Bidirectional Plasmon-Exciton Coupling Between Quntum Emitters and Gold Nanodisks Array

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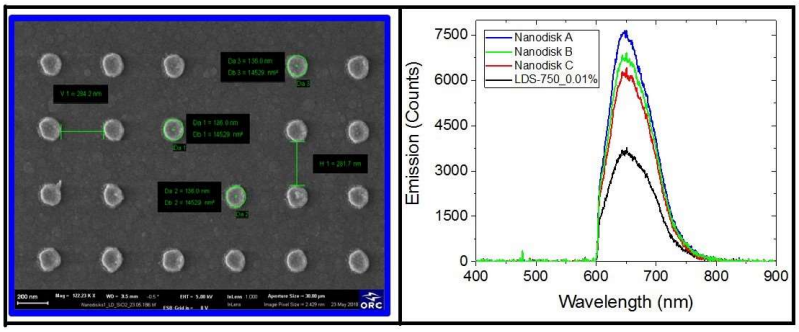

Nano-scaled plasmonic−excitonic systems are offering promising characteristics in the studies of light−matter interaction to achieve light amplification via enhancement in emission and absorption rates [12]. In addition, these hybrid nanostructures provide loss compensation in plasmonic metamaterials and single photon sources (SPSs) with higher efficiency [3−4]. The hybridization of plasmonic nanostructures with different quantum emitters (QEs) such as fluorescent dye molecules, core-shell quantum dots (QDs) or 2D hexagonal boron nitrite (h-BN) [5] can open an avenue towards practical applications for novel light sources, which are the vital components of future quantum technologies.

In this regards, we have designed and fabricated an array of plasmonic nano-disks that interacts with different types of QEs in visible range of wavelength. The proper geometry of our design provides such absorption-reflection properties which spectrally overlap with emission spectrum of the QE. Alongside such spectral overlap, a thin layer of the dielectric layer between the plasmonic structures and a gain medium provides the possibility of spatial overlap. The interaction between the strong subwavelength localized field at the edges of the gold nano-disks and QEs, enhances Purcell factor towards the modification of the fluorescence and decay time of QEs. This approach allows enhanced emission from different emitters embedded in hybrid quantum systems. In this work, we study the interaction of the fluorescent dye molecules (LDS 750) and CdSe/ZnS hydrophobic QDs with the array of plasmonic nano-disks. The performed study will lead us towards investigating of the nano-antennas with h-BN layers for emission enhancement and nano-lasing purposes.

References:

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