

Preface

At very low temperatures and at certain filling factors ν , the ground state of a high mobility electron gas exposed to a strong magnetic field becomes incompressible, forming an integer quantum Hall (IQH) or fractional quantum Hall (FQH) state. The $\nu = 5/2$ state is one of the most exceptional of these states, as it is believed to exhibit non-Abelian quasiparticle excitations. This property makes it not only interesting from a fundamental physics point of view, but also for possible applications in topological quantum computing.

In this book, we investigate the properties of the IQH and FQH states, using transport measurements in the bulk, in quantum point contacts (QPCs) and through quantum dots (QDs) or interferometers implemented in high mobility GaAs samples. One important goal of the work presented in this book has been to study the properties of the $\nu = 5/2$ state by investigating its tunneling and confinement properties and to make progress towards the realization of an experiment that allows to probe the statistics of the quasiparticle excitations at $\nu = 5/2$.

This book gives an insight into the work on the $\nu = 5/2$ state that has been conducted at ETH Zürich in a collaboration of the groups of Werner Wegscheider and Klaus Ensslin, since 2010. The book is based on a dissertation written by Stephan Baer in the group of Klaus Ensslin [1].

This book provides an overview of recent developments in experiments probing the fractional quantum Hall (FQH) states of the second Landau level, especially the $\nu = 5/2$ state. It summarizes the state-of-the-art understanding of these FQH states. It furthermore describes how the properties of the FQH states can be probed experimentally, by investigating tunneling and confinement properties. The progress towards the realization of an experiment, allowing to probe the potentially non-Abelian statistics of the quasiparticle excitations at $\nu = 5/2$ is discussed. The book is intended as a reference for graduate students and postdocs starting in the field. The experimental part of this book gives practical advice for solving the experimental challenges which are faced by researchers studying highly fragile FQH states.

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Reference

1. S. Baer, Transport spectroscopy of confined fractional quantum Hall systems, Ph.D. thesis, ETH Zürich, Zürich, 2014. <http://dx.doi.org/10.3929/ethz-a-010252603>

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