



Matrix-product states and tensor networks: a gentle introduction

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Fridays 2, 9, and 16 October 2026, 10:00–12:15. In person at IPhT and live online.

These lectures will provide an introduction to tensor-network methods in quantum many-body physics, with an emphasis on matrix-product states (MPS).

- Basic tensor-network language, including graphical notation, virtual indices, bond dimensions, gauge freedom, canonical forms, QR and singular-value decompositions, and the role of entanglement in controlling the efficiency of the representation.
- Main MPS algorithms, including contractions, correlation functions, matrix-product operators, DMRG, and time-evolution methods.
- Brief introduction to projected entangled-pair states (PEPS) as a higher-dimensional generalization of MPS, together with the basic ideas behind approximate PEPS contraction.
- Tensor-network representations of mixed states, quantum channels, and Lindblad dynamics, with applications to thermal states and open quantum systems.

Based on <https://arxiv.org/abs/2606.24803>.

Please check the IPHT courses website courses.ipht.fr for last-minute changes in the schedule. To receive the latest news on this course and the video-conference links, please subscribe to its newsletter, as explained at the courses website. An open, non-interactive livestream will also be available at youtube.com/ipht-tv.