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Stick-slip nanofriction in cold-ion traps[1] DAVIDE MANDELLI, SISSA, Trieste, Italy, ANDREA VANOSSI, CNR-IOM Democritos, SISSA, Trieste, Italy, ERIO TOSATTI, ICTP, CNR-IOM Democritos, SISSA, Trieste, Italy
— Trapped cold ions are known to form linear or planar zigzag chains, helices or clusters depending on trapping conditions. They may be forced to slide over a laser induced corrugated potential, a mimick of sliding friction [1,2]. We present MD simulations of an incommensurate 101 ions chain sliding subject to an external electric field. As expected with increasing corrugation, we observe the transition from a smooth-sliding, highly lubric regime to a strongly dissipative stick-slip regime. Owing to inhomogeneity the dynamics shows features reminiscent of macroscopic frictional behaviors [3]. While the chain extremities are pinned, the incommensurate central part is initially free to slide. The onset of global sliding is preceded by precursor events consisting of partial slips of chain portions further from the center. We also look for frictional anomalies expected for the chain sliding across the linear-zigzag structural phase transition. Although the chain is too short for a proper critical behavior, the sliding friction displays a frank rise near the transition, due to opening of a new dissipative channel via excitations of transverse modes.

[1] A. Benassi et al, Nature Comm. 2, 236;
[2] T. Pruttivarasin et al, New Jour. of Phys. 13, 075012;
[3] S.M. Rubinstein et al, Nature 4, 1005.

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