Dr. Ali Hussain Reshak
Visiting Scientist

Has born in Basrah – Iraq and got his B.Sc and M.Sc from Basrah University as Laser designer on Designing and construed the First Iraq's High power Laser System with output power 5 MW, and Ph.D from I. I. T. Roorkee (India). Since 2005 till now he is Associate Professor, Senior Scientist in South Bohemia University in Czech Republic as Group Leader of Computational workgroup - Condensed Matter Physics and Group Leader of Laser & Optical Microscopy laboratory. He has more than 150 papers published in High impact factor international journals; the last 85 papers were published in the last two years. In addition to one published Book and the second book under release for Nova Publishers – USA. He is Editor of three international journals and potential reviewer of several international journals, Phys. Rev B, Phys. Rev. Letter, J. Physical Chem. Also, a research collaboration with deferent research groups around Europe, India and China. He is a Theoretician and Experimentalist in the following:

- Condensed Matter Physics (Theoretical and Experimental).
- Laser, Microscopy & Spectroscopy to detect the vegetation area, forest, mountains, roads,……etc and pollution in air and water.
- Designing and constructions Two photon/multi-photon laser-scanning microscopy.
- Designing Optical Tweezers for any kind of Microscopy to trap the moving object
- Photonic Crystals & Biophotonics
- Nonlinear crystal (nanocrystal and Bulk crystal)

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A BRAIN GAIN MALAYSIA PROGRAM
by Ministry of Science, Technology and Innovation (MOSTI)

NANOTECHNOLOGY MATERIALS STUDY AND MANUFACTURING: LECTURES, RESEARCH AND KNOWLEDGE TRANSFER

By

ASSOC. PROF. DR ALI H. RESHAK
(CZECH REPUBLIC)

25th March & 1st April 2010
Time: 10am
Venue: KWSP, 10th Floor, Kangar, Perlis Malaysia

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The magic of the laser to uncover the true architecture of the nano/micro sized materials on 25th March 2010

- Multi-functional Two-Photon Laser Scanning Microscopy (MF-2PLSM) provides attractive advantages over conventional Two-Photon Laser Scanning Microscopy. Simultaneously measured the second harmonic generation (SHG) signals in the forward and backward directions as well as the two photon excitations fluorescence (TPEF) were done for some biological materials. This measurement show that some biological materials produce high SHG signal in both directions and the SHG signals strongly depend on the laser's status of polarization and the orientation of the dipole moment in the molecules that interact with the laser light. The SH imaging show that the structure of some biological materials has unusual structure with various categories and sizes. The novelty of this work is; (1) uncover the unusual structure of some sophisticated biological materials. (2) using the MF-2PLSM which I established by combing three platforms of laser scanning microscopy; the fluorescence microscopy, harmonic generation microscopy and polarizing microscopy for detecting the SHG signals in the forward and backward directions as well as the two photon excitation fluoresce (TPEF). With this MF-2PLSM one can use the SH imaging to uncover the true architecture of the living biological sample without photodamage or photobelching by utilizing the fact that the SHG is known to leave no energy deposition to the interacted matters due to their virtual energy conservation characteristic.

Second harmonic imaging of the birefringent Biomaterials reorienting under linearly polarized laser using the multi-functional Two-Photon Laser Scanning Microscope on 1st April 2010

- Second harmonic imaging reveals information about the structure of spatially oriented structures with an asymmetry. The second harmonic images of the birefringent biological particles were demonstreted. A multi-functional two-photon laser scanning microscope with blocking filters to suppress fluorescence generated both forward and backward second harmonic illumination to be captured. Upon illumination the birefringent biological particles changed their orientation affecting the SHG signal. The orienting effect of linearly polarized light on birefringent particles is easily understood; Since the light can carry angular momentum as well as linear momentum, the incident beam of linear polarization becomes elliptically polarized and gains angular momentum after impinging on a birefringent particle whose optical axis is not parallel to that of the polarization of the light. The resulting change in angular momentum generates a reaction torque on a particle. Since most the biological materials exhibit strong birefringence, the resulting anisotropic interaction with the linearly polarized laser beam strongly contributes to the optical torque orienting these particles which opens new direction to manufacture micromotors for micromechanical systems. The torque can be controlled by changing the laser's power. Rotating of the in vivo birefringent biological microparticles was successfully obtained from chloroplast.
- The first aim of this work is to describe experiments using linearly polarized laser to probe in vivo biological particles. The linearly polarized laser used to induce motion and tumbling of the chloroplast in cells of living tissue. The second aim of this work is the reconstruction of complementary images by eliminating the angle dependence of images when using linear polarized laser and show the true SHG images of the samples to uncover their structures. This will provide the biologists and medical researchers another useful visualization tool to explore the nature of living samples. The third aim is to provide the optical non-invasive nature desirable for microscopy applications.