NS/2DMD-11-3-I-TH

Novel classical and quantum photonic devices by manipulating light-matter interactions in one and two-dimensional systems

Ritesh AGARWAL*

Materials Science and Engineering, *University of Pennsylvania*, *USA*

riteshag@seas.upenn.edu

Strongly confined electrical, optical and thermal excitations drastically modify material's properties and break local symmetries that can enable precisely tunable novel responses and new functionalities. With an emphasis on low-dimensional materials such as nanowires and monolayer MoS_2, we will discuss how extreme confinement of fields interacting with low-dimensional materials produces new and unexpected materials response. For example, we will discuss how the strong plasmonic fields can lead to a new paradigm of nanoscale photonics such as optical emission in the visible region and nonlinear optical devices. Furthermore, by utilizing the fundamental symmetry breaking properties of fields, new quantum phenomena such as chirality-dependent optical and electronic properties will be discussed in non-chiral materials and utilized to enable new functionalities that are only possible in strong spin-orbit coupled materials. The role of geometry in low-dimensional systems to produce new properties in the presence of symmetry breaking fields will be discussed. Finally, effect of plasmons on light matter interactions in 2D excitonic crystals will be discussed, which can be engineered to produce novel responses such as enhanced and tunable emission, Fano resonances and strong exciton-plasmon polaritons, which can be precisely controlled to produce novel device concepts.