Jana Soumendu, J Laser Opt Photonics 2018, Volume 5
DOI: 10.4172/2469-410X-C1-023

Dissipative soliton in VCSEL

Jana Soumendu
Thapar Institute of Engineering and Technology, India

Dissipative soliton (DS) are localized structure e.g., wave and pulse in lossy systems. Such DS has been excited in form of bright spot on dark background in vertical cavity surface emitting laser (VCSEL) based models in conjugation of frequency selective feedback (FSF). These DS are popularly referred as cavity soliton (CS). DS in cavity or cavity soliton (CS) exhibits intriguing dynamics, which is supported by the large area of VCSEL. The parametric space for stabilization and control of CS has been identified. The role of system randomness, an unavoidable feature that arises from multiple parameters, has been explored. Since CS dynamics is very sensitive to the any inhomogeneity present in the system we explore the possibility to use it to design an alternate microscopy, namely, 'soliton force microscope'. However, the size of the CS is pivotal to decide the resolution of the microscope. Emphasis has given to reduce the CS spot size. Also, we searched for the systems which can be scanned with the existing size of CS. The result may lead to design a 'soliton force microscope' primarily with moderate resolution. A sustained CS or CS cluster requires a stable background. We found two distinct types of CS on a stable background. This may lead to realization of three-level logic. Besides, CS may be exploited to design memory devices. An essential feature of CS is the presence of their bistability character, which can be better realized by introducing a saturable absorbing material or saturable absorber (SA) in the cavity. Generally semiconductor saturable absorber mirrors are used. We explored the potential of graphene and other 2D materials as SA in VCSEL. Particularly, graphene eases the CS generation significantly as well as upgrades the CS system as an efficient biomedical sensor. The future line of investigation is highlighted.

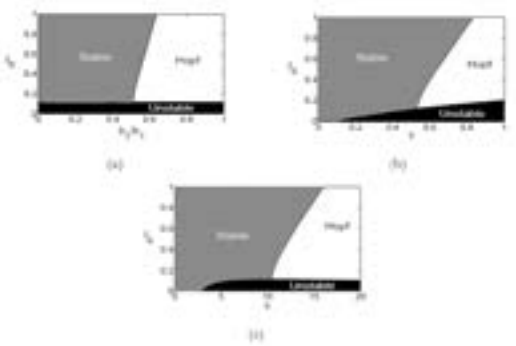

Figure 1: The stable, Hopf instable and unstable regions for cavity solitons in VCSEL-FSF-SA for different sets of system parameters.

Recent Publications

1. Ackemann T, Radwell N, Noblet Y and Jager R (2012) Disorder mapping in VCSELs using frequency-selective feedback. Optics Letters 37(6):1079-1081.
2. Tlidi M, Vladimirov A G, Pieroux D and Turaev D (2009) Spontaneous motion of cavity solitons induced by a delayed feedback. Physical Review Letters 103:103904.
3. Kaur B and Jana S (2018) Cavity soliton molecules and all-optical push-broom effect. Journal of Lightwave Technology 36(12):2463-2470.
4. Kaur B and Jana S (2017) Generation and dynamics of one-and two-dimensional cavity solitons in a vertical-cavity surface-emitting laser with a saturable absorber and frequency-selective feedback. Journal of the Optical Society of America B 34:1374-1385.
5. Parmar G S, Jana S and Malomed B A (2017) Dissipative soliton fiber lasers with higher-order nonlinearity, multiphoton absorption and emission, and random dispersion. Journal of the Optical Society of America B 34(4):850-860.

Biography

Jana Soumendu obtained his MSc degree in 2001 from Vidyasagar University, India and PhD in 2008 from Birla Institute of Technology (BIT), Mesra, India. He worked with the CNQO group at University of Strathclyde, Glasgow, UK, during his BOYSCAST Postdoctoral Fellowship tenure. Currently, he is an Associate Professor at School of Physics and Materials Science, Thapar Institute of Engineering and Technology, Patiala, India. His research interest includes nonlinear optics, photonics and nonlinear dynamics. He published nearly fifty research papers in peer reviewed international journals and conference proceedings. He published a book entitled *"Nonlinear Pulse and Beam Propagation"*. He is a Referee of many internationally renowned research journals. He is also a Visvesvaraya Young Faculty Research Fellow.

soumendu.jana@thapar.edu

Notes: