# Postdoctoral Fellowship – CSOF4

Role summary for potential applicants

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| Advertised Job Title**:** | CSIRO Postdoctoral Fellowship in Theoretical Physics |
| Reference Number**:** | 58835 |
| Classification**:** | CSOF4 |
| Salary Range: | AU $82k to AU $93k plus up to 15.4% superannuation |
| Location**:** | Lindfield, NSW |
| Tenure: | Specified Term of up to 3 years (or part time equivalent) |
| Relocation assistance**:** | Will be provided to the successful candidate if required |
| Applications are open to: | Australian Citizens Only  Australian/New Zealand Citizens and Australian Permanent Residents Only   * All Candidates |
| Functional Area**:** | Research Scientist / Engineer – Postdoc |
| % Client Focus - Internal: | 50% |
| % Client Focus - External: | 50% |
| Reports to the: | Project Leader |
| Number of Direct Reports: | 1 |

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| **Role Overview:** |
| **Postdoctoral Fellowships** at CSIRO provide opportunities to scientists and engineers who have completed their doctorate and have less than three years relevant postdoctoral work experience. These fellowships will help launch their careers, provide experience that will enhance their career prospects, and facilitate the recruitment and development of potential leaders for CSIRO.  Postdoctoral Fellows **are appointed for up to three years or part time equivalent** and will work closely with a leading Research Scientist or Engineer in their respective field. They carry out innovative, impactful research of strategic importance to CSIRO with the possibility of novel and important scientific outcomes. They present the findings in appropriate publications and at conferences.  The Superconductivity team at Lindfield has developed world-leading scientific capability in high-temperature superconducting (HTS) electronic devices, circuits and application systems. These include HTS SQUIDs and associated magnetic field sensor systems, terahertz (THz) detectors, THz imaging and spectroscopy, superconducting wireless communication receivers and more recently Josephson junction arrays for improvedmagnetometers with improved linearity and noise performance. A superconducting device modelling capability is under development at CSIRO and with our collaborators at the University of Adelaide, and can be used to describe the quantum-mechanical properties of superconducting-junction arrays using experimentally realizable material-parameters.  The Postdoctoral Fellowship role will require a combination of skills including strong background in theoretical physics, in particular superconductivity, condensed matter physics and/or quantum physics and have excellent mathematical and computational skills. The role requires developing theoretical models of Josephson junction arrays, based on high- and low- critical temperature materials, in order to improve the array design and therefore the sensitivity of arrays to small magnetic fields. The Postdoctoral Fellow will be capable of developing theoretical models combining both the lumped element model approach and the quantum mechanical description of Josephson junctions and superconductivity more generally. There will be the opportunity to collaborate regularly with researchers at the University of Adelaide and the Institute of Photonics and Advanced Sensing (IPAS). In addition, this role will offer the unique prospect to direct or participate in scanning probe experiments to study the current pathways at the surface of the superconducting microchips and compare these with the modelling of the arrays with collaborators in the Netherlands.The role requires a highly motivated, independent and productive researcher who follows ideas and tasks through to completion and works hard to meet deadlines. They will also work well in a team environment with excellent communication skills. |

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| **Duties and Key Result Areas:** |
| * Under the direction of senior research scientists, carry out innovative, impactful research of strategic importance to CSIRO that will, where possible, lead to novel and important scientific outcomes. * The Postdoctoral Fellow will model electromagnetic (EM) response of superconducting Josephson Junctions and of other superconducting micro/nanostructures by using a combination of different theoretical tools. * Starting from the more conventional lumped element and Ginzburg-Landau approaches, more advanced modelling techniques such as the kinetic Monte-Carlo and the Non-Equilibrium Green’s Function, along with other novel approaches, could be considered to improve the models. * Build on the unique modelling capability so far developed by a collaboration between CSIRO and the University of Adelaide, with whom the successful applicant will interact regularly. * The approach will begin with using current junction models and solving systems of differential equations, which have had some success with describing the ideal circuit performance of arrays of different junction architectures in the presence of external electromagnetic fields. * A large parameter space of variables, including noise sources and junction parameter spreads, will be included in theoretical models to better describe high temperature superconducting junctions. * Investigate different junction array architectures and material properties to seek dramatic improvements in magnetic field sensitivity, the linearity of the response under EM excitations and noise performance. * Contribute to a combined experimental and theoretical approach, to study current pathways and mapping the supercurrent flow through complex superconducting electronic structures such as arrays. * Develop data-fitting procedures to analyse experimental measurements of arrays where needed and use this information to inform future array designs. * Undertake regular reviews of relevant literature and patents. * Produce high quality scientific and/or engineering papers suitable for publication in quality journals, for client reports and granting of patents. * Prepare appropriate conference papers and present those at conferences as agreed with your supervisor. * Contribute to the development of innovative concepts and ideas for further research. * Make a contribution to the effective functioning of the research team and help deliver CSIRO’s organisational objectives and plans. * Work collaboratively with colleagues within your team, the business unit and across CSIRO. * Communicate effectively and respectfully with all staff, clients and suppliers in the interests of good business practice, collaboration and enhancement of CSIRO’s reputation. * Adhere to the spirit and practice of CSIRO’s Values, Health, Safety and Environment plans and policies, Diversity initiatives and Zero Harm goals. * Undertake an appropriate training and development program developed by CSIRO. * Other duties as directed.   **CSIRO’s postdoctoral training program**is developed between the Postdoctoral Fellow and a CSIRO scientist or engineer. The program will focus on enhancing the Fellows’ capabilities to the level expected of an independent researcher and will include on-the-job and course-based development encompassing:   * Discipline-specific techniques and protocols * Professional growth * Project management * Communication and influencing skills * Working and collaborating with others   <http://www.csiro.au/en/Careers/Student-and-graduate-programs/Postdoctoral-fellowships> |

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| **Selection Criteria:** |
| *Under CSIRO policy only those who meet all essential criteria can be appointed*  ***Pre-Requisites:***   1. **Education/Qualifications:** A doctorate (or will shortly satisfy the requirements of a PhD) in a relevant discipline area, such as theoretical physics, in particular superconductivity, condensed matter physics or quantum physics.   ***Please note:*** *To be eligible for this role you must have* ***no more than 3 years (or part time equivalent)*** *of relevant postdoctoral experience.*   1. **Communication: High level written and oral communication skills with the ability to represent the research team effectively internally and externally, including at national and international conferences.** 2. **Publications: A record of publications in quality, peer reviewed journals.** 3. **Behaviours:** A history of professional and respectful behaviours and attitudes in a collaborative environment.   ***Essential Criteria:***   1. A sound knowledge of theoretical physics especially superconductivity and condensed matter physics. 2. Demonstrated theoretical physics/mathematical modelling capabilities. 3. High quality scientific communications skills demonstrated by publications in high quality journals. 4. Excellent skills using packages such as Matlab, Python, C++ or similar. 5. High level interest in applying the models and equations to solving real world problems and helping improve the sensor performance in a range of applications. 6. Be available to travel regularly to and interact with the Physics Department at the University of Adelaide. 7. **The ability to work effectively as part of a multi-disciplinary, regionally dispersed research team, plus the motivation and discipline to carry out autonomous research.** 8. A record of science innovation and creativity, plus the ability & willingness to incorporate novel ideas and approaches into scientific investigations.   **Desirable Criteria:**   1. Interest in solving problems that address applications-based research. 2. Interest in cryogenic experimental measurements. 3. Solid-state electronic device processing knowledge and experience. 4. Understanding of semiconductor/superconducting device design for multilayer photo-lithography   **As Australia’s Innovation Catalyst, CSIRO has strategic actions underpinned by behaviours aligned to**:   * Excellent science * Inclusion, trust & respect * Health, safety & environment * Delivery on commitments.   **In your application and at interview you will need to demonstrate alignment with these behaviours.**  To be appointed as a Postdoctoral Fellow within CSIRO, candidates are required to have **submitted** their PhD at the time of commencement, as a minimum requirement, if PhD conferment has not been obtained. If a candidate has submitted, but their PhD has not yet been formally attained, the starting salary will be CSOF4-1 (AU$82,450).Upon CSIRO receiving written confirmation that the PhD has been awarded (within a six month period from commencement date), the salary will be increased to the negotiated level and the difference will be back-paid to the Officer’s start date.  ***Special requirements:***  Appointment to this role may be subject to conditions including security/medical/character clearance requirements. Applicants who are not Australian Citizens or Permanent Residents may be required to undergo additional security clearance processes; which may include medical examinations and an international standardised test of English language proficiency (i.e. IELTS test).- <http://www.ielts.org/default.aspx> |

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| **Other Information:** |
| **How to Apply**  Please apply for this position online at <https://jobs.csiro.au/> and enter requisition number **58835**. Internal applicants please apply via ‘Jobs Central’ in SAP (click ‘Recruitment’)  Please load your CV (Maximum 2MB). You may also be required to respond to some screening questions.  If you experience difficulties applying online call 1300 984 220 for assistance. Outside Australian business hours please email: [csiro-careers@csiro.au](mailto:csiro-careers@csiro.au).  **Referees**: Please provide contact details of two previous supervisor or academic/professional referees in your resume/CV. We will ask your permission before making contact.  **Contact:** If after reading the position details above you require more information please contact:  **Dr Emma Mitchell**via email: emma.mitchell@csiro.au or phone: **+61-2-9413 7749** or  **Dr Giuseppe C. Tettamanzi** via email: [giuseppe.tettamanzi@adelaide.edu.au](mailto:giuseppe.tettamanzi@adelaide.edu.au) or phone: **+61-8-83130248**  Please do not email your application directly to Dr Mitchell or Dr Tettamanzi. Applications received via this method may not be considered by the selection panel.  **About CSIRO**  Australia is founding its future on science and innovation. Its national science agency, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.  Find out more! [www.csiro.au](http://www.csiro.au).  We work flexibly at CSIRO, offering a range of options for how, when and where you work. Talk to us about how this role could be flexible for you.  Find out more! [CSIRO Balance](https://www.csiro.au/en/careers/the-csiro-experience/balance)  **CSIRO Manufacturing**  CSIRO Manufacturing is developing cleaner advanced materials and technologies to enable manufacturers to secure a competitive and sustainable future which contributes strongly to national productivity, economic growth and societal wellbeing.  In particular, Manufacturing seeks to support the metals, chemicals, carbon fibre, cotton, biomedical and biotechnology industries. |