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Momentum-Space Entanglement and Loschmidt Echo in Luttinger Liquids after a Quantum Quench REX LUNDGREN, Joint Quantum Institute, University of Maryland/NIST, BALZS DRA, Budapest University of Technology and Economics, MARK SELOVER, The University of Texas at Austin, FRANK POLLMANN, Max-Planck-Institut fr Physik komplexer Systeme — Luttinger liquids (LLs) arise by coupling left- and right-moving particles through interactions in one dimension. This most natural partitioning of LLs is investigated by the momentum-space entanglement after a quantum quench using analytical and numerical methods. We show that the momentum-space entanglement spectrum of a LL possesses many universal features both in equilibrium and after a quantum quench. The largest entanglement eigenvalue is identical to the Loschmidt echo, i.e., the overlap of the disentangled and final wave functions of the system. The second largest eigenvalue is the overlap of the first excited state of the disentangled system with zero total momentum and the final wave function. The entanglement gap is universal both in equilibrium and after a quantum quench. The momentum-space entanglement entropy is always extensive and saturates fast to a time independent value after the quench, in sharp contrast to a spatial bipartitioning. Ref: Phys. Rev. Lett. 117, 010603 (2016)

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