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Continuous matrix product representations for mixed states¹ JULIAN RINCON, MARTIN GANAHL, GUIFRE VIDAL, Perimeter Institute for Theoretical Physics — The continuous matrix product state (cMPS) is a powerful variational ansatz for the ground state of strongly interacting quantum field theories in 1+1 spacetime dimensions [F. Verstraete, J.I. Cirac, Phys. Rev. Lett. 104, 190405(2010)]. The cMPS applies to theories that have a finite short-distance behavior under a characteristic length scale. This ultraviolet cut-off may be natural or enforced (e.g. by adding a regulator to the field theory). In this paper we propose a density matrix generalization of the cMPS, the continuous matrix product density operator (cMPDO), and investigate its suitability to represent thermal states and master equation dynamics. We show the existence of such an object by taking the continuum limit of a lattice MPDO and characterize its mathematical properties. For thermal states, we find that the cMPDO offers an accurate description of their corresponding density matrix. We argue that these results can also be extended for the case of master equation dynamics. Finally, we propose and demonstrate an algorithm to find the cMPDO representation of thermal states.

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