

## Postgraduate Scholarship Information Sheet

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|--------------------------------------------------|------------------------------------------------------------------------------------------|
| Scholarship Title                                | Searches for Quantum Entanglement in High Energy Particle Collisions at CERN             |
| Reference number                                 | WD_2025_09_SPONS_2                                                                       |
| Supervisor(s)                                    | Dr Deirdre Kilbane (SETU)<br>Prof Ronan McNulty (UCD)<br>Dr Barry Dillon (UU)            |
| Research Group/Centre                            | Walton Institute SETU                                                                    |
| Department /School/Faculty                       | Department of Computing and Mathematics / Department of Science                          |
| Duration                                         | 4 Years (48 months for PhD by research)                                                  |
| Status: Full-time / part-time                    | Full-time                                                                                |
| Funding information                              | Walton Institute Funded                                                                  |
| Value of the scholarship per year for four years | Stipend: €25,000 per annum<br>Fees: €5,750 per annum<br>Research Costs: €3,000 per annum |
| Closing date and time                            | Thursday, 27 August 2026 at 4pm Irish Time                                               |
| Interview date                                   | TBC                                                                                      |
| PhD commencement date                            | Immediately                                                                              |
| P Code                                           | TBC                                                                                      |

### Post summary

Applications are invited for a PhD Studentship in Walton Institute, South East Technological University, Ireland. The candidate is expected to be highly self-motivated, and will work with emerging topics in High Energy Particle Physics and Quantum Physics. The research will develop the underlying theory, simulations and Artificial Intelligence (AI) for quantum entanglement and tomography in particle decays and measure these using data from the Large Hadron Collider (LHC) at CERN. Quantum tomography aims to reconstruct the full density matrix of proton collisions, which includes all accessible information on polarisations and correlations. This requires advances in theory and simulation in collaboration with Ulster University utilising AI and high-performance computing facilities in Walton Institute SETU, thus providing a route to interpretable and explainable AI tools for the LHC and future colliders. Access to data will be provided through the LHCb collaboration, of which the PhD candidate will become a member, with the opportunity to spend some time at CERN.

<https://doi.org/10.1051/epjconf/201919901022> - Central exclusive production at LHCb

<https://arxiv.org/pdf/2507.13447> - Theory-Informed Neural Networks for Particle Physics

## Knowledge & Experience

### Essential

- Background in high energy particle physics and/or advanced quantum mechanics
- Experience with programming, simulation, or Artificial Intelligence
- Excellent analytical and organizational skills

### Desirable

- Knowledge of quantum theory
- Demonstrated capability in the delivery of research projects at undergraduate or postgraduate level

## Skills & Competencies

### Essential

- Applicants whose first language is not English must submit evidence of competency in English, please see SETU's English Language Requirements for details.
- Highly motivated student, demonstrating initiative and the ability to work within multi-disciplinary team to achieve results.
- Strong interpersonal and communication skills.
- Excellent academic record and good writing skills.

### Desirable

- Prior experience in scientific paper and report writing.
- Willing to spend some time at CERN.

## Further information

University Website: <https://www.setu.ie>

## Application procedure

Complete the online Application Form from the [SETU website](https://www.setu.ie) quoting the advert reference number from above.

Please ensure that you upload all supporting documents as part of your submission.

*Please note that applications must be submitted by this route.*

For queries relating to the application and admission process please contact the Postgraduate Admissions Office via email [researchadmissions@setu.ie](mailto:researchadmissions@setu.ie) or telephone +353 (0)51 302883.

University Website: <https://www.setu.ie>

The University will short-list and interview those applicants who provide the most suitable information in terms of experience, qualifications and other requirements relevant to the post.

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