# Position Details

## CSIRO Early Research Career (CERC) Postdoctoral Fellowship– CSOF4

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| The following information is for applicants | |
| Advertised Job Title | CSIRO Postdoctoral Fellowship in Imaging Black Holes |
| Job Reference | 93599 |
| Tenure | Specified Term of 3 years  Full-time or Part-time, minimum 0.6 FTE |
| Salary Range | AU$92,624 to AU$101,459 pa (pro-rata for part-time)  plus up to 15.4% superannuation |
| Location(s) | Kensington, WA |
| Relocation Assistance | Will be provided to the successful candidate if required |
| Applications are open to | All Candidates |
| Position reports to the | Team leader, Space & Astronomy |
| Client Focus – Internal | 80% |
| Client Focus – External | 20% |
| Number of Direct Reports | 0 |
| Enquire about this job | Contact Nithyanandan Thyagarajan via email at Nithyanandan.Thyagarajan@csiro.au or phone +61 8 6436 8626 |
| How to apply | Apply online at <https://jobs.csiro.au/>  Internal applicants please apply via **Jobs Central**  If you experience difficulties when applying, please email [careers.online@csiro.au](mailto:careers.online@csiro.au) or call 1300 984 220. |

**Acknowledgement of Country**

CSIRO acknowledges the Traditional Owners of the land, sea and waters, of the areas that we live and work on across Australia. We acknowledge their continuing connection to their culture and pay our respects to their Elders past and present. View our [vision towards reconciliation](https://www.csiro.au/en/about/Indigenous-engagement/Reconciliation-Action-Plan).

**Child Safety**

CSIRO is committed to the safety and wellbeing of all children and young people involved in our activities and programs. View our [Child Safe Policy](https://www.csiro.au/en/about/policies/child-safe-policy).

### Role Overview

**CSIRO Early Research Career (CERC) Fellowships** provide opportunities to scientists and engineers who have completed their doctorate and have less than three years relevant research experience. These Fellowships aim to develop the next generation of future leaders of the innovation system through:

* A differentiated career development program to deliver capability excellence and breadth across all facets of the national innovation system;
* Research training via strategic research and development projects with a clear focus that will deliver real impact through science and engineering excellence;
* An innovative culture supporting the development and demonstration of original thinking and expertise leading to peer-recognition; and
* Opportunities to develop skills and experience in collaborative research teams to effectively work within national and global multi/transdisciplinary and multi-stakeholder environments.

CERC Fellows **are appointed for three years or full time equivalent.**

The CERC Fellow will develop new and independent image reconstruction methods based on deep learning methods and the theory of interferometry to determine the spacetime warping and morphology around the event horizons of black holes. A planet-sized network of telescope arrays using Very Long Baseline Interferometry (VLBI) is needed to image close in on the event horizons of supermassive black holes, which is extremely challenging because the telescopes must be accurately calibrated for delays and attenuations in the signal paths, and the spatial information sampled by the telescopes contains only sparse and incomplete information. The independent end-to-end image reconstruction technique addressing these challenges will be applied to real data obtained from VLBI networks, including primarily the recent and famous example of the supermassive black holes at the centres of our Milky Way and M87 galaxies by the Event Horizon Telescope (EHT).

This independent approach to interferometric imaging will provide a powerful constraint on the structure of spacetime warping near black holes. It will be instrumental in testing fundamental physics such as the theory of General Relativity and will also reveal the relativistic astrophysics at the black hole site. In parallel, this project will benefit both radio astronomy and deep learning, computational astrophysics in general, as well as interferometric imaging problems in other domains such as medical imaging and seismology.

The CERC Fellow will work in close collaboration with the principal investigator Dr. Nithyanandan Thyagarajan (Space & Astronomy), and co-principal investigators Dr. Ivy Wong (Space & Astronomy) and Dr. Foivos Diakogiannis (Data61) at CSIRO to provide novel solutions to the scientific and technical challenges faced by extreme VLBI imaging applications. The CERC Fellow will have the opportunity to utilize state-of-the-art GPU infrastructure both at CSIRO and National facilities like Pawsey Supercomputing Centre's High Performance Computing facility, Setonix, for this project, giving a competitive advantage.

### Duties and Key Result Areas

Under the direction of senior research scientists and engineers, this CERC Fellow will:

* + Develop and implement machine learning / deep learning solutions to interferometric imaging problems where sparsity of information and precise calibration of the data collected by the interferometric elements are the primary limitations to image reconstruction quality.
  + Effectively translate machine/deep learning techniques to interferometric imaging problems in radio astronomy using CSIRO high-performance computing facilities.
  + Effectively translate machine/deep learning techniques from radio interferometry to other fields that use interferometry for imaging such as medical imaging, seismology, etc.
  + Publish results and methods in relevant international journals (and conferences) and release solutions onto public repositories such as GitHub.
  + Collaborate with members of a diverse project team and external partners to ensure research leads to lasting application impact.
  + Carry out innovative, impactful research of strategic importance to CSIRO that will, where possible, lead to novel and important scientific outcomes.
  + Recognise and exploit opportunities for innovation and the generation of new theoretical perspectives, and progress opportunities for the further development or creation of new lines of research.
  + Carry out research investigations requiring originality, creativity and innovation.
  + Record, manage, and analyse data/information using relevant domain data science techniques.
  + Proactively undertake development to grow effective researcher capabilities to support career goals.
  + Adhere to the spirit and practice of CSIRO’s Values, Code of Conduct, Health, Safety and Environment procedures and policy and diversity initiatives.
  + Other duties as directed.

The CERC Fellow learning, development and training programis developed between the CERC Fellow and their CSIRO supervisor. The program will focus on enhancing the Fellow’s 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

## **Selection Criteria**

#### Essential

*Under CSIRO policy only those who meet all essential criteria can be appointed.*

1. A doctorate (or will shortly satisfy the requirements of a PhD). The doctorate must be in a relevant discipline area, such as Computer Science, Astrophysics/Physics, Mathematics, Electrical Engineering, Software Engineering or similar.

Please note: To be eligible for this role you must have **no more than 3 years** (or full time equivalent) of relevant research experience.

1. Demonstrated expertise in designing and implementing ML frameworks and workflows.
2. Demonstrated expertise in high-level programming language(s) such as Python or similar.
3. High level written and oral communication skills in English with the ability to represent the research team effectively internally and externally, including the presentation of research outcomes at national and international conferences.
4. A sound history of publication in peer reviewed journals and/or authorship of scientific papers, reports, grant applications or patents.

## **Desirable**

1. Experience with programming in high-performance computing environments
2. Reasonable understanding of interferometry and Fourier transforms.
3. Reasonable understanding of image processing.
4. A record of science innovation and creativity, including the ability & willingness to incorporate novel ideas and approaches into scientific investigations.
5. Ability to remain productive, positive and resilient in complex, ambiguous and/or uncertain environments.
6. **The ability to work effectively as part of a multi-disciplinary, potentially regionally dispersed research team, plus the motivation and discipline to carry out autonomous research.**

## **Required Competencies**

* **Teamwork and Collaboration:** Cooperates with others to achieve organisational objectives and may share team resources in order to do this. Collaborates with other teams as well as industry colleagues.
* **Influence and Communication:** Uses knowledge of other party's priorities and adapts presentations or discussions to appeal to the interests and level of the audience. Anticipates and prepares for others reactions.
* **Resource Management/Leadership:** Allocates activities, directs tasks and manages resources to meet objectives. Provides coaching and on the job training, recognises and supports staff achievements and fosters open communication in the team.
* **Judgement and Problem Solving:** Investigates underlying issues of complex and ill-defined problems and develops appropriate response by adapting/creating and testing alternative solutions.
* **Independence:** Recognise and makes immediate changes to improve performance (faster, better, lower cost, more efficiently, better quality, improved client satisfaction).
* **Adaptability:**Copes with ambiguity or situations that lack clarity. Adapts readily to changing circumstances and new responsibilities (which may include activities outside own preferences) in the interests of achieving team objectives. Recognises the need for and undertakes personal development as a result of changes.

To be appointed to this CERC Fellowship role within CSIRO, candidates will be expected to commence employment by 31 January 2024. Candidates are also required to have **submitted** their doctoral thesis 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 ($89,680). 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 is subject to provision of a pre-employment background check and may be subject to other security/medical/character clearance requirements.

* The successful candidate will be asked to obtain and provide evidence of a National Police Clearance or equivalent. Please note that individuals with criminal records are not automatically deemed ineligible. Each application will be considered on its merits.
* If the successful candidate is not an Australian Citizen or Permanent Resident, they may be required to undergo additional security clearances, which may include medical examinations and an international standardised test of English language proficiency (i.e. IELTS test- https://ielts.com.au/)

**Our value proposition**

We want CERC Fellows to join our world class science, engineering and digital teams to solve big, complex problems that make a real difference to the future of Australia and the world.

You'll get to work with some of the most talented minds in their fields, not just in Australia, but in the world. At CSIRO, we spark off each other, learn from each other, trust each other and collaborate closely to achieve more than we could individually.

Find out more about our CSIRO Early Research Career (CERC) Fellow Experience Employee Value Proposition (EVP) [here](https://www.csiro.au/en/careers/postdoctoral-fellowships).

## **About CSIRO**

We solve the greatest challenges through innovative science and technology. Visit [CSIRO Online](http://www.csiro.au/) and [Space and Astronomy](https://www.csiro.au/en/about/people/business-units/Space-and-Astronomy) and [Data61](https://www.csiro.au/en/about/people/business-units/Data61) for more information.

CSIRO is a values-based organisation.  In your application and at interview you will need to demonstrate behaviours aligned to our values of:

* People First
* Further Together
* Making it Real
* Trusted