

## Optimization of Superconducting Devices by Mean of Quantum Field Theories

### Who can apply?

- Australian Citizens & Permanent Residents
- New Zealand Citizens
- Citizens of countries within the Five Eyes Alliance (FVEY).

### Industry partner and funding body

- [Silanna](#)
- [Defence Trailblazer](#)

### Program of study available

- Doctor of Philosophy (PhD)
- Master of Philosophy (MPhil)

### Total annual stipend amount

- A base scholarship of \$40,000pa plus \$10,000 top-up scholarship

### Start date

- PhD - by June 2024
- Masters - by January 2025

### About the project

Leaning on the zero resistance properties of superconductors materials, superconducting technology has garnered considerable theoretical and practical interest, with applications spanning the areas of quantum computing, ultra-high precision sensing and quantum metrology. The key phenomenon underpinning these sectors is the Josephson effect, which is the ability for quantum tunnelling super-current to flow between two superconducting electrodes. This effect has been exploited to construct Superconducting Quantum Interference Devices (SQUIDs), which can be used as state-of-the-art sensors of electromagnetic (EM) signal. More recently, several new kinds of SQUID devices have demonstrated a great potential for Defence/medical applications such as, for example, the task of capturing and analysing signals used for communications. So far, circuit models have been used to model the performances of these devices, however these are somehow limited. Hence, by using new effective field theories for superconductivity such as the phenomenological Ginzburg-Landau formalism or the non-equilibrium statistical mechanic's approaches, this project will develop and implement a new class of microscopic models. This in turn can be used to validate the behaviour of more complicated devices.

### Eligibility criteria

- Australian citizens and defence industry professionals are encouraged to apply. It is expected that this project will require the candidate to have a security clearance which will likely limit applicants to Australian Citizens or citizens of countries within the Five Eyes Alliance (FVEY).
- Applicants with strong experimental and numerical skills in computational physics, electromagnetic and/or quantum mechanics, particularly in condensed matter and solid state physics will be considered favourably.
- Excellent students who hold a Bachelor of Computational Physics or a double degree with Electronics and Electrical Engineering (EEE) or equivalent would be especially suitable and encouraged to apply.
- Applicants with well-developed written and verbal communication skills will be considered favourably.
- Be willing to provide your personal details by way of a Student Deed Poll.

### Benefits

- Work closely with skilled experts on defence industry led projects
- Translate research into a tangible solution for Defence
- \$50,000pa tax-free\* stipend (pro-rated for eligible part-time students). Conditions apply
- No tuition fees apply
- Acquire a unique set of skills and expertise
- Enhance your employability skills sought after by industry; graduates are highly regarded by employers
- Opportunities for local and international travel
- Work alongside world-leading researchers
- Gain industry experience and grow your networks
- Solve real life problems through industry engaged projects
- Publish your contributions
- Become an expert and make a real impact
- Access paid annual, parental and personal leave

## How to apply

- Complete an [expression of interest](#)
- The primary supervisor will assess your eligibility, and if successful, will prompt your application for admission via the University of Adelaide.

## More about Defence Trailblazer

The Defence Trailblazer for Concept to Sovereign Capability is a once in a generation opportunity to strengthen the collaboration between defence, academia and industry whilst accelerating research and commercialisation.

In partnership with the University of Adelaide (UoA), the University of New South Wales (UNSW), industry partners and supported by the Australian Government, the initiative will skill the workforce of the future, support defence-focussed innovation, and play a leading role in accelerating the delivery of sovereign capabilities for the nation's security and prosperity...at-speed and at-scale.

Learn more: <https://dtb.solutions/>

## Industry Research Program

All students supported under the Defence Trailblazer initiative will participate in the Defence Trailblazer Industry Research Program (IRP).

Candidates will be located on-site at both university and industry offices for at least 60 FTE days (pro-rated for eligible Masters candidates), to enable professional development opportunities in an industry setting.

## Defence Research Capability

Academics participating in the Defence Trailblazer IRP are leaders in their fields.

UNSW adds a critical dimension to preparing defence forces across areas as diverse as Autonomous Systems, Hypersonics, Sensors and Space. The UNSW Defence Capability Portfolio showcases UNSW's excellence in defence research and technology and highlights work across academia, government and industry, as well as with global policy makers, to create a hub of defence-related knowledge. The vision is to translate this knowledge into impact which can transform Australian and global societies.

There's no greater reassurance for our community than knowing we're well prepared to prevent or avert threats to our security. UoA researchers support this in very domain: on land and online; in space, the air and at sea, working extensively with the [Department of Defence](#) and defence-related organisations in a variety of ways—as an advisor, research partner and producer of high-quality, career-ready graduates equipped to make our world a better and more secure place.

[Find out more](#) about defence research at the University of Adelaide.

## Further information

For a confidential discussion contact:

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*Defence Trailblazer, together with UoA and UNSW, are actively working to support equity groups. We strongly encourage applications from people with a disability, veterans and women interested in working in non-traditional work settings*  
University of Adelaide CRICOS Number 00123M