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Transport in a capacitive ultracold atomtronic circuit[1] MARK EDWARDS, BENJAMIN ELLER, Georgia Southern Univ, STEVE ECKEL, CHARLES CLARK, Joint Quantum Institute — A recent NIST experiment [2] studied the transport of a gaseous Bose–Einstein condensate (BEC) confined in an atomtronic "dumbbell" circuit. The optically created condensate potential consisted of a tight harmonic potential in the vertical direction confining the BEC to a horizontial plane. The horizontal potential consisted of two cylindrical wells separated by a channel produced by a harmonic oscillator potential transverse to the line joining the wells. The BEC, formed in the "source" well, was released to flow toward the "drain" well. The evolution of this system was shown to be reproduced by a model electronic circuit consisting of a charged capacitor, C, in series with an inductor, L, and a parallel combination of a resistor, R, and a Josephson junction. We modeled this system with the Gross–Pitaevskii (GP) equation and found good agreement with the data provided that the confining potential is carefully reproduced. The GP simulations show behavior, not detectable in the experiment, that atoms can jump out of the dumbbell area after filling up the drain well. We also present the dependence of R and L on the channel shape.

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[2]J.G. Lee, et al., arXiv:1506.08413 (2015)

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