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Ultrashort optical pulse generation in quantum dot lasers

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This work uses semiconductor quantum dots, which are nanoscale inorganic materials, in order to achieve extremely short optical light pulses. Such pulses find use in high bit rate optical communications, wave division multiplexing, microscopy, multi-photon imaging and the generation of terahertz signal sources. Passively mode locked ultra-short pulses are created using an absorber section within a quantum dot lasing cavity, and the repetition rate, or time between successive pulses, is controlled by the length of the cavity. The work confirms the merits of random population for the generation of ultra-short pulses. When the quantum dots are randomly populated, they are independently occupied, which allows access to the entire gain spectrum. Sub pico-second pulse-widths were achieved using these methods, without any significant device engineering. A relatively simple method for significantly improving the optical pulse width when the dots are randomly populated will also be highlighted. These techniques can be applied to any quantum dot material.

Biography

Ian O'Driscoll obtained his PhD at UCC, Ireland in 2008, where he studied the carrier dynamics of InAs quantum dots. He then worked at Cardiff University, UK, as a Research Associate until 2012, where he investigated the physics of quantum dot laser materials and the consequences of carrier localization on device behavior. Since 2013, he works at the Tyndall National Institute, Ireland, where he is a recipient of the Starting Investigator Research Grant funded by Science Foundation Ireland. He has published over 30 papers in reputed journals and currently serves as Guest Editor for a special issue in *MDPI Photonics*.

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