Jing Bai et al., J Laser Opt Photonics 2016, 3:2 (Suppl)
http://dx.doi.org/10.4172/2469-410X.C1.005

Investigation on soliton related effects in mid-infrared quantum-cascade lasers

Jing Bai[1], **Hanquan Wang**[2] and **Debao Zhou**[1]
[1]University of Minnesota Duluth, USA
[2]Yunnan University of Finance and Economics, P R China

Since the first demonstration in 1994, quantum-cascade lasers (QCLs) have become one of the most important solid-state mid-infrared (MIR) coherent light sources for various applications in environment sensing, medical diagnosis and defense and free-space communication. Dynamics analysis and stable pulse progression of MIR QCLs are crucial in order for QCLs to have reliable performance in these applications. An explicit description of dynamics of QCLs is inevitably complicated when compared to conventional lasers because of the unique combination of ultrafast carrier scatterings and gain recovery, significant non-linearities and dispersion effect in a QCL medium. Discussions on dynamics in MIR QCLs have been mostly focused on the stability analysis. However, the interplay between the non-linearity and dispersion effect during the QCL coherent pulse progression has received less attention. Especially, in a nonlinear dispersive lasing medium, the combination of group-velocity dispersion (GVD) and self-phase modulation (SPM) could possibly lead to the soliton formation. A measurement of GVD in the MIR QCLs has been reported. The interaction between the GVD and the saturable absorber (SA) in the self-induced transparency (SIT) modelocking of QCLs is discussed, where the analysis is based on the evolution of electric field only and the coherence effect in the lasing transition is not included. In our current study toward the soliton formation in QCLs, we got the opportunity to carefully examine each of those two effects and analyze their interaction on the coherent pulse progression in both time-domain and frequency-domain.

Biography

Jing Bai is an Associate Professor and the Director of Graduate Studies (DGS) in Department of Electrical Engineering at University of Minnesota Duluth (UMD). She received her PhD degree in Electrical and Computer Engineering at Georgia Institute of Technology in 2007. His current research activities focus on nano-photonics, nano-photovoltaics, non-linear optics and nanoscale biomedical devices. Her research at UMD has been supported by the National Science Foundation (NSF), the Whiteside Institute for Clinical Research, the MN Drive Initiatives, and the Graduate School of University of Minnesota.

jingbai@d.umn.edu

Notes: