Applied Mathematics Seminar

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Benjamin Lingnau

Physics Department, University College Cork

Multimode Dynamics of Long-Cavity Semiconductor Lasers

Semiconductor lasers are ubiquitous in modern technology, be it as optical sources for telecommunication or in optical LIDAR systems for distance measurements in autonomous vehicles. Many intricate designs have been developed to make these lasers single-mode, i.e., have them emit at only a single wavelength of light. If it was possible to instead use multimode lasers with many different emitted wavelengths, the laser design could be much simpler and ultimately money could be saved in their fabrication. This would, however, require taming of the laser emission to suit the needs of the desired application. A thorough theoretical understanding of the dynamical properties of these lasers is thus necessary. Traditional multimode laser models rely on an a-priori separation of the laser emission into its different modes. While numerically efficient, such models fail when describing dynamics on the time scale close to the mode frequency spacing. We therefore derive a numerical model based on a delay-differential equation approach to consistently describe the multimode laser dynamics, showing good agreement with experimental measurements. We analyse the multimode dynamics of a multimode laser both when free-running laser as well as under external optical injection. In the injected laser, we focus on the transition between the locking regions of neighbouring FP modes, which could not be described using traditional multimode rate-equation models, and highlight the differences compared to optically injected single-mode lasers.

Wednesday, 09.10.2019 · 16:00 · WGB G08

University College Cork · Western Road · Cork · T12 XF62