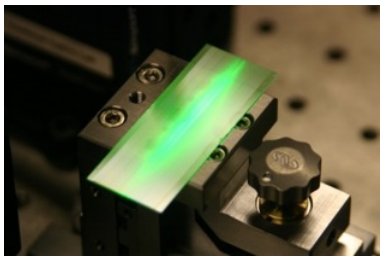
Associate Professor,
Associate Head of School (Research)
Physics
Alexander.Solntsev@uts.edu.au

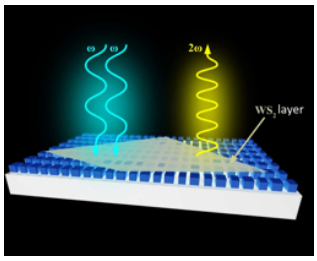
Alex is an optical physicist working at the frontier of quantum and nonlinear photonics. He leads a thriving research group at UTS that explores how light behaves at the nanoscale, how photons can be manipulated and entangled, and how these phenomena can be applied to real-world technologies - from ultra-secure communication to quantum biomedical sensing. As Associate Head of School (Research), he has helped grow one of the most vibrant physics research environments in Australia, and he's passionate about mentoring the next generation of scientists and innovators.

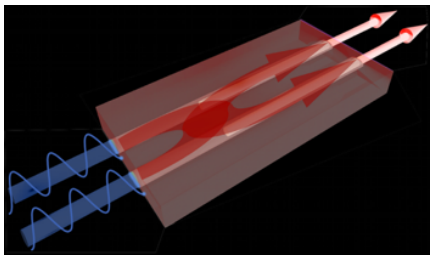
Join a research journey that explores the strange and powerful world of light and quantum interactions. You'll be part of a dynamic team working on problems that sit at the heart of future communication, sensing, and computing technologies.

Keywords: lasers · optics · quantum · nonlinear · nano · telecom · biomedical sensing · AI

Honours programs: Bachelor of Science (Honours), Master of Science (Research)







I supervise Honours projects on:

- How can we turn a red beam of light into blue using advanced photonic structures
- How do we entangle photons for quantum communication and imaging
- What will make future telecom networks faster, safer, and more energy-efficient
- Can we use light to uncover new information about biological systems

What methods or research skills might you learn?

- Using lasers, spectrometers, microscopes, and quantum light sources
- Programming for data analysis and modelling (Python, MATLAB, LabView)
- Experimental design, optical alignment, and precision measurements
- Applying AI tools for modelling and data interpretation
- Scientific communication and research project management

I collaborate with:

- UTS Physics: Irina Kabakova – biomedical photonics and imaging, Chris Poulton – nanophotonics and waveguide theory, Matt Arnold – optical materials
- Defence Innovation Network: optical sensing
- Leading Australian institutions: CSIRO, ANU, UNSW, University of Queensland
- Industry and clinical partners in biomedical sensing and next-gen diagnostics

A/Prof Cuong Ton-That

Associate Professor
Physics
Email: Cuong.Ton-That@uts.edu.au

My research focuses on the development of wide bandgap semiconductors, oxide materials, nanostructures, electrodes and junction devices for emerging applications in optoelectronics, power electronics and solar-driven water splitting. My group includes 4–6 PhD students and a research associate working on materials synthesis, defect engineering, and advanced optical/electrical characterisation techniques. We maintain strong collaborative links with semiconductor fabrication companies Nanovation and 3D-Oxides, ensuring relevance to both academic and industrial research.

Keywords: semiconductors, optoelectronics, power electronics, water splitting, hydrogen production

Honours programs: Bachelor of Science (Honours) in Physics and Chemistry

I supervise Honours projects on:

- **Gallium oxide for power electronics**
  Development and characterisation of oxide semiconductor thin films and nanostructures with a focus on doping strategies for device applications. Supported by an ARC Discovery Project.
- **2D oxide nanosheets**
  Synthesis of atomically thin oxide nanosheets via liquid metal exfoliation and investigation of their nanoscale optoelectronic properties.
- **Photocatalytic water splitting**
  Development of integrated oxide thin films and atomic catalysts for efficient, solar-powered hydrogen production via unassisted photocatalytic water splitting

What methods or research skills will you learn?

- Thin film fabrication, nanostructure synthesis, plasma processing, ion implantation, electron microscopy, X-ray spectroscopy, cathodoluminescence, photoluminescence, Raman spectroscopy, chemical and surface analysis

Our team:

- My group comprises five PhD students engaged in research projects spanning fundamental physics and applied technology development.

We collaborate with:

- Dr Amar Salih
- A/Prof Matthew Arnold
- Prof Matthew Phillips
- Dr Dinushi Munasingha
- Prof Long Nghiem (FEIT, UTS)
- Prof Zhenguo Huang (FEIT, UTS)
- Prof Kourosh Kalantar-Zadeh (USyd)
- Dr David Rogers (Nanovation)
- Dr Giacomo Benvenuti (3D Oxides)

Prof Milos Toth

Professor
Physics
Milos.Toth@uts.edu.au

Milos works in the fields of nanofabrication and quantum photonics. He has worked in both industry and academia, and his research includes "blue-sky" physics research as well as technology development done in collaboration with industry partners. He supervises a team of postdocs and undergraduate/honours/PhD students who collaborate with a broad range of researchers based in Australia and abroad - see, for example the Centre of Excellence for Transformative Meta-Optical Systems.

Honours programs: Bachelor of Science (Honours) in Physics or Chemistry

I supervise Honours projects on:

- Nanofabrication techniques.
- Nano-chemistry at surfaces driven by electron/ion beams.
- 2D materials.
- Optoelectronic devices.
- Single photon emitters.

What methods or research skills will you learn?

- Material growth (e.g., chemical vapour deposition).
- Nanofabrication techniques such as electron/optical lithography, reactive ion etching, 3D printing using electron/ion beams.
- Fabrication and manipulation of quantum emitters.
- Fabrication of optoelectronic devices based on 2D materials.
- Fabrication of optical structures such as photonic crystal cavities.
- Microscopy and spectroscopic techniques such as electron microscopy, atomic force microscopy, confocal scanning laser fluorescence microscopy, Raman spectroscopy, photoluminescence and cathodoluminescence spectroscopy.

Our team:

The immediate team is a medium-size research group of ~4 postdocs, ~10 PhD students and 2-6 undergraduate/honours students. You will be embedded in this team and will have the opportunity to work with a broad range of external collaborators in Australia and abroad. Examples of our recent work can be found here (author lists on these papers illustrate the diversity of our collaborators).

I work/co-supervise with:

- Researchers at UTS and domestic universities, including ANU, USYD, RMIT
- Researchers at overseas universities, including NTU (Singapore), MIT (USA), TUB (Germany)
- Researchers at Thermo Fisher Scientific

To study the:

- Fabrication of materials and devices for integrated quantum photonics.
- Use of ion beams to modify materials.
- Use of an electron beam for "subtractive 3D printing" done using electron-driven chemical reactions that etch materials such as diamond and 2D boron nitride, or to study photonic materials and devices.

Dr Anastasiia Zalogina

Chancellor's Research Fellow
Physics
anastasiia.zalogina@uts.edu.au

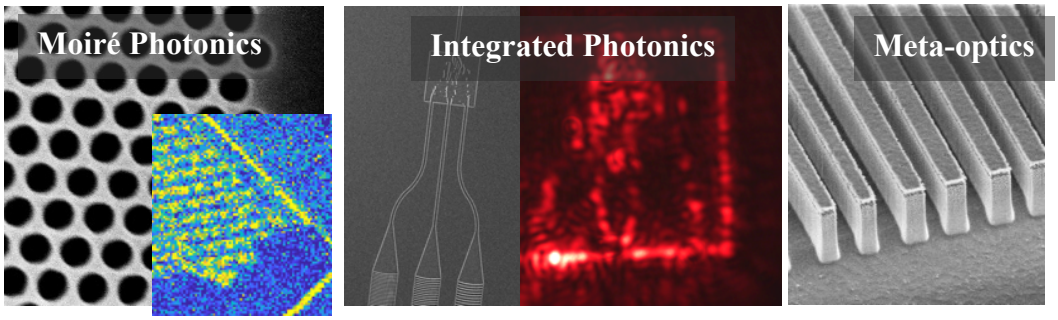
Anastasiia works across disciplines at the intersection of quantum photonics, nanofabrication, and material science. She currently works on quantum metasurfaces and on-chip integration of quantum materials. She is part of a leading group in the field of van der Waals materials with quantum emitters, where device development spans from nanofabrication to full optical characterization at both room and cryogenic temperatures.

Keywords: photonics, nanofabrication, quantum emitters, metasurfaces, 2D materials

Honours programs: Bachelor of Science (Honours) in Physics

I supervise Honours projects on:

- *Twist and Shine: Exploring Light in 2D Material*s (Flatband and Moiré Photonics)
- *Putting Light on Chip* (Integrated Photonics)
- *Flat Optics for Future Technologies* (Meta-optics)
- *Enhancing Quantum Emitters with Cavities* (Complex Nanofabrication around Cavities)



What methods or research skills will you learn?

- Nanofabrication of photonic devices.
- Cleanroom techniques including electron beam lithography, and dry etching.
- Scanning electron microscopy and atomic force microscopy for nanoscale imaging.
- Optical characterisation of the fabricated devices using laser- based setups.
- Transfer techniques for stacking 2D materials and forming heterostructures.
- Confocal and cryogenic measurements for studying quantum emitters and 2D materials.

Our team:

- 5 Post docs, and 13 PhD students

I co-supervise with:

- Prof Igor Aharonovich
- Prof Milos Toth
- Dr Mehran Kianinia

Prof Jiajia Zhou

Professor
Institute for Biomedical Materials & Devices
jiajia.zhou@uts.edu.au

Jiajia's research interests focus on lanthanide nanophotonics, fluorescence nanothermometry, fluorescence microscopy in life-sciences, luminescent sensors based on inorganic systems, rare earth spectroscopy, up/down conversion, quantum cutting and point-of-care diagnostic technologies, with a recent expansion into rapid COVID-19 antigen tests. Dr Zhou has published more than 100 peer-reviewed papers and her work has attracted more than 5,000 citations. She is the winner of the 2019 Sturge Prize for her outstanding contribution to the spectroscopy of rare earth based up-conversion nanoparticles; she was a finalist in the Australian Museum Eureka Prizes for Outstanding Early Career Researcher in 2019, and a finalist for the 2020 Eureka Prize Emerging Leader in Science; she was shortlisted for the 2022 Australian Academy of Science Pawsey Medal. She is the winner of the 2022 MAPS Award for Research Excellence in the MCR category and the 2023 David Syme Research Prize.

Keywords: single nanoparticle spectroscopy, nanothermometry, point-of-care testing, rapid COVID-19 antigen test, milk protein test

Honours programs: Bachelor of Science (Hons) in Physics and Chemistry

I supervise Honours projects on:

- Luminescent nanoprobes: synthesis, surface modification, and optical imaging
- Nanothermometry: unique thermometers and super-resolution sensing technology
- Protein test in food, such as milk, meat
- COVID antigen test

What methods or research skills will you learn?

- Lateral flow assay
- Microscopic optical imaging
- Cell imaging
- Luminescence spectroscopy
- Immunofluorescence and ELISA
- DLS/Zeta potential/FTIR

Our team:

- PhD Students: Mr Yangjian Cai, Miss Ziwei Wu, Miss Yitong Zhao, Mr Maoxin Zhang

I work/co-supervise with:

- Prof Yuri Kivshar (ANU), Dr David Bishop (Science), Dr Peter Su (FEIT), Dr Gungun Lin (Science)
- Milk industry
- COVID team including Distinguished Prof Dayong Jin (Science, UTS), Prof Majid Warkiani (FEIT, UTS), Dr Olga Shimoni (Alcolizer Technology)

Mathematics and Statistics Supervisors

Mathematical Science

This section relates to the following award:

Bachelor of Mathematical Science (Honours)

The Bachelor of Mathematical Science (Honours) is an introduction into research training and advanced study in the areas of mathematics, statistics, data science, finance, and industrial optimisation. There is focus on independent learning fostering professional skills such as effective time management through the hands-on experience of managing a creative project. This course focuses on the application of cutting-edge mathematical techniques to real-world problems through the completion of student led learning. The course challenges students to exercise more initiative and independence, and to develop greater depth of knowledge and advanced analytical skills, all attributes that are highly sought after by employers.

For further inquiries please email to the program director:

Dr Hanyu Gu (Hanyu.Gu@uts.edu.au)

The course comprises 48 credit points of study, consisting of advanced coursework (24 credit points) together with a substantial research project (24 credit points). The project involves a major piece of independent study, providing students with the opportunity to apply the skills developed in their coursework. Students will choose three subjects (may include an AMSI course, taken as Mathematics seminar subject) from the specialised areas of modern algebra, mathematical analysis, advanced statistical methods, optimisation, stochastic process, financial econometrics and machine learning. The results of the project are presented in an oral seminar and in a written thesis, both of which are formally assessed. Students may enrol in the course for Autumn or Spring intake. Other professional development activities and seminars are scheduled throughout the year and will be advertised via the Canvas subject sites.

Dr Ara Asatryan

Lecturer
Mathematics
Ara.Asatryan@uts.edu.au

Ara completed his PhD in 1988 at Yerevan State University, Armenia. The subject of his thesis was the construction of short wavelength asymptotic solutions of the wave equation and characterization of wave fields at foci and caustics. After postdoctoral positions at Macquarie University (1997) and the University of Sydney (2000), Ara took the position of research fellow at the University of Technology Sydney in (2001). He is currently a Lecturer at the department of Mathematical and Physical Sciences at UTS. The main area of his research is mathematical modelling of complex artificial materials like photonic crystals and metamaterials. Ara has more than 100 publications in world leading journals and his current citation h-index is 30 on Google Scholar with total citations just short of 2900.

Keywords: Photonic crystals, Topological Photonics, Metamaterials, Anderson Localization, Quantum Optics

Honours programs: Bachelor of Mathematical Sciences

I have previously supervised Honours projects on:

- Gaussian beam scattering on photonic crystals
- Characterization of two dimensional photonic crystals infiltrated with liquid crystals

What methods or research skills will you learn?

- How to use mathematics to describe wave scattering in modern complex and exciting structures
- Write simple FORTRAN codes to find numerical solutions for derived equations

Activities within the Discipline:

- Currently I am teaching several Mathematics subjects at different levels at UTS.

I have collaborated with world leading researchers in the field such as:

- Prof S. Fan from the Stanford University
- Prof H. Cao from the Yale University
- Prof V. Freilikher from the Ben Gurion University
- Locally, with Prof C. Poulton from the Maths department

Prof James Brown

Head of Discipline | Professor of Official Statistics
Mathematical Sciences
james.brown@uts.edu.au

James completed his PhD in 2001 looking at estimation and adjustment of census coverage for the 2001 Censuses of the UK, and he has over 25 years experience collaborating with government statistical agencies. He also has general interests in applied statistics with applications in health, education, and law; and works on approaches to population size estimation and use of administrative data in official statistics. He moved to Australia and UTS in 2013 and maintains connections to ABS.

Keywords: applied statistics, surveys, population census, health, education

Honours programs: Bachelor of Mathematical Sciences (Honours), Master of Philosophy (Mathematical & Statistical Data Science)

I supervise Honours projects on:

- Statistical modelling applied to health / education / law applications
  My current work is focusing on legal needs of people with HIV / Hepatitis, but happy to work with students on data that interests them.
- Use of (non-random) surveys in official statistics
  Traditional survey inference relies on the design-based approach of random selection but how can we do acceptable inference with non-random surveys?

What methods or research skills will you learn?

- The application (and extension) of statistical modelling skills you have developed in your studies so far.
- Statistical computing skills

Activities within the Discipline:

- I currently supervise (jointly) two PhD students; one working on population size estimation and one looking at small area estimation using surveys. Within the Discipline, I typically work with Dr Joanna Wang and A/Prof Stephen Woodcock.

I collaborate with:

- Dr David Carter in Law
- Australian Bureau of Statistics
  - a direct project with ABS is possible for Australian Citizens
  - working on things of 'interest' to ABS is possible for any student

Prof Sally Cripps

Professor of Mathematics and Statistics
Director of Technology at Human Technology Institute
sally.cripps@uts.edu.au

I am the Director of Technology at the Human-Technology Institute (HTI) at UTS. I am also a professor of mathematics and statistics with expertise in Bayesian machine learning and statistics. At HTI we have a large research grant to study the educational pathways of Australian school children to learn what interventions impact outcomes. We do this using Directed Acyclical Graphs (DAGs) and the impact of interventions on the structure of the graph. We have 4 research scientists as well as several scholarships for HDR students from the Next Gen AI program administered by CSIRO.

Keywords: Bayesian machine learning, graphical models, causal inference

Honours programs: Bachelor of Mathematical Sciences (Honours)

I supervise Honours projects on:

- Bayesian Graphical Models; jointly learning the structure and impact of interventions with application to educational outcomes.
- Mixture models for heterogenous Directed Acyclical Graphs with application to mental health outcomes

What methods or research skills will you learn?

- Causal Inference and uncertainty quantification, probability theory, Markov chain Monte Carlo

Our team (optional):

- Roman Marchant

[I/we] collaborate with (optional):

- The Brain and Mind Centre at the University of Sydney; The Centre for Transforming Early Education and Child Health at Western Sydney University; The Paul Ramsay Foundation

Prof Anthony Dooley

Professor
Mathematics
Anthony.dooley@uts.edu.au

My research area is in mathematical analysis, notably harmonic analysis on Lie groups, and ergodic theory of non-singular group actions. I did my PhD at ANU, have held positions at UNSW, University of Bath and have been at UTS since 2016. I have supervised 23 PhD theses and 35 Honours/Masters projects over a wide range of mathematical topics ranging from mathematical foundations of quantum mechanics, through contractions of Lie groups, calculus of variations, algebraic geometry, to applications in finance. I'm interested in applications of analysis in data science.

My UTS profile is available here.

Keywords: Mathematical analysis, harmonic analysis, differential equations, Lie groups, ergodic theory

Honours programs: Bachelor of Mathematical Sciences (Honours)

I supervise Honours projects on:

- Fourier analysis and its extensions to harmonic analysis on Lie groups, including representation theory, and geometrical methods.
- Ergodic theory and Dynamical Systems is the study of how systems transform under a transformation or group of transformations. Random dynamical systems introduce randomness or noise.
- Current interests include mathematical models in biology including enzyme kinetics.

What methods or research skills will you learn?

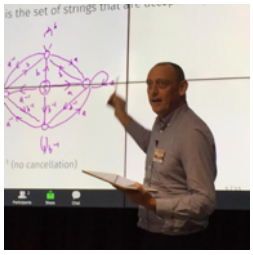
- Expertise in a range of mathematical techniques spanning analysis, geometry with links to probability and stochastic calculus. Advanced techniques for solving systems of differential equations. Some of these are relevant to mathematical finance, and biological modelling.

Our team:

- PhD students: Tim Guo, Jie Jin, Faisal Arlwile, Greg Cave, Ghali Hussein

I collaborate with:

- Join the Groups Analysis Geometry seminar, which meets every fortnight to discuss student and staff projects.



Prof Murray Elder

Professor
Mathematics
Murray.Elder@uts.edu.au

My research lies at the intersection of pure mathematics (algebra, geometric group theory, enumerative combinatorics) and theoretical computer science (computational complexity, algorithms, formal language theory, post-quantum cryptography). Please see my webpage for papers and more information.

Potential topics:

- proving (elementary) results in Lean
- counting homomorphisms to finite groups; surjective constraint satisfaction problems
- post-quantum cryptographic schemes

Previous students have worked on:

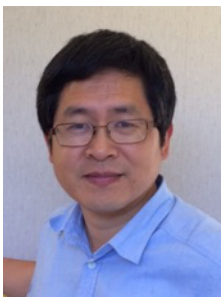
- pattern-avoiding permutations
- geodetic graphs
- virtually abelian groups
- NP-completeness
- EDT0L and ET0L languages
- growth functions for groups
- automata groups
- random walks on groups and amenability

Keywords: geometric group theory, complexity theory, automata and formal language theory, enumerative combinatorics, pattern-avoiding permutations, complexity theory

Programs: AMSI Vacation Research Scholarship program; C09129 Bachelor of Mathematical Sciences (Honours); C09119 Bachelor of Computing Science (Honours) C03026 Master of Science (Research) in Mathematical Sciences; C02030 Doctor of Philosophy

Useful background/skills:

- Programming skills (Python, C++, Rust, Lean, GAP)
- LaTeX
- Interest in pure mathematics and/or theoretical computer science
- UTS Subjects: 41080 Theory of Computing Science; 35003 Modern Algebra; 37233 Linear Algebra; 37181 Discrete Mathematics; 68105 Algebra



Dr Hanyu Gu

Senior Lecturer
Mathematical Science
hanyu.gu@uts.edu.au
https://profiles.uts.edu.au/Hanyu.Gu

My research interests are focused on solving large-scale combinatorial optimisation problems using decomposition methods, stochastic programming, integer programming, hybrid meta-heuristics and machine learning. Since joining UTS in 2013, I have worked with industries on education timetabling, train maintenance planning, vehicle routing, and project scheduling for underground mining. I have a PhD in Power Engineering from Shanghai Jiao Tong University and have worked in several companies including NICTA.

Keywords: combinatorial optimisation, integer programming, stochastic programming, machine learning, planning and scheduling

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Mathematical Science)

I supervise Honours projects on:

- Solving large industrial optimisation problems arising in mining, transportation, manufacturing, and supply chain
- Decision under uncertainty including stochastic programming and reinforcement learning
- Machine learning for optimisation including Bayesian optimisation and neural network.
- Optimisation for machine learning
- Theory and algorithms on combinatorial optimisation and scheduling

What methods or research skills could you learn?

- Advanced theory and algorithms for various optimisation problems
- Techniques for solving real-world problems
- Computer programming skills for solving complex optimisation problems

I co-supervise projects with:

- Julia Memar

A/Prof Mikhail Lapine

Associate Professor
Physical Sciences
Mathematical Sciences
Mikhail.Lapine@uts.edu.au

Mikhail is exploring a wide range of research directions related to artificial materials, metamaterials and metasurfaces, which are assembled of specifically designed "meta-atoms". Such materials provide a route to unusual properties such as negative refractive index, extreme diamagnetism, dispersion compensation, etc., and operate predominantly in the areas of electromagnetism and acoustics.

Keywords: Metamaterials, Metasurfaces, Nonlinear optics, Effective material parameters, Optoacoustics

Honours programs: Bachelor of Mathematical Sciences (Honours), Bachelor of Science (Honours)

I am offering projects on:

• Effective material parameters of unconventional structures.
Design of metamaterials and metasurfaces has been typically performed along the lines of relatively simple shapes which permit a clear theoretical description (such as conducting rings, for example). However such designs do not necessarily offer optimal characteristics. In this projects, more sophisticated shapes will be explored for resonant metamaterials as well as non-resonant diamagnetics, combining theoretical and numerical approaches for the analysis.

• Mesoscopic material parameters for large finite structures
If at all, material properties are best understood for two extreme situations: when we have a piece of material with so many atoms that it can be treated effectively "infinite" and analysed on average, or when we have a few specific structural elements which can be directly modelled in a precise way. However, there is size / scale gap between the two simple limits, systems with many thousands of meta-atoms. In this project, semi-analytical and numerical methods are being developed for such structures.

What methods or research skills will you learn?
• Electromagnetic theory
• Nonlinear optics
• Numerical modelling of large systems
• Programming in Matlab

Collaboration within the School:
I normally work and co-supervise students with:
Prof Chris Poulton, Prof Alex Solntsev, and A/Prof Matthew Arnold

External Collaborators:
• Prof Yuri Kivshar (Australian National University, Canberra)
• Prof Pavel Belov (ITMO University, Saint Petersburg, Russia)
• Prof Andrey Bogdanov (Harbin University of Technology, Qingdao, China)
• Prof Pavel Ginzburg (Tel-Aviv University, Israel)
• Prof Tim Liedl (Lüdwig-Maximillian-University, München, Germany)

Dr Julia Memar

Lecturer
Mathematical Sciences
Julia.Memar@uts.edu.au

Julia is an applied mathematician with interests in approximate and exact algorithms for scheduling problems, flow shop problems with a buffer, Lagrange relaxation methods, complexity theory. Julia's recent project is concerned with applications of stochastic scheduling for underground mining.

Julia has been teaching mathematics at UTS for more than ten years, and she also runs the UTS Mathematics Bridging courses and Mathematics and Science Study center that provides support in introductory mathematical and quantitative areas including statistics and selected first-year science subjects.

Julia holds Master's degree in applied mathematics from Moscow State University and PhD in Operations Research from UTS.

Keywords: operations research, optimization, scheduling, complexity theory, stochastic programming

Honours programs: Bachelor of Science (Honours), Master of Philosophy (Mathematical Science)

I supervise Honours projects on:

- Theory and combinatorial optimization and scheduling algorithms
- Decision under uncertainty including stochastic programming

What methods or research skills will you learn?

- Theory and algorithms for optimization and scheduling problems
- Methods and approaches for solving applications
- Computer programming skills

I co-supervise projects with:

- Dr. Hanyu Gu

Dr Len Patrick Garces

Lecturer, Program Director (PG Quantitative Finance)
Mathematical Sciences
LenPatricDominic.Garces@uts.edu.au

Len's research interests lie within the field of financial and actuarial mathematics, primarily on the applications of probability theory and stochastic analysis to tackle financial and actuarial problems and the development of numerical and statistical methods to solve these problems. His current research is on continuous-time stochastic mortality models and their applications to actuarial valuation, the design and valuation of retirement income products, robust consumption and investment problems, and indifference pricing of mortality-linked securities.

Keywords: financial mathematics, insurance studies, mortality modelling, probability theory, stochastic analysis

Honours programs: Bachelor of Mathematical Sciences (Honours), Master of Philosophy (Mathematical and Statistical Data Science), Master of Data Science in Quantitative Finance

I supervise Honours projects on:

- **Pricing of financial derivatives:** Given some assumptions on the evolution of financial asset prices and other risk factors, we are interested in pricing contracts whose value is dependent on the value of simpler financial assets and in quantifying and managing the risk exposures related to these products

- **Design and valuation of innovative insurance or retirement income products:** In view of increasing mortality and longevity risks, there is also an increasing demand for innovative products to help supplement one's retirement income. This project seeks to design optimal retirement income products and use mathematical methods to price these contracts.

What methods or research skills will you learn?

Depending on the project, you will learn:

- How to apply stochastic analysis and probability concepts (and extend those that you have learned) to formulate and solve problems in finance and insurance studies

- How to design and implement numerical methods to solve ODEs and PDEs in Matlab or Python

- Visual, written, and oral communication of results arising from an applied mathematics research project

I collaborate with:

- Academics from the School of Risk and Actuarial Studies, UNSW Sydney

- Quantitative finance researchers in the School of Mathematical and Physical Sciences, UTS.

Dr Rachel Rogers

Lecturer
Mathematical Sciences
rachel.rogers@uts.edu.au

Rachel completed her PhD in statistics in 2024, focusing on measurement methods in online trial scenarios. Her research focuses on the explainability of statistical methods, particularly in forensics. This includes interactive graphics and perception.

Keywords: forensic statistics, data visualization, explainability

Honours programs: Bachelor of Mathematical Sciences (Honours), Bachelor of Science (Honours)

I supervise Honours projects on:

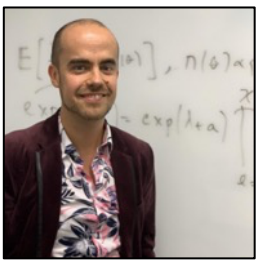
- Forensic Statistics
- Data Visualization and Interactive Graphics
- Explainability of Statistical Methods

What methods or research skills will you learn?

- Statistical computing and communication
- Statistical programming

I collaborate with:

- Forensic Science



Dr Matias Quiroz

Senior Lecturer
Mathematical Sciences
Matias.quiroz@uts.edu.au

My research interests lie in the area of computational statistics, which is closely related to machine learning. You can find out more about my research on www.matiasquiroz.com.

Keywords: Statistical computation, Bayesian inference, complex models

Honours programs: Bachelor of Mathematical Sciences (Honours), Master of Philosophy (Mathematical & Statistical Data Science)

I supervise Honours projects on:

- **Speeding up Markov chain Monte Carlo for large datasets**:
  Markov chain Monte Carlo is arguably the state-of-the-art algorithm for sampling from the posterior distribution in Bayesian statistics. This project will study some of the existing approaches and novel areas of application of the methodology.
- **Control variates for efficient stochastic optimisation**: Stochastic gradient descent and variants thereof have achieved tremendous success in machine learning applications. This project will study the potential of improving these approaches by variance reducing control variates.

What methods or research skills will you learn?

- A deep understanding of state-of-the-art simulation algorithms.
- A solid knowledge of implementing, analyzing, and validating algorithms.

My team:

- I supervise HDR students Thomas Goodwin and Zixuan Wang

Dist Prof Matt Wand

Distinguished Professor of Statistics
Mathematical Sciences
Matt.Wand@uts.edu.au

Keywords: Linear mixed models, nonparametric regression, variational inference, statistical computing.

Honours programs: Bachelor of Mathematical Sciences (Honours), Master of Philosophy (Mathematical & Statistical Data Science)

I supervise Honours projects on:

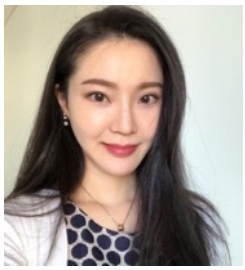
Statistical methodology, theory and computing geared towards large and complicated data sets. The project could involve any of these three facets. A possible area of application is electronic commerce.

What methods or research skills might you learn?

Depending on the project, you may learn about advanced distribution theory, graph theory, Markov chain Monte Carlo algorithms, variational inference algorithms, algorithmic development and implementation in computer languages such as R and C++, R packaging, statistical theory involving e.g. matrix algebra and asymptotic expansion.

I collaborate with:

Several researchers in Statistics and other areas, in various universities around the world.



Dr Joanna Wang

Senior Lecturer, Honours and Masters in Mathematical Science
Program Director
Mathematical Sciences
joanna.wang@uts.edu.au

Joanna completed her PhD at the University of Sydney investigating ways to improve econometric models for financial time series data. Before joining UTS in 2019, I worked as a research statistician at the Bureau of Crime Statistics and Research. My research primarily focuses on applied statistics, with applications in health, epidemiology and crime. My current research program focuses on the analysis of crime data for undertaking rigorous evaluations to evaluate the effectiveness of justice programs and policies.

Keywords: applied statistics, crime data, policy evaluation, health and epidemiology

Honours programs: Bachelor of Mathematical Sciences (Honours), Master of Philosophy (Mathematical & Statistical Data Science)

I supervise Honours projects on:

- Statistical modelling applied to health / crime data
- Use of interrupted time series model for evaluation studies

What methods or research skills will you learn?

- Statistical methods for modelling time series data
- Statistical methods for intervention evaluation
- Statistical computing skills

I collaborate with:

- Professor James Brown
- Bureau of Crime Statistics and Research
- Crime and Security Science research group in Faculty of Arts and Social Sciences

A/Prof Stephen Woodcock

Associate Professor
Mathematical Sciences
stephen.woodcock@uts.edu.au

Stephen joined UTS in 2010 after studying at the University of Glasgow and the University of Oxford in the UK. During this time, he has enjoyed strong collaborations with a diverse group of researchers, mainly in the health and environmental sciences and brings skills in applied probability, applied statistics and theoretical ecology to a diverse range of problems. His research is centred on the applied sciences and always aims for real-world impact. He has a strong record of successful student supervision at Honours, Masters and PhD level, including several past Honours graduates going on to subsequent PhD study after graduation.

Keywords: applied probability, applied statistics, mathematical biology, environmental modelling, sport and exercise science, game theory

Honours programs: Bachelor of Mathematical Sciences (Honours), Master of Philosophy (Mathematical & Statistical Data Science)

I supervise Honours projects on:

- Applications of probability theory and statistics to biological systems. This covers a broad range of topics with applications in the health sciences and environmental sciences. These can be very applied, data-driven projects in close collaboration with field or laboratory researchers or can be more theoretical, for example modelling interspecies competition from a game theory perspective.

What methods or research skills will you learn?

- Interdisciplinary communication and collaboration
- Statistical computing skills

I collaborate with:

- Particularly on projects in the health sciences, I collaborate within the Discipline, primarily with Prof. James Brown.
- Researchers in the Climate Change Cluster (C3), specifically coral biologists interested in the health of the Great Barrier Reef
- Researchers in the School of Life Sciences, including the Seafood Safety Group, looking at improving the sustainability and profitability of Australia's seafood industry, maintaining high levels of safety for the human food supply.
- Sports and exercise scientists within the Human Performance Research Centre (HPRC) in the Faculty of Health, based at UTS's Moore Park campus. This work is focused on both health and performance outcomes at all levels, from elite professional sports to grassroots participation.