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Quantum Science and Technology

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Recent understanding of Quantum Science and Technology has exceeded our expectations for meeting the requirements of human society for different applications, such as telemedicine, in the 21st century. Free-space optical (FSO) communication is considered to be one of the key technologies for realizing ultra-high-speed multi-gigabit-per-second (multi-Gb/s) large-capacity communications. Using lasers as signal carriers, FSO laser communications (Laser-Com) can provide a line-of-sight, wireless, high-bandwidth, communication link between remote sites. Rapidly growing use of the Internet and multimedia services has created congestion in the telecommunications networks and placed many new requirements on carriers. IR Laser transmitters offer an intermediate low-risk means to introduce desired network functionalities with extremely high bandwidth. The wireless aspect of FSO Laser-Com can be a crucial advantage, particularly in local area networks (LANs) and metropolitan area networks (MANs) where in cities the laying of optical fibers is expensive. FSO Laser-Com offers substantial advantages over conventional RF wireless communications technology, including higher data rates, low probability of intercept, low power requirements, and much smaller packaging. FSO Laser-Com systems have proven to be a viable alternative to optical fiber based systems in several applications, as the technology comes closer and closer to providing the 5-nines (99.999%) service that many different types users require of their data networks.

Nature offers us a full assortment of atoms, but Quantum engineering is required to put them together in an elegant way to realize functional structures not found in nature. A particular rich playground for Quantum era, is the so-called III-V semiconductors, made of atoms from columns III and V of the periodic table, and constituting compounds with many useful optical and electronic properties in their own right. Guided by highly accurate simulations of the electronic structure, modern semiconductor quantum devices are literally made atom by atom using advanced growth technology to combine these materials in ways to give them new proprieties that neither material has on its own. Modern mastery of atomic engineering, allows high-power and highly efficient functional devices to be made, such as those that convert electrical energy into coherent light or detect light of any wavelength and convert it into an electrical signal.

This talk will present the future trends and latest world-class research breakthroughs that have brought quantum engineering to an unprecedented level, creating light detectors and emitters over an extremely wide spectral range from deep -UV).2 to THZ 300 microns. As well as their integration with Si photonics.

Biography

Manijeh Razeghi is the Walter P. Murphy Professor of Electrical Engineering at Northwestern University and Director of the Center for Quantum Devices, which she founded in 1991 after a successful 10-year career as the Director of Exploratory Materials at Thomson-CSF, France. She is one of the leading scientists in the field of semiconductor science and technology, having pioneered the development and implementation of major modern epitaxial techniques. Her current research interest is in nanoscale optoelectronic quantum devices from deep-UV up to terahertz. At Northwestern University she has commercialized aluminum-free pump lasers, developed type-II superlattices for next generation infrared imagers (an area in which she holds key patents), and currently holds most of the quantum cascade lasers records for high power and tunability. She has authored 18 books, 31 books chapters, and more than 1000 journal publications. She is editor, associate, and board member of many journals, including Nano Science and Nano technology. Her awards include the IBM Europe Science and Technology Prize, the SWE Lifetime Achievement Award, the R.F. Bunshah Award, the IBM faculty award, Jan Czochralski Gold Medal, and many best paper awards. She is a fellow of SWE, SPIE, IEC, OSA, APS, IOP, IEEE, and MRS.

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