University of Crete
Department of Physics

Physics Colloquium

Thursday, 13 January 2022 | 17:00 – 18:00, Online with ZOOM

Semiconductor membrane lasers, integrated nonlinear optics, and THz applications

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ABSTRACT

I will present a novel laser platform based on epitaxially grown semiconductor membrane quantum well lasers transferred on substrates of silicon carbide and oxidized silicon. We can demonstrate coherent laser arrays in a waveguide geometry and we record lasing thresholds as low as 60 mW of pump power. We study the emission of single lasers and arrays of lasers in the sub-mm range. We are able to create waveguide laser arrays with modal widths of approximately 5-10 μm separated by 10-20 μm, using real and reciprocal space imaging we study their emission characteristics and find that they maintain their mutual coherence while operating on either single or multiple longitudinal modes per lasing cavity. The laser arrays are optically re-configurable via manipulation of the shape, power and position of the pump laser beam. This technology can be integrated as pump laser in other photonic technologies, such as: nonlinear waveguide systems; Kerr micro-combs; silicon photonics circuits; optical computing concepts such as neural networks. Finally it can be used to implement loss and gain topologies for demonstration of non-Hermitian systems.

Our work in supporting quantum technologies focuses on the development of micro-comb frequency sources. I will present our work on the spectral broadening performance of silica clad and unclad Tantalum pentoxide. We have demonstrated octave spanning supercontinuum in linear waveguide and now we work to implement micro-rings which according to our simulations can achieve frequency comb generation with 10s of mW of pump.

I will give also during my talk an overview of my research in THz technology in tunable metamaterial systems incorporating Graphene and Liquid crystals; on THz material identification using machine learning and detection of protein interactions with water in THz micro-fluidics.

ZOOM Link: https://zoom.us/j/96667863236?pwd=MGplZVZ1WWp4L0gyNzNwTTdBVFEwQT09