JOB OFFER no. Postdoc_JS_2024_06

Position in the project:	**Adjunct – Research Employee (postdoc) in the Quant-ERA call 2023 project:** *Unifying and Optimising Resources for Quantum Computation*
Scientific discipline:	physical sciences – quantum physics (including quantum computation, quantum information, categorical quantum mechanics, graphical calculi, quantum resource theories)
Job type (employment contract, part-time employment contract, civil law contract, etc.)	full-time employment
Number of positions offered:	1
Remuneration/stipend amount/month:	**gross monthly salary up to 11400,- PLN,** depending on experience (based on research resume and publication record)
Position starts on:	01.07.2024, start date is negotiable
Maximum period of contract/stipend agreement:	24 months
Institution:	**International Centre for Theory of Quantum Technologies, University of Gdańsk, Poland**
Project leader:	**John Selby**
Project title:	Unifying and Optimising Resources for Quantum Computation, *financed by the National Science Centre*
Project description:	We are looking for an enthusiastic and motivated Post-doctoral Researcher to work in the International Centre for Theory of Quantum Technologies (ICTQT) hosted by the University of Gdańsk. The position has been created as part of the "Unifying and Optimising Resources for Quantum Computation" project financed by the National Science Center under the Quant-ERA program (call 2023). <u>About the project</u> The project is a collaboration between - John H. Selby at ICTQT, University of Gdańsk, - Tobias J. Osborne, at Institut für Theoretische Physik, Leibniz Universität Hannover, and - Shane Mansfield, and Pierre-Emmanuel Emeriau, at Quandela, Paris. The project is aimed at identifying, unifying, and optimising resources for quantum computation. One of the longest standing open questions in quantum computation is to understand exactly which quantum resources are relevant for the quantum speedup. In this project there are three key aspects to this problem that we seek to address. - The first is that, to date, many seemingly disparate resources have been identified as being responsible for the quantum speedup, and which of these is actually relevant seems to depend on which model of computation one considers. We seek to understand whether or not there is any underlying resource which underpins all of these, that is, to find a model independent resource which is responsible for the speedup. - The second is that there is a large gulf between the kinds of resources

which are considered fundamental quantum resources and those that are typically relevant in a given experimental implementation. For example, nonlocality and contextuality are often considered the most fundamental signatures of the nonclassicality of nature, but (at least for near term devices) the more relevant resources are typically things such as quantum volume, cluster states, the number of T gates, or the depth of the quantum circuit. We aim to bridge this gulf by understanding how these fundamental and practical resources relate to one another.

- The third aspect is to use the developed understanding of quantum resources for computation in order to develop new optimisation techniques for quantum technologies.

Key tools for the project will be drawn from, and contribute towards the development of:

- structural methods (for example graphical languages) coming from logic and theoretical computer science that are well suited to addressing considerations like compositionality that we know to be at the heart of the differences between quantum and classical theories and phenomena;

- machine learning techniques, in particular, reinforcement learning, that are well suited to the allocation and optimisation of complex quantities such as quantum resources; and

- general methods from quantum information theory, in particular, the study of quantum resource theories.

We welcome candidates who are not necessarily experts in these fields but that have a deep interest in the goals of the project – we appreciate any other tools and insights that the candidate brings with them to the team!

Keywords: quantum computation, resource theories, categorical quantum mechanics, graphical calculi, machine learning, optimisation.

For further details on the project or the advertised position then please feel free to get in contact with dr. John Selby, e-mail: john.selby@ug.edu.pl.

More information is available on the quantera website: quantera.eu/resourceq/.

About ICTQT

The International Centre for Theory of Quantum Technologies (ICTQT) is a joint research unit of the University of Gdańsk (UG) and the Institute of Quantum Optics and Quantum Information of the Austrian Academy of Sciences (IQOQI-Vienna) subordinated to the UG Rector. ICTQT was established in 2018 as a part of the International Research Agendas program co-financed by the Foundation for Polish Science. The founders of ICTQT are Marek Zukowski and Pawel Horodecki.

ICTQT is a pioneering and leading quantum information research center in Poland, focused on quantum communication and new computing techniques. The purpose of the ICTQT is to conduct scientific research and development works under the adopted ICTQT Research Agenda, in an international academic environment and at the highest academic level, with due regard for high ethical standards, good academic practice in particular, and to disseminate knowledge.

ICTQT is located in Gdańsk, near Gdynia and Sopot, which together form Tri-City. The mentioned region is the cradle of Polish jazz and rock festivals. Moreover, it is one of the most beautifully located urban areas in Poland, with sandy sea beaches, lakes, and woods in the nearby area.

More information at: www.ictqt.ug.edu.pl

Key responsibilities include:	1. Active scientific research. 2. Presentation and discussion of ideas and results with a diverse audience at

	ICTQT and at external events. 3. Participation in mentoring of PhD students. 4. Participation in activities organised by ICTQT. 5. Participation in seminars, group meetings, and other activities of scientific exchange.
Profile of candidates/requirements:	1. PhD degree in physics, mathematics, computer science, or other relevant subject (PhD degree obtained in 2016 or later). 2. The candidate should be interested in mathematical foundations of quantum computation, quantum information, and related topics, especially those which are within the research agenda of the project. 3. Good written and oral communication skills are appreciated. 4. The candidate should be committed to working collaboratively within an inclusive and diverse environment.
We offer:	1. Employment in a rapidly developing unit, the International Centre for Theory of Quantum Technologies at the University of Gdansk. The start date of employment is negotiable. 2. Scientific and organizational support. 3. Basic equipment and core facilities. 4. Friendly, inspiring, interdisciplinary environment.
Required documents:	All required documents should be prepared in English: 1. Recruitment form 2. Curriculum vitae; 3. A research resume with a list of publications, and a list of ongoing research projects (with specification of their role in the research if unclear); PDF files of three most relevant papers by the candidate (or just web links, in the case of open access publications); a list of talks at conferences and workshops, and a list of academic prizes and awards (if any); 4. Motivation letter (including statement of current scientific interests) – up to 2 pages; 5. Documents confirming academic degrees (a copy of a PhD diploma or a certificate of obtaining the title or confirmation of the planned date of defense (no later than 3 months from the date of announcement of the competition)). NOTE: Before signing the employment contract, the person selected in the competition is requested to submit to the University of Gdańsk the original of the PhD diploma. At the stage of employment, other documents will not be honored; 6. Reference letters about the candidate sent directly by two or more senior researchers (**the candidate is expected to contact the referees and ask them to send reference letters directly to ictqt-careers@ug.edu.pl. The letters must be sent before the deadline for submitting applications**).
General rules of the recruitment process:	1. A postdoctoral position can be offered to candidates who received their PhD degree in 2016 or later. 2. An interview is expected in **June 2024** 3. ICTQT Selecting Commission (SC) reserves the right to invite for the interview only pre-selected candidates. 4. SC's decision is final and is not subject to appeal. 5. SC reserves the right to close the competition without selecting a candidate. 6. The decision will be made by SC within 3 months from the date of recruitment completion. 7. In the event of resignation from accepting the position of the selected candidate, the SC has the right to send the offer to the person placed on the reserve list, and in the absence of such a list, the SC has the right to reconsider the applications submitted to the competition and to indicate a new candidate.
Please submit the documents to:	ictqt-careers@ug.edu.pl
Application deadline:	**June 14,2024**