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Long-lived non-equilibrium states in a quantum-Hall Tomonaga-Luttinger liquid[1] TOSHIMASA FUJISAWA, KAZUHISA WASHIO, RYO NAKAZAWA, MASAYUKI HASHISAKA, Tokyo Inst of Tech - Tokyo, KOJI MURAKI, NTT Basic Research Laboratories, YASUHIRO TOKURA, Univ. Tsukuba — The existence of long-lived non-equilibrium states without showing thermalization, which has previously been demonstrated in time evolution of ultracold atoms (quantum quench), suggests the possibility of their spatial analogue in transport behavior of interacting electrons in solid-state systems. Here we report long-lived non-equilibrium states in one-dimensional edge channels in the integer quantum Hall regime. For this purpose, non-trivial binary spectrum composed of hot and cold carriers is prepared by an indirect heating scheme using weakly coupled counterpropagating edge channels in an AlGaAs/GaAs heterostructure. Quantum dot spectroscopy clearly reveals that the carriers with the non-trivial binary spectrum propagate over a long distance (5 - 10 um), much longer than the length required for electronic relaxation (about 0.1 um), without thermalization into a trivial Fermi distribution. This observation is consistent with the integrable model of Tomonaga-Luttinger liquid. The long-lived spectrum implies that the system is well described by non-interacting plasmons, which are attractive for carrying information for a long distance.

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