

*Jagiellonian University in Kraków promotes cooperation and cares for a good atmosphere based on mutual trust. It implements the strategy resulting from The Human Resources Strategy for Researchers, creating stable conditions for employment as well as the development of academic career, which resulted in the award of the HR Excellence in Research by the European Commission*

## **INFORMATION ON SELECTION PROCEDURE**

**Date of selection procedure announcement** Kraków (Cracow) 24.02.2025

<b>Dean of the faculty of /Director of a non-faculty, inter-faculty or common unit</b>	Dean of the Faculty of Physics, Astronomy and Applied Computer Science
<b>Address</b>	Prof. Stanisława Łojasiewicza Str. 11 30-348 Kraków

### **RECTOR**

**of the Jagiellonian University**

**announces a selection procedure for the position of an**

**ASSISTANT (Ph.D. Student)**

<b>Group of employees</b>	Research staff
<b>JU organisational unit (place of work performance)</b>	Faculty of Physics, Astronomy and Applied Computer Science
<b>Field of science</b>	Science and natural sciences
<b>Discipline</b>	Physical sciences
<b>Scope</b>	Quantum physics
<b>Number of posts (in the case of more than 1 post)</b>	2
<b>Type of employment</b>	employment contract
<b>Working time</b>	Full time
<b>Planned duration of employment</b>	12 months, with the possibility of extension for a further 24 months (total 36 months)
<b>Expected date of employment commencement</b>	2nd quarter 2025
<b>Remuneration</b>	according to the <a href="#">Rules for Remunerating Jagiellonian University</a>

	<a href="#">Employees</a>
<b>Requirements</b>	<p>The selection procedure is open for all individuals, who meet the requirements set out in Articles 113 and 116.2.4) of the Act of 20 July 2018 – Law on Higher Education and Science, and who meet the following eligibility criteria according to § 166 of the Statute of the Jagiellonian University:</p> <ul style="list-style-type: none"> <li>• holding Master of Science degree or equivalent</li> <li>• exhibiting aptitude for research work.</li> </ul>
<b>Additional requirements and expectations</b>	<ul style="list-style-type: none"> <li>- degree in theoretical physics or mathematics or computer science;</li> <li>- a background in quantum theory and quantum information;</li> <li>- a good command of spoken and written English (language certificate proving advanced language skills will be considered as an advantage)</li> <li>- preference will be given to candidates with some research experience in quantum information theory.</li> </ul>
<b>Project Title</b> (in the case of project selection procedures / IDUJ)	<i>Typical and Atypical structures in quantum theory / TAtypic</i>
<b>Project description</b> (in the case of project selection procedures / IDUJ)	<p>The project: Typical and atypical structures in quantum theory concerns theoretical physics and quantum mechanics. The main goal of the project is to investigate the properties of typical quantum states and quantum channels, as well as to identify <u>distinctive</u> structures with extreme properties, useful for quantum information processing and quantum technologies. To find out more, see below and visit the website of the <a href="#">ERC Advanced Grant</a> led by <a href="#">Karol Życzkowski</a>.</p> <p>Quantum theory, confirmed by numerous sophisticated experiments, is widely believed to describe our world at the micro-scale. It is therefore legitimate to investigate which structures are allowed by quantum theory and which of them are potentially relevant for the development of quantum technologies. The basic notion of a quantum state - a mathematical tool for calculating probabilities that characterise the results of a quantum measurement - is of primary importance. Quantum maps, which describe the evolution of quantum states in time, and quantum super maps, which represent the evolution in the space of quantum maps, are also analysed. Assuming that the number of outcomes is finite, all these sets form a convex framework embedded in a real space of appropriate dimension.</p> <p>The case where the physical system consists of several subsystems is of particular interest, as one can analyse correlations and entanglement between the subsystems. The main goal of this project is to study the properties of typical quantum states, maps and supermaps, and to identify distinctive atypical structures with extreme properties useful for quantum information processing. We will search for new constructions of absolutely maximally entangled multipartite states that imply the existence of quantum error-correcting codes, novel schemes of mutually unbiased bases, and symmetric informationally complete generalised quantum measurements that provide optimal measurement accuracy. Furthermore, we plan to analyse quantum supermaps with distinctive properties and to study how these structures behave under decoherence, when quantum features are gradually suppressed. To put all these structures on the same footing, we will use generalisations of the Choi-Jamiołkowski isomorphism, which relates quantum maps to quantum states of the extended system and apply the theory of random matrices to elucidate differences between typical objects with generic features and atypical ones with desired properties.</p>

	<p>About the Jagiellonian University:</p> <p>The second oldest university in Central Europe, it was founded in 1366 in Cracow (Krakow), Poland. Alumni of the Jagiellonian University include Nicolaus Copernicus (1495) and Jan Olszewski (1872) who, together with Zygmunt Wróblewski, was the first in the world to liquefy nitrogen in 1883. Our science faculties are located on the new campus at Łojasiewicza Street, just outside the city centre. The Faculty of Physics, Astronomy and Applied Computer Science is renowned for its world-class research and innovation.</p>
<p><b>Scope of duties</b> (to be completed with the appropriate description of duties resulting from the project / IDUJ)</p>	<p>according to the <a href="#">Work Regulations of the Jagiellonian University</a> Annex 1 to the Work Regulations of the Jagiellonian University – Model scopes of responsibilities and duties of academic teachers.</p> <p>Your tasks will focus on the implementation of the project described above.</p> <p>Your role in the project will focus on one or more of the following areas</p> <ul style="list-style-type: none"> <li>- A) Typical quantum structures: taking advantage of recent developments in the theory of random matrices, we will study generic properties of random quantum states, random operations, random Lindblad generators and random supermaps.</li> <li>or</li> <li>- B) Atypical quantum structures: We will search for distinctive quantum structures with extremal properties. We will search for strongly entangled quantum states, generalised quantum measurements including mutually unbiased bases (MUBs) and symmetric informationally complete measurements (SICs), and different kinds of quantum designs</li> </ul>
<p><b>We offer</b></p>	<ul style="list-style-type: none"> <li>• employment contract at the renowned university,</li> <li>• cooperation with the interdisciplinary academic community represented by well-known scientists,</li> <li>• scientific support as well as the possibility of qualifications improvement and professional development,</li> <li>• access to research infrastructure,</li> <li>• additional social benefits.</li> </ul>
<p><b>Application documents</b></p>	<ol style="list-style-type: none"> <li>1. a short letter of motivation</li> <li>2. CV including full list of publications,</li> <li>3. a copy of a university degree (Master of Science or equivalent)</li> <li>4. personal questionnaire filled in by the candidate,</li> <li>5. declaration of the candidate, confirming that the Jagiellonian University will be their primary place of work, should they be selected in the selection procedure,</li> <li>6. statement under Article 113 of the Law on higher education and science,</li> <li>7. statement on acknowledging and accepting the rules and regulations concerning intellectual property management and commercialisation in force at the Jagiellonian University.</li> </ol> <p><b>Declaration and statement forms (no. 5-7) and personal questionnaire template (no. 4) can be obtained at:</b>  <a href="https://cso.uj.edu.pl/en_GB/konkursy">https://cso.uj.edu.pl/en_GB/konkursy</a></p>
<p><b>Additional application documents</b></p>	<p>Letters of recommendation from 2-3 academics</p>
<p><b>The course of selection procedure</b></p>	<p>The first stage of the selection procedure is the formal assessment of the submitted documents. Applications which meet all formal requirements are the subject of substantive assessment, during which an interview with the Candidate may be conducted (directly or via electronic communication channels), upon settling the date of the interview with the Candidate. The Candidate has the right to appeal</p>

	against the negative assessment by the selection board within 7 days from receiving the information about the results of the assessment. The selection procedure is conducted in accordance with <a href="#">The Policy of Open, Transparent and Merit-Based Recruitment Process at the Jagiellonian University</a>
<b>Form of submission</b>	by e-mail to the address: <a href="mailto:krystyna.wajda@uj.edu.pl">krystyna.wajda@uj.edu.pl</a> , Email subject: "application for doctoral assistant position", Please submit your application in English.
<b>Deadline for submission of applications</b>	31 March 2025
<b>Expected date of the selection procedure settlement</b>	2-3 weeks from the closing date for application
<b>Method of communicating of the results of the selection procedure</b>	by e-mail or phone
<b>Questions</b>	For further information please contact Krystyna Wajda e-mail address: <a href="mailto:krystyna.wajda@uj.edu.pl">krystyna.wajda@uj.edu.pl</a>

In the selection procedure, the Jagiellonian University follows the principles of the European Charter for Researchers and a Code of Conduct for the Recruitment of Researchers.  
Jagiellonian University does not provide housing.

On behalf of  
the Rector of the Jagiellonian University  
Dean of the  
faculty of /Director of a non-faculty, inter-faculty or common  
unit