

Competition notice

Project title: „Quantum Coherence and Entanglement for Quantum Technology”

Principal Investigator: dr Alexander Streltsov

Project description: Aim of the project is to provide a solid theoretical background for nonclassical phenomena, such as quantum coherence and entanglement, with particular focus on their role in quantum technology. We aim to find new quantum protocols which make use of these fundamental quantum features, and to study the thermodynamical limitations of quantum communication protocols.

Successful candidate will work in a team of theoretical physicists on one of the following topics:

- Quantum resource theories: exploring fundamental features of quantum systems, such as quantum entanglement, coherence, and quantum thermodynamics. Addressing questions such as the state conversion problem, quantifying resource costs for quantum process implementation.
- Quantum communication and quantum computation: application of quantum resource theories to quantify resource consumption in quantum communication protocols and to detect quantum features required for noisy quantum computation.
- Open quantum systems: application of quantum entanglement and coherence to detect and quantify memory effects in open quantum systems

Requirement

- A master degree in physics or related area;
- Good understanding of physics, quantum theory, and quantum optics.
- Knowledge of at least one of the following topics: quantum entanglement, quantum coherence, quantum speed limits, open quantum systems,
- A good command of English.

Discipline: Physical Sciences

Admission limit: 1

Recruitment schedule

- registration in the Internet Registration of Candidates, referred to as “IRK”, submitting an application to the IRK: 23.10 -10.12.2020
- qualification procedure: 14.12-17.12.2020
- announcement of the ranking list: until 21.12.2020
- accepting documents from qualified candidates: 22.01.2020 - 27.01.2021 until 14:00
- announcement of the list of accepted candidates: until 31.01.2021

Recruitment fee

150 PLN

Form of the selection procedure

Evaluation of the following elements shall be taken into account in the selection process:

- 1) the research project proposed by the candidate;
- 2) scientific activity of the candidate based on a CV or resumé, documented with scans of materials attached to the application for admission to the School;
- 3) interview with the candidate.

Language of the selection process, including the interview

The interview shall be carried out in Polish or English – in accordance with the candidate's preferences presented in IRK. If the Polish language is selected, the interview may include parts in English.

Required documents

The candidate shall submit the application for admission to the School only in IRK. It shall include:

- 1) the application for admission to the Doctoral School;
- 2) scan of a diploma of completion of the long-cycle Master's degree programme or second-cycle programme or an equivalent diploma obtained under separate regulations or –in the case of candidates pursuing education within the European Higher Education Areas –a declaration that the diploma or certificate of obtaining a Master's degree shall be provided by 27 January 2021, in the case of holding a diploma equivalent to the diploma of completion of the long-cycle Master's degree programme or second-cycle programme, the candidate shall justify this equivalence; PhD candidates should have a master's degree in physics or related area
- 3) a description of the initial research project proposal in English;
- 4) a resumé or curriculum vitae containing information about scientific activities, including scientific interests and scientific achievements during five calendar years preceding the submission of the application, subject to § 18 s. 5, in particular publications, research and organisational work in scientific associations, participation in scientific conferences, participation in research projects, awards, distinctions, research internships, completed training courses on research skills, science popularisation activities, activities in bodies representing scientific societies, professional career;
- 5) scans of materials confirming scientific activities referred to in the resumé or CV;
- 6) a document confirming the command of English at least at B2 level or declaration about the command of English to the extent enabling the education in the school;
- 7) a scan of the declaration of the supervisor candidate about their willingness to be the candidate's supervisor and the number of doctoral students, for whom they are appointed as the supervisor, in accordance with the template determined by the Rector; additionally, the candidate can enclose a scan of the opinion of the supervisor candidate and opinions of other academic staff on the candidate and their scientific activities or the proposed research project;
- 8) one photograph of the candidate's face, allowing their identification;
- 9) declaration whether the candidate is or was a doctoral student or participant of doctoral studies, and if yes – title of doctoral dissertation or the research project prepared by the candidate, as well as first name and surname of the academic tutor or the supervisor;
- 10) declaration on familiarising themselves with the content of the Resolution, as well as Article 40 and Article 41 of the Code of Administrative Procedure;
- 11) scans of transcripts of records of the first and second cycle programmes, the long-cycle Master's degree programme or equivalent documents (e.g. diploma supplement);
- 12) abstract of the master's thesis or draft master's thesis in English (up to 3,000 characters with spaces);

Evaluation criteria

1. Assessment of the completeness and compliance of formal documents;
2. Preliminary evaluation of the research project proposal (0-5 points);

3. Assessment of experience necessary to work in a research project, including scientific achievements (0-35 points);

4. Interview (0-60 points)

- Checking the candidate's knowledge and skills in the discipline of Physical Sciences, in particular regarding:
 - quantum entanglement,
 - quantum coherence,
 - quantum communication,
 - quantum computation,
 - open quantum systems.
- conversation about the research project, candidate's understanding of the research topic;
- a series of short questions about the presented scientific achievements and questions about the course of studies to date.

Education program

The education lasts 4 years. It includes obligatory classes (no more than 300 hours in total during the whole period of education) and the implementation of an individual research program, carried out under the supervision of a supervisor. Beginning of education - March 1, 2021.

Scholarships

The scholarship is PLN 4500 gross-gross (for the duration of the research project). After its completion, PhD student receives a scholarship in the amount provided for in the general regulations.