Winter College on Optics in Environmental Science
2-13 February 2009

SMR2018

ORAL Presentation abstracts

LAMP SEMINAR SESSION I

1. GOGOI Ankur

Title:

Light scattering study of small particles by using multidetector array incorporated laser based probing setup

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Abstract:
A laser based light scattering setup which can be operated at three different incident wavelengths (543 nm, 594 nm and 632 nm) and uses an array of 16 static Si detectors has been designed and constructed. The system can measure scattered light signals from 100 to 1700 in steps of 10. Performance of the setup is evaluated by studying the scattering characteristics of polystyrene spheres of average size 500 nm and comparing the results with Mie predictions. The setup successfully measured the light scattering behavior of some aerosol (TiO2, SiO2, carbon black) and hydrosol (tropical fresh water diatoms) samples.

2. GRÜNHUT Vivian

Title:

Simulating Synthetic Aperture Radar data using rigorous theories of scattering from rough surfaces

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Abstract:
Microwave scattering can be used to obtain information about the dielectric properties or the geometric features of soil surfaces. Motivated by the future launch of Argentine satellites involving L-band full polarimetric Synthetic Aperture Radars, we have begun to investigate the pros and cons of using rigorous electromagnetic theories of scattering from rough surfaces to simulate polarimetric radar data. In this context, rigorous models can be useful for two different but complementary purposes. On the one hand, for checking the validity of common scattering theories, such as the physical optics, geometric optics or small perturbation theories, and on the other hand for simulating real polarimetric data obtained for surface targets characterized by geometric parameters with values in those ranges where the approximated methods are known to fail. Here we report some preliminary results obtained with a numerical code based on a perturbative solution of the integral

equation called the reduced Rayleigh equations. These results are expected to be valid for small-rms-height, small-rms-slope random rough surfaces and for any values of the electric permittivity and magnetic permeability of the material below the surface. To validate the code, we show that our numerical examples reproduce both the main features predicted by physical optics for the diffraction of light from deterministic corrugated surfaces as well as the widely-known enhanced backscattering phenomenon observed in random rough surfaces.

3. VINCENTI Maria Antonietta

Title:

Negative refraction and sub-wavelength resolution below the diffraction limit using a semiconductor-based superlens

Abstract:
We theoretically demonstrate negative refraction and sub-wavelength resolution below the diffraction limit in the UV and extreme UV ranges using semiconductors. The metal-like response of typical semiconductors such as GaAs or GaP makes it possible to achieve negative refraction and super-guiding in resonant semiconductor/dielectric multilayer stacks, similar to what has been demonstrated in metallo-dielectric photonic band gap structures. The exploitation of this basic property in semiconductors raises the possibility of new, yet-untapped applications in the UV and soft x-ray ranges.

4. THANUSUTIYAPORN Pimrapat

Title:

3-dimensional display

Abstract:
The objective of this project is to demonstrate two techniques to produce a three-dimensional display. The first technique employs the concept of Computer Generated Holography (CGH). The Fourier Transforms of two dimensional virtual images, in a form of sequence of frames are sent to an LCD panel of a standard projector at a real time. The original images are observed subsequently by illuminating with a coherent light. The second technique is the multiple angles holography. In this technique, different objects or different forms of the object are recorded at different angles on the same hologram. A dynamic image can be seen when the reference beam is scanned on the hologram over the range of the recording angles. These techniques are straightforward demonstrations of three dimensional holographic displays. All the experimental setups can be used as a prototype which is beneficial for many scientific and entertainment use imaging applications.

LAMP SEMINAR SESSION II

5. WEBER Christian

Title:

Remote sensing applied to Weeds detection in no-till systems:
a new tool in Argentinean Pampas

Christian Weber.
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Abstract:
Many years ago, in the Argentinean Pampas, could be seen large areas characterized by cattle eating grass. Nowadays, this has changed considerably. Cattle production has been shifted to other areas and in its place different crops have been planted under no-till systems. These production systems have some advantages over the traditional ones as the decrease the erosion effect produced by water and wind and the increase of soil organic matter. However, as a important disadvantage, large quantities of herbicides are needed.
Remote sensing has been identified as a promising technique for identifying weeds in crops, and potentially offers a solution to herbicides application.
In the Centro de Investigaciones Ópticas (CIOp) of Argentina, we have developed a low cost sensor that has Light emission Diode (led´s) as detector elements. This is due to the fact that leds can be used both as emissors, (its most know application) and as detectors. So, in this case led's are used as filters and photodiodes, that is to say, significantly reducing the cost of sensor manufacture.
In this work, I present the results of reflectance measurements performed with a led's based sensor. The results indicated that the latter method is possible for use with passive sensors to weeds detection in no-till agronomic system. I show the results obtained in the determination of the Normalized Difference Vegetation Index (NDVI) corresponding to 2007 field experiments concerning weeds detection in Soybean (*Glicine max* L.) sttubles to refine sensor-based herbicides rate recommendations.

6. CASAS BEDOYA Alvaro

Title:

Spectrometer on a chip for Biodiesel sensing applications

Abstract:
The aim of this research is to design a spectrometer-on-a-chip for biodiesel sensing applications; we propose a specific waveguide configuration to sense the absorbance, and a planar concave demultiplexer to measure the intensity at different wavelengths.

7. FIRDOUS Shamaraz

Title:

Polarized light Imaging and characterization of biomaterials

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Abstract:
We have characterized different biomaterials using polarized laser and 400-800nm arc lamp light. The biological materials due to its optical properties, birefringence, transmission, absorption scattering, and structural variation produce changes in light polarization. The microscopic, polarimetric and pathological data for cells, tissues and other biomaterials is presented. This study will enhance optical technologies in biomedical engineering, at cellular and sub cellular levels to study laser material characterization, and to develop methodologies for diagnosis and treatment of specific pathological conditions. Knowledge of optical properties of biological tissue is essential in both diagnostic and therapeutic applications of lasers in medicine. For useful clinical applications the optical properties should be determined quickly and non-invasively. This research will provide basic optical diagnostic techniques for tissue and biological materials.
Keywords: Optical properties, cell microscopy, laser tissue interaction, and biomaterials.

LAMP SEMINAR SESSION III

8. PATTANAIK Amitansu

Title:
Optical sensor systems for the atmospheric probing of chemical agents in the vis-ir region

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Abstract:
In the field of remote sensing, lasers play an important role due to their inherent capability of generating well-collimated beams with outstanding characteristics in high coherence, monochromaticity, and directivity. Laser remote sensing techniques provide powerful tools for scientific studies of atmosphere, environmental monitoring, measurement of air quality parameters, remote sensing of oceans and rivers, remote assessment of vegetation etc. Developments in laser technology such as second harmonic generation, high power compact diode pumped solid-state lasers, and tunable solid-state lasers etc. led to new possibilities for laser remote sensing. Some of the techniques using lasers for the stand off detection as well as for the point detection of chemical agents will be discussed.
First, Theoretically it will be discussed that how LIDAR (LIght Detection and Ranging) technique is implemented for the stand off detection of chemical agents like Sarin, Tabun, Mustard gas etc. and atmospheric pollutants like Sulphur Dioxide, Hydrogen Sulphide, Ammonia etc in the Mid IR range i.e. from 2-5μm and 9-11μm depending upon the transmission window of atmosphere. DIAL (Differential Absorption Lidar) technique will be used for the same. OPO (Optical Parametric Oscillator) technique for the 2-5μm range detection of chemical detection will be discussed. Implications of various lidar techniques will also be cited.
Secondly, some experimental results will be shown for point detection of atmospheric pollutants carried out in our laboratory. The sensors are developed using laser dyes due to its stability. The technique, which is used, is fluorescence. The Fluorescence quenching and sensitization are observed for this type of sensor systems. The agents like Acetone, Hydrogen Peroxide, Hydrogen sulphide, Ammonia etc are detected using the same.

9. KAMUNDA Caspah

Title:
Design and construction of microclimate monitoring system

Abstract:
A portable and user-friendly weather monitoring system, based on the PIC16F876 microcontroller is described. This instrument measures three parameters: temperature in the range -10oC to +70oC within ±1oC using an LM335 temperature sensor, wind speed from 0 to 10m/s within ±0.1m/s using a heated bead thermistor, and solar radiation from 0 to1000W/m2 within ±10W/m2 using a solar cell. These variables are displayed digitally, one at a time, with a 5 second separation. The values are stored on EEPROM at 2 minute intervals. The instrument is intended for use in agriculture and for educational purposes.

10. BUTT Mohsin Jamil

Title:

Development of Snow Maps in Pakistan Using MODIS Satellite Data

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Abstract:
Snow is an important, though highly variable, earth surface feature. Its existence affects physical, chemical and biological processes. It has important economic and societal impacts. Snowmelt runoff serves as an important water resource in many areas of the world. In addition, the high visible albedo of snow reflects very high percentage of incoming solar radiations thus, plays an important role in the earth-atmosphere energy budget. Thus, accurate monitoring of snow cover extent is an important research goal in the science of earth systems. Ground monitoring of snow is normally based on point measurement, which in mountainous region has various problems. In addition, conventional methods of data collection are time consuming and spatially limited. Thus, remote sensing is the only mean, particularly at high elevation and in remote areas of the globe, to examine the snow cover distribution. This research is concerned with preeminent use of satellite data to monitor snow area extent and to develop monthly snow maps in Pakistan. Moderate Resolution Imaging Spectroradiometer (MODIS) data for the production of monthly snow maps of Northern Pakistan is used in this study. MODIS represents a considerable improvement in the capability for global cryosphere monitoring over comparable existing systems. Normalized Difference Snow Index (NDSI) is used to produce snow maps. It is expected that the accurate snow maps will help both hydrologists and climatologists to use snow products with confidence for river run off models and climatological models in the region.