Seminar of

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Laser Matter Interaction for Novel Nanoarchitectonics

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The physics of light matter-interaction with various kinds of nanostructures, including metallic (plasmonic), dielectric and semiconductors, 2D, as well as hybrid nanostructures holds the key in designing advanced functional optical/photonic devices and sensors. The use of lasers has actually created new opportunities for material nano-processing become more familiar with the cutting edge advances in this respect. On top of that the exotic interaction of intense nanosecond laser pulses with metallic surfaces produces high-density plasma at the point of impact. There is a tremendous interest in such table-top astrophysical sources for probing fast reaction dynamics, nano-scale imaging and lithography. We had previously established the maximal coupling of laser light to solid metallic targets to study the expansion behavior of laser produced silver plasma particularly in ambient liquid using space resolved optical emission spectroscopy and plasma instigated size controlled synthesis of silver nanoparticles via laser ablation Also, we were able to create green nanohybrid materials in-situ for bio-sensing and imaging as well as low toxic, highly luminous GQDs for chemical sensing. We have also designed MoS_2/graphene/metal nanocomposites by liquid phase laser ablation. Also, the nonlinear optical response of different metal organic frameworks and transition metal dichalcogenides (TMDCs), such as MoS_2 and WS_2 another core area of our research for the development of potential optical limiters and shutters. Recent studies have explored the fascinating phenomena of random lasing from colloids and electrospun fibers, and studied the analyses of the emission spectra, revealing new insights into the complex behaviour of such novel materials. In combination with a thorough experimental investigation, starting from their controlled synthesis processes to their structural and optical properties, high level *Ab initio* quantum mechanical and molecular dynamics studies were done to give valuable insights and can guide the design of the next generation photo generated advanced nanomaterials. Furthermore, the design of nano-devices went hand in hand with the development of these nanomaterials. These devices include, currently, the most investigated organic electronics devices, optical and non-enzymatic electrochemical biosensors, SERS sensors, optical limiters and random lasers.

Keywords: Optical emission spectroscopy, Nanohybrids, SERS, Optical limiters, Random Lasing

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