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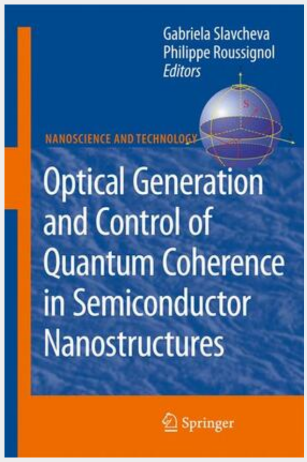
Optical Generation and Control of Quantum Coherence in Semiconductor Nanostructures

The fundamental concept of quantum coherence plays a central role in quantum physics, cutting across disciplines of quantum optics, atomic and condensed matter physics. Quantum coherence represents a universal property of the quantum s- tems that applies both to light and matter thereby tying together materials and p- nomena. Moreover, the optical coherence can be transferred to the medium through the light-matter interactions. Since the early days of quantum mechanics there has been a desire to control dynamics of quantum systems. The generation and c- trol of quantum coherence in matter by optical means, in particular, represents a viable way to achieve this longstanding goal and semiconductor nanostructures are the most promising candidates for controllable quantum systems. Optical generation and control of coherent light-matter states in semiconductor quantum nanostructures is precisely the scope of the present book. Recently, there has been a great deal of interest in the subject of quantum coh- ence. We are currently witnessing parallel growth of activities in different physical systems that are all built around the central concept of manipulation of quantum coherence. The burgeoning activities in solid-state systems, and semiconductors in particular, have been strongly driven by the unprecedented control of coherence that previously has been demonstrated in quantum optics of atoms and molecules, and is now taking advantage of the remarkable advances in semiconductor fabrication technologies. A recent impetus to exploit the coherent quantum phenomena comes from the emergence of the quantum information paradigm.

The unprecedented control of coherence that can be exercised in quantum optics of atoms and molecules has stimulated increasing efforts in extending it to solid-state systems. One motivation to exploit the coherent phenomena comes from the emergence of the quantum information paradigm, however many more potential device applications ranging from novel lasers to spintronics are all bound up with issues in coherence. The book focuses on recent advances in the optical control of coherence in excitonic and polaritonic systems as model systems for the complex semiconductor dynamics towards the goal of achieving quantum coherence control in solid-state. Special attention is given to the optical control of spin coherence. These front edge research topics are presented in the form of review articles by leading scientists.



160,49 €
149,99 € (zzgl. MwSt.)

Lieferfrist: bis zu 10 Tage

Artikelnummer: 9783642263828
Medium: Buch
ISBN: 978-3-642-26382-8
Verlag: Springer
Erscheinungstermin: 07.09.2012
Sprache(n): Englisch
Auflage: 2010
Serie: NanoScience and Technology
Produktform: Kartoniert
Gewicht: 546 g
Seiten: 338
Format (B x H): 155 x 235 mm