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Transport in a capacitive ultracold atomtronic circuit[1] BENJAMIN ELLER, KAYLA WARREN, Georgia Southern University, STEPHEN ECKEL, CHARLES CLARK, Joint Quantum Institute, MARK EDWARDS, Georgia Southern University — 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. We modeled this system with the Gross-Pitaevskii (GP) equation and found good agreement with the data provided that the channel 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 describe the GP evolution of this system with a model RCL circuit having a time–dependent resistance. This resistance exhibits a strong connection to the time–dependence of the atom loss in the drain. We also studied and present the dependence of the R and L parameters of this model circuit on the channel shape.

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

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