Abstract Submitted
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Superlubricity in a nutshell.[1] ERIO TOSATTI, SISSA and ICTP, Trieste, DAVIDE MANDELLI, SISSA, Trieste, ANDREA VANOSSI, CNR-IOM Democritos and SISSA, Trieste — Cold ion chains in optical lattices emulate the Frenkel-Kontorova model, whose frictional behavior depends on commensurability or incommensurability between the two lattices. In the latter and more interesting case, there are two different regimes: one with pinning and static friction, and one without pinning, called superlubric. Only in an infinite chain the two regimes exist, separated by a dynamical Aubry transition. A cold ion chain is necessarily finite and short, we nevertheless proposed that a clear remnant of that transition should persist in trapped ion chains[1]. Recent experiments showed how in fact a small number of ions suffices to demonstrate incommensuration effects, with a change of friction by orders of magnitude from matched to mismatched geometries[2]. Here we present simulation results suggesting for increasing optical lattice amplitude a clear vestigial Aubry transition for very few ions, with a weak dependence upon the ion number and a stronger one upon the relative mismatch. A properly chosen amplitude should therefore show the vestigial transition from pinning at small mismatch to superlubricity at large mismatch. Alternatively, a chain which at T=0 is pinned at all mismatches could develop an Aubry transition at finite temperature to a state of "thermally induced superlubricity", due to the thermal smearing of the optical lattice amplitude. [1] A. Benassi et al., Nat. Comm. 2, 236 (2011). [2] A. Bylinskii et al, Science 348, 1115-1118 (2015).

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