Causality and relativistic localization in 1-d Hamiltonians[1] BEN
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University — Superluminal motion and its connection to causality is explored in the
context of quantum mechanical systems. It is shown that, while the mean velocity of
a quantum wave packet may be less than c, certain portions of the wavepacket may
still spread superluminally. Criteria are developed that can be used to determine if a
wavepacket is spreading superluminally, and these criteria are used to show that the
relativistic Schrodinger equation is non-causal and that up to 8% of the wavepacket
may violate causality. It is also verified that the Dirac and Klein-Gordon equations
are causal, and extensions of this work to quantum field theories are briefly discussed.

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