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

Can quantum computers give a leg up to classical quantum Monte Carlo algorithms?

Quantum many-body problems are exponentially hard to tackle with classical computers. Since decades, very sophisticated codes have been developed to tame this exponential wall. Among them, quantum Monte-Carlo codes stand out as very powerful tools that have been used to gain insights into the physics of strongly-correlated systems such as condensed-matter problems or quantum chemical problems. Despite their sophistication, these codes often run into numerical hurdles often called the Monte-Carlo sign problem. Recently, hybrid quantum approaches have suggested that quantum processors could help alleviate this sign problem. In this internship, you will explore some of these approaches using the Qaptiva framework and test their robustness to realistic conditions.

Reference: http://arxiv.org/abs/2308.07964

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