

## 4 Postdoc Positions in Quantum Information, Computation, and Foundations

Applications are invited for **4 two-year** postdoctoral positions starting **January 2025** on research themes funded by the A\*MIDEX Chaire d'Excellence project, "**Quantumness: combinatorial, computational, and distributed**" (QCCD). I am the Principal Investigator of this project hosted at Aix-Marseille University (AMU) in the Calcul Naturel (CANA) team of the computer science lab, Laboratoire d'Informatique et des Systèmes (LIS). As part of the requirements for this funding scheme, the applicants should **not** be currently employed by Aix-Marseille University and should have obtained their last academic degree **outside** of AMU.

The details of each research theme and the expertise sought are outlined below:

### 1. Models of quantum computation:

This postdoc is intended for candidates with expertise in models of quantum computation, particularly the state-injection and measurement-based models, with an aptitude for foundational aspects of nonclassicality including (but not limited to) Bell nonlocality, contextuality, and quantum resource theories. The broad goal is to collaborate on deepening our understanding of nonclassical resources that are required for quantum computational speed-ups.

### 2. Nonclassicality in quantum algorithms:

This postdoc is intended for candidates with expertise in quantum algorithms, *e.g.*, variational quantum eigensolvers, shallow quantum circuits, quantum machine learning algorithms and/or their dequantization. The broad goal is to collaborate on identifying the sources of nonclassicality exploited by quantum algorithms and use this understanding to inform the design of new quantum algorithms.

### 3. Quantum causality:

This postdoc is intended for candidates with expertise in quantum causality, broadly understood (*e.g.*, quantum causal models, indefinite causal order, classical/quantum causal compatibility in networks), with a solid background in quantum information theory and an interest in developing applications of quantum causal models.

### 4. Quantum information and foundations:

This postdoc is intended for candidates with expertise in quantum information theory with a strong interest and/or expertise in quantum foundations including (but not limited to) topics such as post-quantum theories (generalized/operational probabilistic theories, process theories, *etc.*), correlations in quantum and post-quantum theories (Bell inequalities, contextuality, *etc.*), and the use of convex optimization techniques such as linear and semidefinite programming for investigating topics (*e.g.*, measurement incompatibility) in quantum information and foundations.

Applicants should include the following materials in their application:

1. their full **academic CV**, including a list of publications,
2. a **cover letter (max 1 page)** mentioning their expertise and fit with the theme(s) of the specific postdoc position(s) they want to apply for, including their order of preference,
3. a **research statement (max 3 pages)** outlining their research goals for the duration of the postdoc and ideas for potential collaborative projects,
4. **two reference letters** to be sent directly by the referees to [ravi.kunjwal@lis-lab.fr](mailto:ravi.kunjwal@lis-lab.fr).

All materials above, including the name and email of the two references, should be sent by email to [ravi.kunjwal@lis-lab.fr](mailto:ravi.kunjwal@lis-lab.fr). It is possible to indicate an interest in more than one position: if so, the applicant **must** indicate their order of preference among the positions for which they are applying. This order will be taken into account in the evaluation of the application so it is in the applicant's best interest to focus their application on the theme that best fits their research profile and interests.

The deadline for sending all these materials (including reference letters to be sent directly by the referees) is **September 8, 2024 (timezone AoE)**. Shortlisted candidates will be interviewed in September and final offers will be made soon after all the interviews are done.