Looking for KPZ Scaling on IBM Quantum Devices

Nathan Keenan[1, 2]
John Goold[1]

[1]*Trinity College Dublin*
[2]*IBM Quantum*

nathan.keenan@ibm.com

Abstract

Quantum simulation is the original use-case of quantum computation, and has a high chance of being the first area in which we see a quantum advantage. In this work we take inspiration from the random circuit work of [1, 2] to study hydrodynamics on IBM's quantum devices. We investigate whether there is a scalable method to study transport on current digital quantum devices. In particular, we use random circuits and Trotter evolution to study spin-transport in the XXZ model. In the poster we present some results showing that the quantum devices display super-diffusive behaviour at the isotropic point of the XXZ chain, along with the restoration of diffusion when a disordered field is added to the model.

References

[1] Richter, J., & Pal, A. (2021). Simulating hydrodynamics on noisy intermediate-scale quantum devices with random circuits. *Physical Review Letters*, *126*(23), 230501.

[2] Jin, F., Willsch, D., Willsch, M., Lagemann, H., Michielsen, K., & De Raedt, H. (2021). Random state technology. *Journal of the Physical Society of Japan*, *90*(1), 012001.

Figures

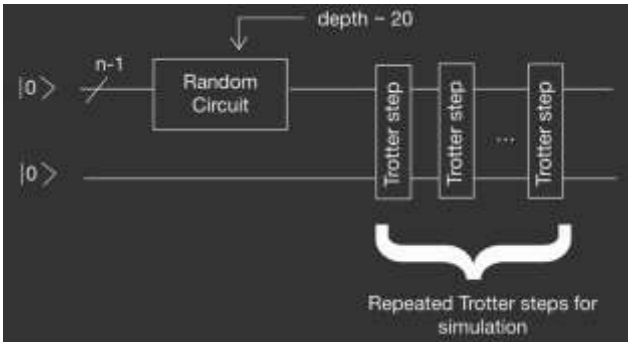

Figure 1: Heuristic of the type of circuit set-up we use for these simulations.