INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Eviden Quantum Lab
CNRS identification code: N/A
Internship director'surname: Thomas Ayral
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Web page: https://eviden.com/solutions/advanced-computing/quantum-computing/
Internship location: Les Clayes-sous-Bois

Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: Eviden

Advanced quantum circuit emulation with tree tensor networks

The classical emulation of quantum circuits is an essential part of quantum computing research, as it is the only way to evaluate realistically the potential of candidate quantum algorithms on quantum chips that are too large or too accurate to build today. Tensor network are important tools for realizing such emulations with reasonable classical resources.
In this internship we will study how to build the best tree tensor network for emulating a given quantum circuit, and how to realize the emulation in the most efficient way as possible. We will produce software, potentially as a part of Qaptiva, to realize this in a black-box fashion.

The Eviden quantum laboratory is based in les Clayes-sous-Bois in the Paris area. It is a research and development team whose focus is quantum computing. Our goal is to make quantum computing useful by providing quantum programming languages and libraries (including compilation tools for most existing quantum hardware), by delivering powerful realistic classical simulators (digital twins) of quantum processors to predict and improve the outcome of experimental quantum computations, and by developing new algorithms for a wide spectrum of applications ranging from quantum many-body physics (condensed matter, quantum chemistry) to combinatorial optimization over differential equations. These developments are made concrete, in particular, in Eviden's Qaptiva platform, our quantum programming platform.
The internships we propose typically involve Python programming. Basic knowledge in quantum mechanics, a solid understanding of linear algebra, fluent Python and English, and a will to learn are skills you will definitely put to use here. Experience with tensor networks, condensed matter physics, git, linux or C++ are also appreciated.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: YES