



# Quantum Confined Laser Devices: Optical gain and recombination in semiconductors (Oxford Master Series in Physics)

*Peter Blood*

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The semiconductor laser, invented over 50 years ago, has had an enormous impact on the digital technologies that now dominate so many applications in business, commerce and the home. The laser is used in all types of optical fibre communication networks that enable the operation of the internet, e-mail, voice and skype transmission. Approximately one billion are produced each year for a market valued at around \$5 billion. Nearly all semiconductor lasers now use extremely thin layers of light emitting materials (quantum well lasers). Increasingly smaller nanostructures are used in the form of quantum dots. The impact of the semiconductor laser is surprising in the light of the complexity of the physical processes that determine the operation of every device.

This text takes the reader from the fundamental optical gain and carrier recombination processes in quantum wells and quantum dots, through descriptions of common device structures to an understanding of their operating characteristics. It has a consistent treatment of both quantum dot and quantum well structures taking full account of their dimensionality, which provides the reader with a complete account of contemporary quantum confined laser diodes. It includes plenty of illustrations from both model calculations and experimental observations. There are numerous exercises, many designed to give a feel for values of key parameters and experience obtaining quantitative results from equations. Some challenging concepts, previously the subject matter of research monographs, are treated here at this level for the first time.

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