

COMPETITION ANNOUNCEMENT

The Director of Interdisciplinary Centre for Mathematical and Computational Modelling, with the consent of the Rector of the University of Warsaw, announces a competition for the position of assistant professor¹ in the programme/project/undertaking NCN MAESTRO-16.

About the programme/project/undertaking:

Title of programme/project/undertaking	Challenging problems in partial differential equations inspired by cutting-edge algorithms in statistics and machine learning
Type of programme/project/undertaking	MAESTRO-16
Funding institution	National Science Centre (NCN)
Duration of programme/project/undertaking	09.04.2025-08.04.2030
Head of programme/project/undertaking	Prof. dr hab. Piotr Gwiazda
Description of programme/project/undertaking	Most mathematical models of natural phenomena are grounded in an understanding of biological and physical processes, allowing us to propose a general structure for the equations. The subsequent step involves validating and calibrating the model using empirical data, a task that often presents significant scientific challenges. Despite being crucial for the model's predictive accuracy, this step is seldom pursued. This project aims to address these challenges by establishing the necessary analytical framework, with a focus on parameter identification for models of various processes, such as tumor growth, traffic flow, and geophysical phenomena. A key strength of the project lies in its innovative application and development of partial differential equation (PDE) techniques, seamlessly integrated with statistical methods. This robust combination drives substantial advancements in optimization, sampling, inference, and machine learning. On one side, statistical approaches such as Bayesian inference play a critical role in identifying the parameters of PDEs, while on the other, newly emerging gradient flow methods hold significant potential for the development of sampling algorithms. The research goals are structured into the following primary tasks: <u>Parameter identification</u>: The problem of parameter identification is a critical step towards developing truly applicable models. Theoretical analysis of nonlinear PDEs, an area of ongoing research, addresses many complex issues, such as the existence, uniqueness, and regularity of solutions. However, to advance to the next stages—building numerical algorithms, conducting computations, and predicting real-world processes—the calibration of certain equation parameters becomes essential. When these parameters are not known a priori, there are various methods available to determine them. <u>Sampling methods</u>: Sampling involves selecting representative data points from a larger dataset to estimate the characteristics of the entire population.

¹ The nouns used in the announcement apply to people of all genders.

	This problem, especially when dealing with a probability distribution known only up to a normalization constant, is fundamental in Computational science, engineering, and Bayesian statistics. Recent research suggests that gradient flow-based algorithms in the space of probability measures offer new directions for sampling. We aim to advance this field, tailoring gradient flow specifications to develop precise algorithms, which are crucial not only for sampling but also for parameter identification. <u>Stability on parameters:</u> The project aims to advance the understanding and development of new analytical methods for studying how solutions to strongly nonlinear partial differential equations (PDEs) depend on parameters. Despite their relevance, issues concerning the dependence of solutions on parameters, such as Hölder (or Lipschitz) continuity and differentiability, remain largely unexplored. Notably, the stability of solutions with respect to parameters is crucial for validating and calibrating models in biomedical and engineering contexts, as well as in optimization problems where control equations are sought to minimize a functional. A key challenge lies in determining the regularity of solutions relative to parameters. For practical applications, choosing numerical methods with optimal convergence rates should align with the expected solution regularity. Such an approach will allow us to distinguish between numerical methods that are purely heuristic from those whose correctness, including the rate of convergence, can be rigorously established. <u>Extended graphons:</u> A significant challenge in the project lies in deriving the mean-field limit for multi-agent systems on a wide range of sparse graphs, known as extended graphons. This is particularly focused on non-exchangeable multi-agent systems with non-identical agents. The analysis draws on various disciplines, including partial differential equations, stochastic analysis, and graph theory. The novel concept of limits for extended graphons captures the network's connectivity structure, which plays a crucial role in collective dynamics. Although this area has seen considerable research activity, it has so far been confined to conservative systems. The project's goal is to extend this concept to non-conservative systems, which is highly significant given that most biological models are expressed as balance laws rather than conservation laws.
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Position details:

Position title	Assistant professor
Organisational unit	Interdisciplinary Centre for Mathematical and Computational Modelling (ICM)
Employment group	Research
Position profile ²	R2
Academic discipline ³	mathematics
Number of positions	2
Form of employment and length of working time (proportionally to full-time employment)	Employment contract, full-time employment. Employment conditions consistent with the principles of employment for the position of assistant professor in the MAESTRO-16 project financed by the National Science Centre.
Expected date of commencement of work and employment period	Employment starting from October 1 st , 2025, for 12-24 months. In exceptional cases possibility of extending employment.
Remuneration	Basic remuneration about PLN 8 850 gross/month. More information: https://rekrutacja-i-rozwoj.bsp.uw.edu.pl/przydatne-dokumenty/
Other working conditions	– <i>Workplace:</i> Interdisciplinary Centre for Mathematical and Computational Modelling

² Complete only in the case of competition for the position in the research employment group or the research and teaching employment group.

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	Career opportunities: more information: https://rekrutacja-i-rozwoj.bsp.uw.edu.pl/praca-na-uw
Basic responsibilities and obligations	– Conducting research on topics indicated by the head of project. – Assistance in organizational activities related to the implementation of the project. – Participation in promotional activities related to the project. – Publication of project-related research results. – Participation in organizing conferences/seminars. – Other tasks indicated by the head of project. More information: https://rekrutacja-i-rozwoj.bsp.uw.edu.pl/przydatne-dokumenty/
Conditions for entering the competition ⁴	– Fulfilment of the requirements set out in Article 113 of the Law on Higher Education and Science (Journal of Laws of 2024, item 1571, consolidated text) – PhD degree in mathematics obtained no earlier than 7 years before the year of employment in the project. – Excellent background in one or more of the following fields: partial differential equations, functional analysis, measure theory, numerical analysis, statistics. – Scientific achievements documented by publications in renowned scientific journals. – International experience, e.g. participation in international conferences, international cooperation documented by publications.
In addition, we expect ⁵	<i>If hired, we expect the University of Warsaw to be the primary workplace for the successful candidate.</i>
Criteria for the assessment of candidates in a competition	- Quality of the candidate's scientific achievements. - Compatibility of the candidate's preparation with the project's subject matter. - Potential for cooperation within the project.

Position ~~related~~/not related⁶ to activities covered by the protection of minors.

Competition rules:

Announcement reference number	1/2025/konkurs/adiunkt
Keywords	optimal transport theory, Bayesian statistics, partial differential equations, gradient flows, inverse problems
Deadline for submitting applications ⁷	July 25th, 2025 <i>Applications sent after this deadline will not be considered.</i>
Method of submitting an application	E-mail to: konkursy@icm.edu.pl (in the form of pdf files, preferably all documents in one file labelled 'name-contest'). Candidates will receive an e-mail confirmation of documents submission.
Required documents	An application should include: - Scientific CV that: - o presents an overview of the background and scientific achievements of the candidate; - o lists all the candidate's research works (including not yet published manuscripts); - o gives a list of three experienced researchers that may provide references for the candidate; - Candidate's questionnaire: PL: https://docs.google.com/document/d/1gbddYyGHWvSrFTIN8c7Zg7Aeu9cwbZzf/edit?usp=drive_link&oid=117931983341375059710&rtpof=true&sd=true

⁴ Required by the Act, the Law on Higher Education and Science, the Statute of the University of Warsaw, as well as necessary for the position.

⁵ Additional conditions to be met; however, not meeting them will not lead to a negative formal assessment.

⁶ Delete as appropriate.

⁷ Not sooner than 30 days from the date of publication of the announcement.

	EN: https://docs.google.com/document/d/1iGTaFVeB97QgcYwGRGTotssPNWMgueKO/edit?usp=drive_link&oid=117931983341375059710&rtpof=true&sd=true <i>Please ensure that your application is complete and submitted by the deadline indicated! Failure to meet these requirements will result in rejection on formal grounds.</i> <i>Information about your degrees, titles and certificates should be included in the questionnaire. If necessary, the committee may call on the candidate to present the original documents. Please do not attach copies of diplomas and certificates.</i>
The competition is the first stage of the recruitment process, please read the Policy of Open, Transparent and Merit-Based Recruitment at the University of Warsaw https://rekrutacja-i-rozwoj.bsp.uw.edu.pl/polityka-rekrutacji/	
Stages of competition	The competition consists of the following stages: – Stage I - formal evaluation of documents; – Stage II - substantive evaluation on the basis of submitted documents; – Stage III - interview with selected candidates (presentation of scientific achievements and answers to questions from the competition committee, candidates will be individually notified about their interview schedule by email); – Stage IV - final evaluation of competence, experience and scientific achievements; – Stage V - adjudication of the competition and announcement of results.
Anticipated date and method of notification of the competition outcomes	Candidates will be informed about the results of the contest by email by August 14, 2025. If the person selected in the competition resigns to take up employment, the position may be offered to the next person on the ranking list.
Contact for any questions relating to the competition	- Substantive questions regarding the project: P.Gwiazda@mimuw.edu.pl; - Formal questions: konkursy@icm.edu.pl. <i>Accessibility needs should be indicated on the Candidate's Questionnaire, in: Other relevant information from a candidate</i>

Employing faculty/unit:

Research profile of faculty/unit	Interdisciplinary Centre for Mathematical and Computational Modelling, more information: https://icm.edu.pl .
Teaching profile of faculty/unit	ICM offers studies in the field of computational engineering, more information: https://studia.icm.edu.pl .
Other information	Information about ICM as a computing center: https://kdm.icm.edu.pl .

The University of Warsaw has implemented the procedure for whistleblowers reporting cases of law violation and for undertaking follow-up actions. For **more information** about this topic and the processing of candidates' personal data please follow the <https://rekrutacja-i-rozwoj.bsp.uw.edu.pl/przydatne-dokumenty/>

The University of Warsaw is a winner of the HR Excellence in Research award granted by the European Commission to institutions adhering to the European Charter for Researchers.

