The interplay of synchrotron light and nanotechnology- how it affects our daily life

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When electrons are circulating in an orbit at speed close to the speed of light, they emit light called synchrotron radiation, commonly known as synchrotron light; the device that produces it is called "synchrotron". The very bright, energy-tunable, highly collimated and pulsed light from modern synchrotrons has made enormous impact on all branches of science and technology. In this talk, I will describe in general terms what synchrotron light is, how it is different from ordinary light, its interplay with quantum phenomena, nanoscience and nanotechnology and its impact on our daily lives such as medicine, environment, electronics, green energy, and arts and archaeology.

Dr. T.K. Sham (Western, 1975), OC, FRSC, is a Distinguished University Professor at Western University in London Ontario Canada. He was on the staff of Brookhaven National Laboratory for a decade prior to returning to Western in 1988. He was the Director of the Canadian Synchrotron Radiation Facility at the Synchrotron Radiation Center, University of Wisconsin-Madison (1999-2008) and a founding member of the Canadian Light Source, a national facility of advanced photon technology in Saskatoon and a beam team leader of three beamlines (PGM, SGM and SXRMB) at CLS.

Dr Sham is presently a Tier I Canada Research Chair (2002-2023) in materials and synchrotron radiation. He conducts research in materials and the development and application of synchrotron radiation, especially in tracking the electronic structure, functionalities and performance of materials. Expertise include nanomaterial synthesis, bimetallic and semiconductor materials, surface and interface, photoemission, X-ray absorption, photon-in photon-out (X-ray emission, X-ray excited optical luminescence, resonant and non-resonant inelastic X-ray scattering) and X-ray microscopy. Recent interests include nanostructure phase transition and nanocomposites, in situ/operand studies of energy materials and devices (e.g. solar cells, batteries, fuel cells, catalysis and light emission), X-ray excited optical luminescence in the energy and time domain, nanomaterials for drug delivery, microbeam analysis of tissues, and cultural and heritage materials. Seminal works include EXAFS study of electron exchange reactions, X-ray-fragmentation of molecules, quantum confinement in porous silicon, blue light emitting carbon quantum dots, interplay of surface and bulk electronic structure in gold nanoparticles, single atom Pt catalyst, in situ/operando study of batteries and more recently a breakthrough in retrieving fine images from 19th century daguerreotypes (first commercial photography in human history) tarnished beyond recognition.

He has mentored many young scientists and engineers in Canada and abroad, including university professors, researchers in industry, staff at the Canadian Light Source and synchrotrons in Europe, US and Asia. He has been active in national and international scientific affairs, having served as a member of the Board of Directors for the Canadian Light Source (2001-2006) and Chair (2003-2006) of the International X-ray Absorption Society (IXAS).