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Seminar Presentation: 11:00am – 12:00pm
Cymer Conference Center, SME 248

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

Abstract:
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 MoS2, we will discuss how extreme confinement of fields interacting with 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 Si 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 by geometry and applied fields to produce novel device concepts.

Biosketch:
Ritesh Agarwal is a Professor in the Department of Materials Science and Engineering at the University of Pennsylvania. He earned his undergraduate degree from the Indian Institute of Technology, Kanpur in 1996, and a master's degree from the University of Chicago. He received his PhD in physical chemistry from University of California at Berkeley in 2001 researching liquid and protein solvation and photosynthesis via nonlinear optical techniques. After completing his PhD., Ritesh was a postdoctoral fellow at Harvard where he studied the photonic properties of semiconductor nanowires. His current research interests include structural, chemical, optical and electronic properties of low-dimensional systems. Ritesh is the recipient of the NSF CAREER award in 2007, NIH Director's New Innovator Award in 2010 and the SPIE Nanoengineering Pioneer Award in 2014.