

RMOSA

Rocky Mountain Section of the Optical Society of America

Joint RMOSA/IEEE-LEOS Seminar & Meeting

Thursday, February 21, 2008

Refreshments: 7 p.m. :: Seminar: 7:30 p.m.

CSU Ft. Collins,
[Lory Student Center](#) Rm 220-2

Many-body effects in semiconductor lasers

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Abstract: The typical description of semiconductor lasers treats the carriers contributing to laser gain as free (noninteracting) particles. While such a description provides some useful insight, its inadequacies show up in analyses of high-quality samples and advanced laser structures, where one clearly sees signatures of the more subtle Coulomb interaction among carriers. Since Coulomb interaction processes always involve more than one carrier, the resulting effects are often called many-body effects.

This talk traces the development of a many-body description of semiconductor lasers. The Coulomb interaction effects impacting semiconductor laser operation and their incorporation into a conceptually straightforward theory for investigating the underlying physics will be discussed. A noteworthy example of the successes of the theory is in the solution to the longstanding semiconductor laser lineshape problem. Also presented are examples illustrating significant many-body influences in laser systems, such as VCSELs, wide-bandgap III-N gain materials and quantum-dot structures.

Bio-Sketch: Weng Chow received the Ph.D. degree in physics from the University of Arizona. His dissertation work involved fluctuation phenomena in quantum optics. At present, he is a Distinguished Member of the Technical Staff at Sandia National Laboratories. Weng Chow's primary research interest is in the application of microscopic theory to semiconductor laser device development. Some of this work is described in two texts, *Semiconductor-Laser Physics* and *Semiconductor-Laser Fundamentals: Physics of the Gain Materials*. His other interests include laser gyros, phased arrays, coupled lasers, quantum optics and optical ignition of pyrotechnics. Weng Chow also holds the positions of Research Professor of Physics at Texas A&M University, Adjunct Professor of Optical Sciences at the University of Arizona and Honorary Professor of Physics at Cardiff University. He has served on the CLEO semiconductor laser program committee and is an associate editor of *IEEE Journal of Quantum Electronics*. Weng Chow is a fellow of the Optical Society of America, and recipient of the Dept of Energy, Basic Energy Science/ Material Science Award, the Alexander von Humboldt Senior Scientist Award and the LEOS Distinguished Lecturer Award.

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