Persistent Current and Drude Weight in Mesoscopic Rings F.
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Universite Henri Poincare, Nancy I, France — We study the persistent current and
the Drude weight of a system of spinless fermions, with repulsive interactions and a
hopping impurity, on a mesoscopic ring pierced by a magnetic flux, using a DMRG
algorithm for complex fields. We find that the persistent current changes from an
algebraic to an exponential decay with the system size, as the system crosses from
the Luttinger Liquid (LL) to the Charge Density Wave (CDW) phase with increasing
interaction U. We also find that in the interacting system the persistent current is
invariant under the impurity transformation $\rho \to 1/\rho$, for large system sizes, where
ρ is the defect strength. In the LL phase the Drude weight decreases algebraically
with the number of lattice sites N, due to the interplay of the electron interaction
with the impurity, while in the CDW phase it decreases exponentially, defining a lo-
calization length which decreases with increasing interaction and impurity strength.
Our results show that the impurity and the interactions always decrease the per-
sistent current, and imply that the Drude weight vanishes in the limit $N \to \infty$, in
both phases.

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