

The Photonics Institute

Time scale dependent carrier and gain nonlinearities in quantum dot lasers and amplifiers

By

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Host: Prof N. Zheludev

Abstract

Quantum dot based optical gain media have dominated semiconductor laser research for more than two decades. Their potential advantages over higher dimension semiconductor structures have been proven often in research laboratories and some of those have now emerged also in commercial devices. Most reported research made use of GaAs based quantum dots emitting at wavelengths below 1300 nm. However, recent advances in InP, based quantum dot material, emitting in the 1550 nm wavelength range where the available optical gain is three times larger than in GaAs, in laser performance in terms of temperature stability and most noticeably dynamic properties. This talk addresses the dynamical properties of InP based quantum dot lasers and optical amplifiers. The dynamics are analyzed on three time scales: few to tens of ps where modulation capabilities are determined; 1-2 ps which determines the carrier dynamics and the nonlinear gain properties and sub 200 fs where quantum coherent phenomena dominate. Detailed modelling and various advanced experimental tools are needed to fully understand the dynamical properties.



Short Biography

Prof Eisenstein holds the Seiden chair in Optoelectronics. He received his PhD in 1980 from the University of Minnesota and then joined the AT&T Bell Laboratory Crawford Hill Research Laboratory where he worked for 10 years at the Photonic Circuits Dept. on dynamics and noise of diode lasers and amplifiers as well as advanced fiber optics systems. He pioneered the work on semiconductor optical amplifiers specializing in facet coating, device modelling and characterization, in particular for quantum well optical amplifiers. In 1989 he joined the Electrical Engineering Dept. at Technion and started the first large research activity in fiber optics and related technologies of any Israeli university. His activities have covered over the years the topics of diode lasers and amplifiers, nano photonics, mainly photonic crystal devices, atomic clocks microwave photonics and fiber optics systems.

Prof Eisenstein was awarded the Alexander von Humboldt Award in 2007 at the TU-Berlin where he has spent a sabbatical leave as guest Professor in 2011 and was invited back as a return Humboldt Awardee, a rather rare invitation. In 2012, he was elected Foreign Member at The Istituto Veneto di Scienze, Lettere ed Arti-a prestigious Venetian academy. In 2014, he received the William Streifer Award of the IEEE. From 2013, Prof Eisenstein is the director of the Russell Burrie Nanotechnology Institute (the largest research entity in Israel with over 150 faculty members belonging to 14 departments and 350 graduate students. Prof Eisenstein is the author of some 450 journal and conference papers and served on numerous conference organizing committees.

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