Enhanced conductance in doped graphene disks

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Recently, ballistic graphene samples in a multimode regime were found to show so-called sub-Sharvin charge transport, characterized by the conductance reduced by a factor of ${π}/{4}$ comparing to standard Sharvin contacts in two-dimensional electron gas, and the shot-noise power characterized by $F≈1/8$ (with *F* being the Fano factor) [1]. Here we consider Corbino disks in graphene, with $R\_{1}$ the inner and $R\_{2}$ the outer radius, finding that the multimode conductance is enhanced for any finite ${R\_{2}}/{R\_{1}}$ ratio, reaching $(4-π)≈0.8684$ of the Sharvin value for $R\_{2}/R\_{1}\rightarrow \infty $. At the same limit, the Fano factor approaches $(9π-28)/(12-3π)≈0.1065<1/8$. Closed-form approximating expressions for any ${R\_{2}}/{R\_{1}}$ are derived supposing incoherent scattering of Dirac fermions on asymmetric double barrier and compared with exact numerical results following from the mode-matching method. For experimentally-accessible radii ratios $5/4⩽R\_{2}/R\_{1}⩽2$, approximately 10 percent conductance enhancement above the value given in Ref. [1] , and a similar shot-noise reduction, is predicted. The effects of tuning the electrostatic potential barrier (preserving the cylindrical symmetry) from rectangular to parabolic shape is also studied numerically, and the crossover to standard Sharvin transport regime is identified.

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**References:**

[1] A. Rycerz and P. Witkowski, *Sub-Sharvin conductance and enhanced shot noise in doped graphene,* Phys. Rev. B **104**, 165413 (2021). <https://doi.org/10.1103/PhysRevB.104.165413>