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**Hartree-Fock theory of a current-carrying electron gas** HÉCTOR MERA, REX GODBY, Department of Physics, University of York, Heslington, York YO10 5DD, United Kingdom, PETER BOKES, Department of Physics, Slovak University of Technology (FEISTU), Ilkovicova 3, 841 04 Bratislava, Slovakia — State-of-the-art simulation tools for non-equilibrium quantum transport systems typically describe the current-carrier occupations in terms of the equilibrium distribution functions of two particle reservoirs characterized by two different electrochemical potentials, while for the description of electronic exchange and correlation, the Local Density Approximation (LDA) to Density Functional Theory is generally used. However, the LDA is based on the homogeneous electron gas *in equilibrium* and therefore its use is inconsistent with the non-equilibrium character of the system to be described. In this work we remove this inconsistency by maximizing the entropy of a two dimensional electron gas with constraints on the total energy and number of left- and right-going electrons and solving the corresponding Hartree-Fock equations. We find that the exchange energy depends only weakly on the current density despite quite considerable changes in the single particle spectrum. This is explained in terms of the symmetries of the exchange hole and its dependence on the current density. Consequences for a current-dependent LDA to the exchange potential are also discussed.

Hector Mera
Department of Physics, University of York
Heslington, York YO10 5DD, United Kingdom

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