"Coherent and ballistic transport in InGaAs and Bi mesoscopic devices"

Hackens, Benoît

ABSTRACT

In 'clean' confined conductors (the so-called mesoscopic systems), the electronic phase and momentum can be preserved over very long distances compared to the system dimensions. This gives rise to peculiar transport properties, bearing signatures of electron interferences, ballistic electron trajectories, electron-electron interactions, regular-chaotic electron dynamics and (in some cases) spin-orbit coupling. Examples of such effects are the Universal Conductance Fluctuations (UCFs) and the Weak Localization observed in the low-temperature magnetoconductance of many confined electronic systems. Of central importance, the electronic phase coherence time and the spin-orbit coupling time determine the amplitude of these quantum effects. In the first part of this thesis, we use UCFs to extract these characteristic timescales in open ballistic quantum dots (QDs) fabricated from InGaAs heterostructures. We observe an intrinsic saturation of the coherence time at low temperature in the InGaAs QDs. The origin of this phenomenon has been intensely debated during the last decade. Based on our observations and previous experimental data in QDs, we propose an explanation: the dwell time becomes the limiting factor for electron interferences in QDs at low temperature. Then, we report on magnetoconductance measurements in a bismuth ballistic nano-cavity. The cavity is found to be zero-dimensional for phase coherent processes at low temperature. We evidence an anomalous reduction of the phase coherence time in the cavity with respect to data obtained in thin Bi films, while the spin-...

CITE THIS VERSION

Hackens, Benoît. Coherent and ballistic transport in InGaAs and Bi mesoscopic devices. Prom. : Bayot, Vincent http://hdl.handle.net/2078.1/5174

Le dépôt institutionnel DIAL est destiné au dépôt et à la diffusion de documents scientifiques émanant des membres de l'UCLouvain. Toute utilisation de ce document à des fins lucratives ou commerciales est strictement interdite. L'utilisateur s'engage à respecter les droits d'auteur liés à ce document, principalement le droit à l'intégrité de l'œuvre et le droit à la paternité. La politique complète de copyright est disponible sur la page Copyright policy.

DIAL is an institutional repository for the deposit and dissemination of scientific documents from UCLouvain members. Usage of this document for profit or commercial purposes is strictly prohibited. User agrees to respect copyright about this document, mainly text integrity and source mention. Full content of copyright policy is available at Copyright policy.
Copyright notice

Readers may view, browse, and/or download material for temporary copying purposes only, provided these uses are for noncommercial personal purposes. Except as provided by law, this material may not be further reproduced, distributed, transmitted, modified, adapted, performed, displayed, published, or sold in whole or part, without prior written permission from the publisher.

Excerpts (figures and parts of texts) of the thesis are reprinted, with permission, from:
- Applied Physics Letters 85, 4508 (2004). Copyright (2004) American Institute of Physics. This article may be downloaded for personal use only. Any other use requires prior permission of the author and the American Institute of Physics. The article may be found at [http://link.aip.org/link/?apl/85/4508].