

Matrix Product State of the XY model during the blackout.

M.M. Rams¹, V. Zauner², F.Verstraete^{2,3}.

¹ *Institute of Physics, Kraków University of Technology, Podchorążych 2, 30-084 Kraków, Poland.*

² *Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Vienna, Austria.*

³ *Ghent University, Krijgslaan 281, 9000 Gent, Belgium*

We show how to analytically obtain Matrix Product State representation of the ground state of the XY model. On one hand, this allows us to demonstrate how Ornstein-Zernike form of the correlation function emerges in the exact case i.e. with infinite MPS bound dimension. On the other hand we can address question, what information about the state is retained during the (inevitable from practical point of view) truncation procedure. Within used framework we can access bound dimension which are way beyond standard numerical methods. We focus on the spectrum of the MPS transfer matrix both for critical and gaped systems. Among others, we see that for non-critical system there emerges the length scale up to which the algebraic part of the correlation function is recovered – irrespective of the growing MPS bound dimension. For critical system we discuss how effective finite length scale appears in the problem.

[1] M.M.Rams, V.Zauner, F.Verstraete, *in preparation*.