Offre n°2025-08963

Post-Doctoral Research Visit F/M Lattice-based bosonic quantum error correction

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : PhD or equivalent

Fonction : Post-Doctoral Research Visit

Contexte et atouts du poste

Context and working environment
The position is hosted by the QAT team, located at **École Normale Supérieure (ENS)** and **Inria Paris**. The team conducts research in various aspects of quantum information theory, including quantum error correction, quantum resource theories, and the interface between quantum information and cryptography. The team is part of a strong academic environment within the broader Paris ecosystem for quantum science and is involved in multiple national and European projects.

The team values diversity and is committed to building an inclusive environment for people of all backgrounds.

The position is accompanied by a generous travel allowance and is potentially renewable for a third year.
Start date: September 1st 2025 (flexible)

Proposed research project
This position is part of the “Bosonic Lattice Codes” (BoLaCo) project, a French-German collaboration funded by the ANR and the DFG, in partnership with Prof. Jens Eisert’s group at Freie Universität Berlin. The project aims to develop new theoretical and practical frameworks for **bosonic quantum error correcting codes**, especially **Gottesman-Kitaev-Preskill (GKP)** codes [1], using tools from lattice theory and coding theory. This builds upon previous work by the project partners that studied the relation of GKP codes to lattices [2] and the use of this connection for the design of new codes [3].

[1] Gottesman, D., Kitaev, A.Y., & Preskill, J. (2000). Encoding a qubit in an oscillator. Physical Review A, 64, 012310. (arXiv:quant-ph/0008040)

[2] Conrad, J., Eisert, J., & Arzani, F. (2022). Gottesman-Kitaev-Preskill codes: A lattice perspective. Quantum, 6(648), 648.

[3] Conrad, J., Eisert, J., & Seifert, J.-P. (2024). Good Gottesman-Kitaev-Preskill codes from the NTRU cryptosystem. Quantum, 8(1398), 1398.

Application documents
To apply, please include:

1. a cover letter
2. a curriculum vitae (including a complete list of publications);
3. a research statement (3 pages maximum), including an overview of your past research and its relation to the proposed program;
4. contacts of 2 potential referees.

Mission confiée

Assignments :
The postdoctoral researcher will contribute to the development of quantum error correcting codes and fault tolerant primitives (state preparation, syndrome extraction, logical gates) for bosonic systems and explore their mathematical and practical properties in relation to different experimental platforms leveraging tools from lattice theory.

In addition to work within the BoLaCo project, the postdoc will have the opportunity to contribute to other ongoing activities of the QAT team: https://qat.inria.fr/projects

The postdoc will also be involved in the supervision of interns and PhD students. While there is no teaching requirement, teaching activities may be arranged for interested candidates through ENS-PSL or affiliated institutions.

For a better knowledge of the proposed research subject :
related works include

Ansgar G. Burchards, Steven T. Flammia, Jonathan Conrad, Fiber Bundle Fault Tolerance of GKP Codes, arXiv:2410.07332

Mao Lin, Christopher Chamberland, Kyungjoo Noh, Closest lattice point decoding for multimode Gottesman-Kitaev-Preskill codes, arXiv:2303.04702

Collaborations :
Besides the members of the Bosonic Lattice Codes project, the postdoc will profit from existing collaborations with theoretical and experimental teams both in France

and internationally.

Principales activités

- Contribute to the mathematical characterization of bosonic quantum error correcting codes, especially GKP.
- Propose and develop new schemes for state preparation, decoding, and fault-tolerant logical operations.
- Help in the supervision and mentoring of interns and PhD students within the QAT team.
- Participate in scientific outreach and dissemination activities

Compétences

Essential:

- PhD in quantum information, mathematical physics, quantum optics, theoretical computer science, or related field.
- Research experience in quantum error correction, ideally with a focus on bosonic codes.
- Previous exposure to continuous-variable systems, lattice theory, or fault-tolerant quantum computing.
- Excellent communication and collaboration skills.
- Fluent in English (written and spoken).

Desirable:

- Experience in interdisciplinary or international research collaborations.
- Familiarity with numerical and/or or symbolic computation tools (Python, Julia, Mathematica, Sage, ...).

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training

- Social security coverage

Informations générales

- **Thème/Domaine :** Algorithmics, Computer Algebra and Cryptology Information system (BAP E)
- **Ville :** Paris
- **Centre Inria :** Centre Inria de Paris
- **Date de prise de fonction souhaitée :** 2025-09-01
- **Durée de contrat :** 2 years
- **Date limite pour postuler :** 2025-07-02

Contacts

- **Équipe Inria :** CASCADE
- **Recruteur :**
  Arzani Francesco / francesco.arzani@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'e?orce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

We are looking for motivated candidates who are confortable working both independently and in a team.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Sécurité défense :
Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :
Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.