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Colloquium of the Physics Department of ENS

Mercredi 25 Janvier 2023, 13 :30
DPT-PHYS-ENS, ConfIV (E244) - 24 rue Lhomond 75005 PARIS
Domaines : physics

Titre : *Simulating strongly correlated systems with tensor network algorithms*

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Résumé : *One of the biggest challenges in physics is understanding strongly correlated quantum many-body systems, which give rise to very remarkable phenomena such as high-temperature superconductivity or novel states of matter with topological order. Despite the fact that these systems can often be described by simple models on a lattice, it is very difficult to study them, because standard numerical and analytical approaches typically fail for these systems. Among the most powerful numerical tools are tensor networks, where the main idea is to approximate a quantum many-body state by a trace over a product of tensors. The best-known example is the matrix product state, which is an efficient ansatz for states in one dimension. Progress in quantum information theory, in particular a better understanding of entanglement in many-body systems, has led to the development of tensor networks for two-dimensional systems, called projected entangled pair-states (PEPS). In this colloquium I will first give an introduction to this field and then show how PEPS helped us to understand the rich and intriguing physics of the quantum material SrCu2(BO3)2 under pressure and in a magnetic field, which is effectively described by the Shastry-Sutherland model.*