Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Optimal Control Theory For Fast and Excitation-less transport of Bose-Einstein Condensation with an atom chip SIRINE AMRI, ROBIN CORGIER, ERNST RASEL MARIA, Institut of Quantrum Optics, Leibiz University of hannover, ERIC CHARRON, Institut Des Sciences Molculaires d'Orsay, NACEUR GAALOUL, Institut of Quantrum Optics, Leibiz University of hannover, QUANTUS TEAM — Recent proposals for testing foundations of physics assume BECs as source of atom interferometry sensors.In this context, atom chip devices allow to build transportable BEC machines with high flux and high repetition rates,as demonstrated with MAIUS (rocket) micro-gravity experiment. In such experiments, the proximity of the atoms to the chip surface is however, limiting the optical access abd the available interferometry time necessary for high-precision measurements.This justifies the need of very well-designed BEC transport protocols in order to perform long base-line, and thus precise, atom interferometry measurements.We present optimal control theory protocols for the fast, excitation-less transport of BECs with atom chips,engineering transport ramps with duration not exceeding a 200 ms with realistic 3D anharmonic trap.This controlled transport is implemented over large distances, typically of the order of 1-2mm, i.e of about 1,000 times the size of the atomic cloud.The robustness of the transport protocol against experimental imperfections is evaluated, and the advantages over ' shorcut-to-adiabacity' schemes reported by our team will be discussed.Such robust control features are crucial for the success of novel implementation of atom interferometry experiments in space.

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Date submitted: 31 Jan 2020 Electronic form version 1.4