Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Lifetime of a one-dimensional fermion[1] MAXIM KHODAS, William I. Fine Theoretical Physics Institute and School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455, USA, IDDO USSISHKIN, Intel Corp., Israel, MICHAEL PUSTILNIK, School of Physics, Georgia Institute of Technology,Atlanta, GA 30332, ALEX KAMENEV, LEONID GLAZMAN, William I. Fine Theoretical Physics Institute and School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455, USA — Interaction between fermions in one dimension is usually accounted for within the exactly solvable Tomonaga-Luttinger model. The crucial simplification made in this model is the linearization of the fermionic spectrum. That simplification leads to an infinite lifetime of a fermion at the mass shell, i.e., the corresponding Green function $G(\varepsilon, \xi_k)$ diverges at $\varepsilon = \xi_k$. We find that inclusion of the curvature of electron spectrum, $\xi_k = v_F k + k^2/2m$, yields a finite decay rate of a fermion, $1/\tau(\xi_k) \propto \theta(k)k^8/m^3$; here for definiteness we consider right-moving particles, and k is measured from the Fermi wave vector. The found finite lifetime allows one to assess the limitations of the Luttinger liquid paradigm.

[1]NSF, Grants No. DMR02-37296, No. DMR-0405212, No. EIA02-10736, and A. P. Sloan Foundation.

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Date submitted: 02 Dec 2006 Electronic form version 1.4