

Zeitschrift: Helvetica Physica Acta
Band: 65 (1992)
Heft: 2-3

Artikel: Edge voltages and distributed currents in the quantum Hall effect
Autor: Thouless, D.J.
DOI: <https://doi.org/10.5169/seals-116391>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 15.01.2026

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

Edge voltages and distributed currents in the quantum Hall effect

D. J. THOULESS

*Dept. of Physics FM-15, University of Washington
Seattle, WA 98195, U. S. A.*

In quantum Hall plateaus the current density in the interior is determined primarily by the potential gradient in its neighborhood and is, to a first approximation, independent of the local chemical potential for the electrons. The total current is, however, determined by the electrochemical potentials at the two edges. Some situations are analyzed in which the current can be distributed across the system while the mobile states at the Fermi energy are closely confined to the edges. Well-known examples of this are an annulus with an induced electromotive force round it, so that the Hall current flows between, rather than along, the edges, and a torus with a hole in it, where there are no edges which can carry current round the system. A reexamination is made of the distribution of current across a Hall bar, using arguments similar to those used by MacDonald, Rice and Brinkman, and by Thouless. It is found that the edge currents are associated with a charge distribution that in turn induces a more widely distributed current. This distributed current initially falls off rather slowly with distance from the edge, and then drops rapidly as a result of screening by the semiconductor beyond the depletion region. The voltage drop across the interior satisfies the Laplace equation in many cases, but this couples to the minority carriers and does not significantly affect the Hall current at low temperatures. Therefore the Landauer-Büttiker argument for quantized Hall conductance is valid, although the current density is not strongly localized near the edges.

Abstract for invited talk at the International Conference on Physics in Two Dimensions, Neuchâtel, August 1991