13 March 2019

Photonic crystal cavities with germanium vacancy color centers in diamond (Conference Presentation)

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Proceedings Volume 10904, Laser Resonators, Microresonators, and Beam Control XXI; (/conference-proceedings-of-spie/10904.toc) 1090411 (2019) https://doi.org/10.1117/12.2507722 (https://doi.org/10.1117/12.2507722)

Event: SPIE LASE (/conference-proceedings-of-spie/browse/SPIE-Photonics-West/SPIE-LASE/2019), 2019, San Francisco, California, United States

Abstract

Development of quantum information processing requires realization of solid state structures able to manipulate light or matter quantum bits. One of the promising candidates for been active elements of such solid-state platform are color centers in diamond. The most famous nitrogen-vacancy color center has number of attractive features and found a lot of applications in sensing and imaging. Still, it has number of considerable disadvantages, among which it sensitivity to the surface damages and thus its incompatibility with nanostructures. On another side implementation of nano- and micro- structures enabled considerable progress in manipulation of light quanta. In particular photonic crystal cavities allowed to realize strong coupling of cavity and spin system. This led to demonstration of efficient light collection and realization of simple quantum gates with artificial or real atoms. Novel color centers such as silicon-vacancy or germanium-vacancy color center due to inversion symmetry of the electron structure are not sensitive to the surface damages and presence of surface nearby. Thus, those are perfect candidates for been combined with photonic crystal structures. Novel technologies enabled growing of the nanodiamonds of ultra-small size having well-defined color center inside. Along with techniques to position those precisely on the nano- and micro structures these achievements opened opportunity to integrate high-fines photonic-crystal cavities with the germanium-vacancy containing nanocrystals thus forming fully solid-state platform for quantum manipulation of light. In my talk I will describe our progress towards realization of this ambitious goal.

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Alexey Akimov (/profile/Alexey.Akimov-765433) and Abdulrahman Alajlan (/profile/notfound?author=Abdulrahman__Alajlan_)"Photonic crystal cavities with germanium vacancy color centers in diamond (Conference Presentation)", Proc. SPIE 10904, Laser Resonators, Microresonators, and Beam Control XXI, 1090411 (13 March 2019); https://doi.org/10.1117/12.2507722 (https://doi.org/10.1117/12.2507722)

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