Book of Abstracts

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INVITED

Lattices of Spin-polarised Interacting Polariton Condensates: A novel quantum simulator platform

P. G. Savvidis[1,2]
[1]*Department of Materials Science and Technology, University of Crete, Greece*
[2]*ITMO University Russian, Federation*

While ultracold atoms have been very successful in probing closed equilibrium condensed matter phenomena, open non-equilibrium quantum systems have attracted a strong and growing interest recently because of their rich dynamics and nontrivial steady states. Exciton-polaritons have emerged as a prime candidate for the non-equilibrium system of interacting bosons. Polaritons are mixed light-matter bosons resulting from the strong coupling of photons in a microcavity and excitons in a quantum well which can condense into macroscopically coherent many-body states. As a prime example of the non-equilibrium nature of polariton condensates, we have shown recently that polariton condensates can spontaneously magnetize [1], and we can control their spin optically and electronically [2]. Interestingly, the coupling of the spin of two coupled condensates can be also controllably aligned (or anti-aligned) [3]. Hence, a lattice of polariton condensates is expected to model a non-equilibrium interacting spin system with unusual properties [4].

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INVITED

Mid-infrared Photonics based on Quantum Cascade Lasers and Detectors

B. Hinkov, B. Schwarz, R. Szedlak, M. Holzbauer, A. Harrer, H. Detz, A. M. Andrews, and G. Strasser
Institute of Solid State Electronics and Center for Micro- and Nanostructures, TU Wien, Floragasse 7, 1040 Vienna, Austria

Since their first demonstration in 1994 [1], quantum cascade lasers (QCLs) have matured as keyenabling devices for various applications in the mid-IR spectral region between 2.6 - 28 µm. Prominent examples include trace-gas spectroscopy (e.g. CO2, N2O, CH4) [2] or medical diagnosis [3]. One major advantage of QCLs is their simultaneous usability as detectors (QCDs) for the identical quantum structures when unbiased. This opens new pathways for highly integrated sensor systems based on monolithic integration (see e.g. Fig. 1). We will review our recent work on developing highly-integrated and miniaturized laser-detector systems using quantum cascade technology. They are based on bi-functional active regions (i.e. identicalwavelength emission and detection) [4] and can e.g. be merged with ring-cavity concepts together with 2ndorder distributed feedback gratings for vertical light extraction.

Literature

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