Offer #2025-09135

Resources in Generalised Process Theories

Level of qualifications required : Graduate degree or equivalent

Fonction : Temporary scientific engineer

About the research centre or Inria department

The Inria Saclay-Île-de-France Research Centre was established in 2008. It has developed as part of the Saclay site in partnership with **Paris-Saclay University** and with the **Institut Polytechnique de Paris** .

The centre has **40 project teams** , 27 of which operate jointly with Paris-Saclay University and the Institut Polytechnique de Paris; Its activities occupy over 600 people, scientists and research and innovation support staff, including 44 different nationalities.

Context

Resources in quantum information theory are typically studied within the circuit model, that is, theories of processes equipped with temporal and spatial composition rules. The motivation is simple, a pair of resources could be used in parallel or in sequence. Formally, this principle informs the definition of a resource theories within quantum information theory as sub-circuit theories (sub-symmetric monoidal categories).

Many aspects of quantum (and classical) physics motivate the study of resources beyond the basic circuit model. Attempts to model temporal neutrality, causality of agents interventions, and higher-order processes called quantum supermaps motivate novel and more elaborate compositional structures than are accommodated by the naive circuit model. The framework of generalized process theories, has been put forward as a way to accommodate the wide spectrum of potential compositional structures relevant within different physical domains into one meta-algebraic theory, using algebras over wiring operads.

The goal of this project is to extend the basic theory of resources in the circuit model to the generalized process theory model.

Assignment

The work plan is the following.

- Define functors for generalized processes and interpret them as resource theories.
- Study the transferability of properties from classical resource theories to the generalized framework.
- Analyze application cases, particularly in higher-order quantum theory and time-symmetric contexts.

This work will be produced in collaboration with John Selby at ICTQC University of Gdansk.

Main activities

Main activities

- Conduct bibliographic study of the literature
- Propose mathematical solutions to the problem
- Write articles and documentation detailing the derived constructions
- Present the progress to the team

Skills

Technical skills and level required : Master in Mathematics, Physics or Computer Science, with a strong background on quantum computation.

Languages : English.

Relational skills : Communication, writing.

Benefits package

- 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 (after 6 months of employment) 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

Remuneration

Regarding professional experience

General Information

- **Theme/Domain :** Proofs and Verification
  Software engineering (BAP E)
- **Town/city :** Gif-Sur-Yvette
- **Inria Center :** Centre Inria de Saclay
- **Starting date :** 2025-11-01
- **Duration of contract :** 6 months
- **Deadline to apply :** 2025-08-09

Contacts

- **Inria Team :** QUACS
- **Recruiter :**
  Valiron Benoît / benoit.valiron@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.