Edited by Benoit Deveaud

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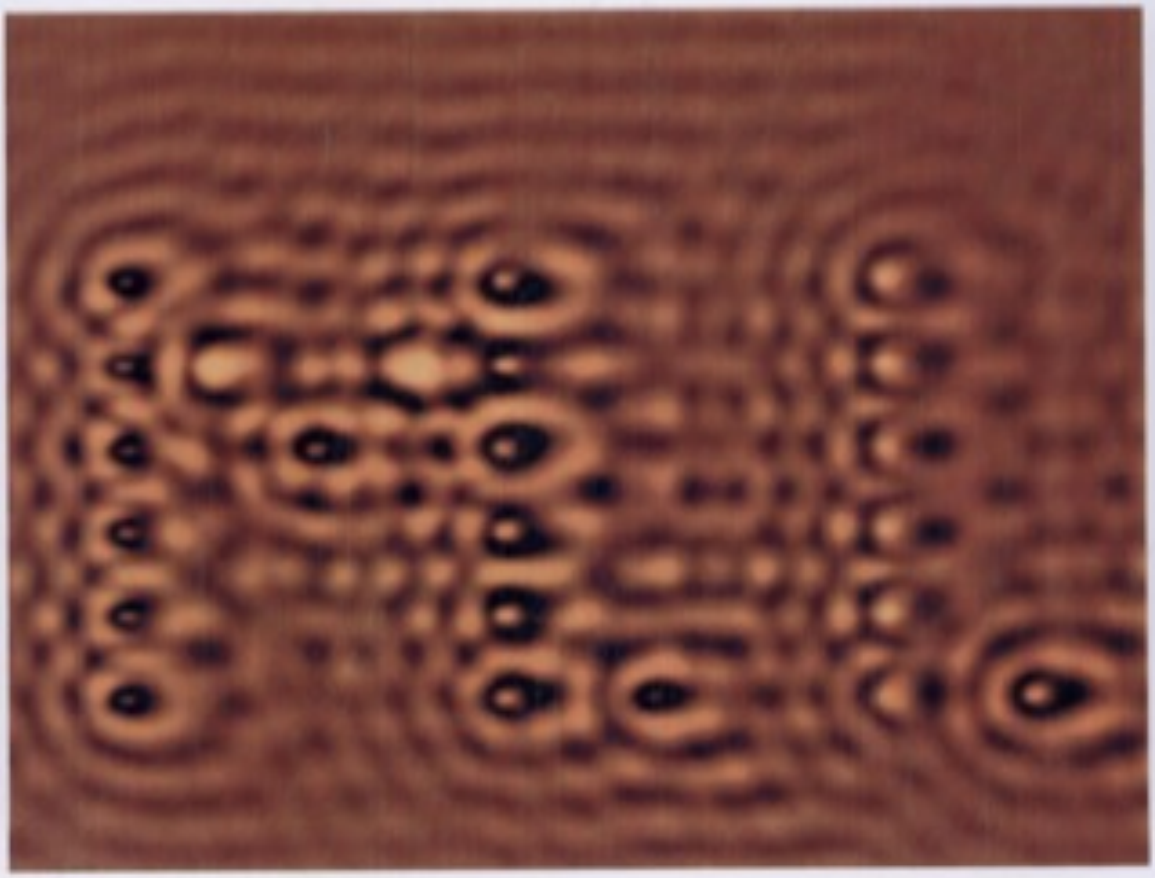
The Physics of Semiconductor Microcavities

From Fundamentals to Nanoscale Devices



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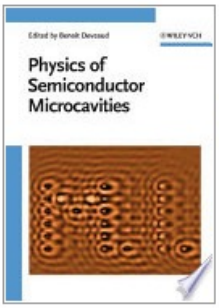

Benoit Deveaud
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Electron and photon confinement in semiconductor nanostructures is one of the most active areas in solid state research. Written by leading experts in solid state physics, this book provides both a comprehensive review as well as a excellent introduction to fundamental and applied aspects of light-matter coupling in microcavities.

Topics covered include parametric amplification and polariton liquids, quantum fluid and non-linear dynamical effects and parametric instabilities, polariton squeezing, Bose-Einstein condensation of microcavity polaritons, spin dynamics of exciton-polaritons, polariton correlation produced by parametric scattering, progress in III-nitride distributed Bragg reflectors using AlInN/GaN materials, high efficiency planar MCLEDs, exciton-polaritons and nanoscale cavities in photonic crystals, and MBE growth of high finesse microcavities.

The activity in EPFL developed from then on in two main directions. In the fundamental one, many results were obtained on the linear and NL behaviour of CPs, experimentally or theoretically, in Ilegems', Deveaud's and Quattropani's groups (see the various contributions to this volume). In Ilegems' group, besides the systematic study of polariton linewidth, particularly noteworthy are: (i) the observation a resonant Rayleigh scattering over a ring; (ii) the coherent backscattering from

CPs which act as a disordered 2D optical system; and (iii) the observation of single beam NL emission phenomena, with specific far-field emission patterns, most certainly connected with the inhomogeneous excitation density (see Romuald Houdré's contribution in this volume).

As regards applications, a 'strategic retreat' was operated towards weak coupling microcavities, within the European SMILES project mentioned above, to be followed by a second project, SMILED (semiconductor microcavity LEDs). EPFL made major contributions in red microcavity LEDs, in modelling and optimization, etc., culminating in setting the world record in planar microcavity with an overall efficiency of 28% [39]. Still today, the theses by Paul Royo and Daniel Ochoa are mines of information for researchers in the field [60]. More recently, work has developed in activities on photonic crystals geared towards integrated photonics applications.