SEMPARIS – Séminaires en région parisienne

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Seminaire exceptionnel

Jeudi 18 Janvier 2024, 14 :00
LPTMC, LPTMC seminar room, Jussieu, towers 12-13, 5th floor, room 523
Domaines : cond-mat

Titre : *From Bell's inequalities to statistical physics models (and back)*

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Résumé : *John Bell's celebrated inequalities (BI) constrain the « hidden-variable models » that Einstein had first envisioned to possibly complete the statistical predictions of quantum physics. The violation of BI by quantum-mechanical predictions imply that the latter are « non-local ». Most experiments have long focused on violating textbook BI, involving a pair of two-level quantum systems. Yet, more recently, the investigation of BI in a many-body context has blossomed, motivated both by the fundamental understanding of the quantum / classical boundary when the complexity of the system increases ; as well as by the certification of genuine non-classical properties, such as quantum entanglement, in quantum-technology hardwares.*

In this talk, we first explain that Bell's local-hidden-variable models are nothing more than classical statistical physics models (namely, generalizations of Ising models). We use this insight to construct new algorithms, inspired by so-called inverse statistical problems in data science, that infer previously-unknown BI from correlation functions as measured in quantum many-body experiments. These new BI are then analized to gain insight in the manifestations of many-body entanglement, and in the certification of quantum properties.