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Degenerate cavity lasers and their applications

Degenerate cavities are known from long time, but recently these have attracted lot of attentions and exploited for both practical applications as well as for the basic research. Degenerate cavity lasers support an enormous amount of spatial modes (~10^5), which are degenerate in losses and can lase equally. These novel sources allow efficient controlling of spatial coherence, where the number of spatial modes supported by laser can be controlled from 1 to as many as 320,000. Moreover, the output energy remains relatively constant over the entire tuning range of spatial coherence. These were also demonstrated for general manipulation of the spatial coherence properties of the laser by resorting to more sophisticated intra-cavity masks. These can be used for speckle-free wide field imaging systems, dynamic multimodality biomedical imaging, and can be employed in applications which require tailored spatial coherence properties. Degenerate cavity lasers have also shown an important method for generating and phase locking large array of lasers in various network geometries. The phase locking of large array of lasers can generate high powers with tight focusing. For the basic research phase locked lasers serve as a platform to investigate the behaviour of coupled nonlinear oscillators and complex network dynamics. Large array of coupled lasers has also exploited for simulating spin systems and solving computationally hard problems. For example, degenerate cavity lasers were shown to investigate geometric frustration in the Kagome lattice, real-time wave front shaping through scattering media by all-optical feedback and rapid phase retrieval. In this talk I will present the experimental and theoretical findings of degenerate cavity lasers and their potential applications for both applied and basic research.

Speaker Biography

Vishwa Pal joined Indian Institute of Technology Ropar, India, as an assistant professor of Physics in May 2018. He received his PhD degree in 2014 from School of Physical Sciences, Jawaharlal Nehru University, New Delhi, India. He has done part of his PhD at CNRS Laboratories Aime Cotton, Orsay, France. During his Ph.D. program, he investigated semiconductor laser systems. After Ph.D., he received a 3-years PBC fellowship for outstanding postdoctoral researcher by the Council for Higher Education of Israel. In 2018, he joined CREOL, The College of Optics and Photonics, Florida, USA, as a research scientist and worked on synthesizing non-diffracting optical beams in free space by exploiting space-time correlations. In 2018, he also received Marie Sklodowska-Curie Actions Individual Fellowship by European Commission.

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