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Post-quench dynamics of long-range interacting systems MICHAEL FOSS-FEIG, National Institute of Standards and Technology, Joint Quantum Institute, and the University of Maryland, ZHE-XUAN GONG, Joint Quantum Institute and the University of Maryland, CHARLES CLARK, ALEXEY GORSHKOV, National Institute of Standards and Technology, Joint Quantum Institute, and the University of Maryland — Lieb-Robinson bounds provide a rigorous underpinning to the common intuition that short-range interacting quantum systems should obey some notion of locality. These bounds have recently been extended to encompass systems with long-range (power-law) interactions [1], however such generalizations no longer enforce locality, allowing instead for correlations that grow with an arbitrarily large velocity. We demonstrate that this behavior arises from unnecessarily pessimistic assumptions used in deriving Lieb-Robinson bounds for long-range interacting systems, and emphasize that, on very general physical grounds, such a divergent velocity is unlikely and perhaps even impossible. We will explicitly demonstrate the mathematical origin of this apparently divergent velocity in the bound, and explain the reason why it does not necessarily exist in the true dynamics, by appealing to the simple and experimentally relevant example of an interacting XY chain.

[1] M. Hastings and T. Koma, Comm. Math. Phys. 265, 781 (2006).

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