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Classical and quantum dissipation of bright solitons in a bosonic superfluid DMITRY K. EFIMKIN, Condensed Matter Theory Center, University of Maryland, United States, JOHANNES B. HOFMANN, Condensed Matter Theory Center, University of Maryland, United States and TCM Group, Cavendish Laboratory, University of Cambridge, United Kingdom, VICTOR GALITSKI, Joint Quantum Institute and Condensed Matter Theory Center, University of Maryland, United States — We consider the quantum dissipation of a bright soliton in a quasi-one-dimensional bosonic superfluid. The dissipation appears due to interaction of the soliton with Bogoliubov excitations, which act as a bath for the soliton. Using a collective coordinate approach and the Keldysh formalism, we derive a Langevin equation for the soliton motion which contains both a friction and a stochastic force. We argue that due to the integrability of the original problem, Ohmic friction is absent, rendering the dynamics non-Markovian. We furthermore show that the resulting friction can be interpreted as the backreaction of Bogoliubov quasi-particles emitted by an accelerating soliton, which represents an analogue of the Abraham-Lorentz force known in electrodynamic.

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