Contribution ID: **40** Type: **Contributed talk**

Designing Atomtronic Circuits via Superfluid Dynamics

Tuesday 3 September 2024 15:20 (20 minutes)

We propose an implementation concept for atomtronic circuit elements based on the criticality of superfluid dynamics in specially designed Bose-Einstein condensates (BECs). Specifically, to obtain a logical 2-input AND-gate, we employ a T-shaped BEC together with two mobile and one stationary Gaussian barrier, functioning as Josephson junctions. The transistor-like behavior of the AND-gate can be identified by studying the resulting non-equilibrium density distributions around the stationary barrier for different scenarios of the deployable mobile barriers. Extending the original setup, we present a logical 4-input AND-gate in an attempt to realize an advanced connected atomtronic circuit. In addition, we discuss the possibility of a universal set of logical gates by establishing a connection to a logical NOT-gate motivated by the recent studies of Singh et al. [1] by exploiting Josephson oscillations. Lastly, we illustrate the potential by merging NOT- and AND-gate elements into an atomtronic NAND-gate.

References

[1] V. P. Singh, N. Luick, L. Sobirey, and L. Mathey, Joseph-son junction dynamics in a two-dimensional ultracold bose gas, Phys. Rev. Res. 2, 033298 (2020).

Short bio (50 words) or link to website

I completed my Bachelor of Science (Physics) with the thesis 'Latent Symmetry Analysis of Small & Medium-Sized Graphs' (2022), under the supervision of Prof. Dr. Peter Schmelcher (https://www.physik.uni-hamburg.de/en/iqp/schmelcher.html). I am currently approaching the end of my Master's degree, under supervision of Prof. Dr. Ludwig Mathey (https://www.physik.uni-hamburg.de/en/iqp/mathey.html).

Relevant publications (optional)

Career stage

Student

Author: JÄHRLING, Sarah

Co-authors: Prof. MATHEY, Ludwig; Dr SINGH, Vijay

Presenter: JÄHRLING, Sarah

Track Classification: FINESS