Laboratoire de Physique Théorique et Hautes Energies

Unité Mixte de Recherche (UMR 7589) de Sorbonne Université et du CNRS

SEMINAIRE du LPTHE

Vendredi 19 Octobre 2018, 11:00

Stefanos Kourtis

Boston University

Quantum-inspired approaches to hard computational problems

Many classes of complex computational problems admit no efficient solution or even approximation, yet have a vast reach in applications across science and industry. From a physics perspective, computational complexity originates from correlations between bits of information. It is reasonable to ask whether computational approaches to quantum many-body problems can be practically useful in this context. In this talk, I will present newly found cases where the answer is affirmative. I will introduce constraint satisfaction problems (CSPs) and reformulate them as interacting models whose ground states represent the solution manifold. A procedure that reaches the ground states of these models implements a protocol of computation. In some protocols, the complexity that arises during computation can be viewed as quantum entanglement, and efficiency is achieved by controlling its growth. Using this reasoning, I will introduce practical methods for solving CSPs based on tensor network contraction and demonstrate that they outperform state-of-the-art solvers for some of these problems by a significant margin. I will conclude with an outline of ongoing work on extensions and applications to problems of current interest, such as the simulation of existing and near-term quantum circuits.

Bibliothèque du LPTHE, tour 13/14, 4$^{\text{ème}}$ étage

N.B. La liste de tous les séminaires en région parisienne est disponible sur
http ://semparis.lpthe.jussieu.fr

LPTHE tour 13/14, 4$^{\text{ème}}$ étage, Campus P. et M. Curie, BP 126, 4, place Jussieu, F-75005 Paris, France