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Effects of disorder on the drag rate in double quantum-wire systems

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Abstract: We study the Coulomb drag rate for electrons in a double quantum-wire structure in the presence of disorder. We use the particle number-conserving relaxation-time approximation to phenomenologically broaden the response functions entering the drag rate expression to account for the disorder effects. In contrast to the usual low-temperature regime investigated by various researchers, we focus our attention on the high-temperature drag rate to which plasmon modes are known to make substantial contribution. The full wave vector and frequency dependent random-phase approximation (RPA) at finite temperature and disorder strength is employed to describe the effective interlayer Coulomb interaction. The interplay between the screening effects and disorder at high temperature yields a nonmonotone behavior of the drag rate on the disorder parameter. The reduction in the interwire momentum transfer rate may be used as a probe to investigate localization properties of coupled quantum-wire systems. PACS numbers:\ 73.50.Dn, 73.20.Mf, 73.20.Dx

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