This Issue is dedeicated to Professor Constantin P. Cristescu on this 70th anniversary

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BENEFITS AND DRAWBACKS OF LASER REMOTE SENSING IN ATMOSPHERIC RESEARCH

Doina NICOLAE, Camelia TALIANU, Anca NEMUC, Emil CÂRSTEA

Lidars are often used in atmospheric research, as well as in topography, oceanography, forestry and air transportation. Lidars are complex optoelectronique systems, having by consequence technological but also theoretical limitations. The information extracted from lidar data should be therefore closely analyzed in relation with instrumental and processing capabilities. This paper presents advantages and drawbacks of using laser remote sensing in atmospheric science, emphasizing the level of trust that can be given to lidar data and derived parameters. Moreover, some new practical solutions for the optimization of the instrument and data processing chain are also presented.

Keywords: lidar, atmosphere, laser, aerosol.

DIMENSIONAL ANALYSIS OF THE PHOTONIC CRYSTALS

Liliana PREDA, Mona MIHĂILESCU

This paper presents the photonic bands structures for 1D, 2D and 3D photonic crystals built as a stack of eight thin layers of SiO_2 and TiO_2 deposited in an order given by Thue-Morse aperiodic sequence. Our combinations give large photonic band gaps for 1D photonic crystal for each TM, TE and coupled modes, small photonic band gaps for TM mode of 2D photonic crystal and no photonic band gaps for the 3D structure.

Keywords: photonic crystals, Thue-Morse sequence, band gaps.

INTENSE FIELD EFFECTS ON HYDROGENIC IMPURITIES IN QUANTUM WELLS

Ecaterina C. NICULESCU, Liliana M. BURILEANU, Adrian RADU

In this paper we discuss the effect of the high-frequency laser field and the impurity position on the binding energy of the shallow acceptors in $GaAs/Al_{0,3}Ga_{0,7}As$ quantum wells. The calculations were performed within the effective-mass approximation and by using a variational method.

Keywords: Laser radiation effect, quantum well, shallow acceptor, binding energy, density of states

CHAOS AND HYPERCHAOS IN A SYMMETRICAL DISCHARGE PLASMA: EXPERIMENT AND MODELLING

Cristina STAN, Constantin P. CRISTESCU, Dumitru ALEXANDROAEI

In this work we present experimental observations and computational modelling of chaos to hyperchaos transition in a plasma system consisting of two identical discharges in a symmetrical set up. The two discharges have identical geometries and are running in the same glass tube under identical conditions. The plasma generated in the inter-anode space is controlled by a relative biasing of the two anodes. We study the changes in the dynamics of this plasma as reflected in the current fluctuations. For a particular range of the d.c. inter-anode biasing we observe a transition from chaos to hyperchaos. We propose a computational model consisting of three coupled nonlinear oscillators. The agreement between the experiment and the results of the model is a clear evidence for the correctness of our model.

Keywords: chaos, hyperchaos, plasma, nonlinear oscillators

EXPERIMENTAL EVIDENCE OF "VIBRATIONAL RESONANCE" IN VCSELs

Viacheslav N. CHIZHEVSKY, Emil SMEU, Giovanni GIACOMELLI

The experimental evidence and characterization of "vibrational resonance" in a VCSEL are reported. The system is driven by two summed forcings, having frequencies different by several orders of magnitude. It is studied in two cases: symmetrical and asymmetrical internal quasipotentials. The phenomenon shows up in the dynamics of the polarized laser emission as a resonance in the low-frequency response and reaching a maximum of the signal-to-noise ratio, depending on the amplitude of the high-frequency forcing. The possibility to use the phenomenon for low-level detection is experimentally demonstrated.

Key words: stochastic resonance, vibrational resonance, gain, signal-to-noise ratio, quasipotential, low level signals

USING ACTIVE REMOTE SENSING TO ASSESS THE SEAWATER QUALITY

Jeni VASILESCU, Livio BELEGANTE, Claudia SLIWINSKI, Constantin CRISTESCU

*Laser remote sensing systems can detect the presence in water of fluorescent constituents that are not visible for other types of devices. The paper presents results obtained for the Romanian coastal zone of Black Sea for the first time using an active remote sensing system. The general principle of Lidar (**Li**ght **D**etection **a**nd **R**anging) detection and applications of a fluorescence ship borne system are discussed. The accuracy of the obtained information is dependent on the technical performances of the device and on the accuracy of the data processing method. Comparative analysis of the results obtained in the investigation of various water sources (river water, marine water, clean water, polluted water) is carried out in order to identify the specific fluorescence fingerprint.*

Keywords: fluorescence LIDAR, seawater pollution, chlorophyll detection

SPECTRALLY CLIPPED PULSES ANALYSIS IN A CPA LASER SYSTEM

Daniel URSESCU, Laura IONEL, Constantin P. CRISTESCU

An analysis of spectrally clipped pulses in an optical stretcher-compressor system is presented. The optical system which includes an optical stretcher, an amplifier and a compressor, is based on Chirped Pulse Amplification principle. Passive pulse shaping technique in the spectral domain was used by introducing an absorbing baffle in the stretcher. Pulse durations and pulse contrast were determined as a function of various parameters. The system will be used experimentally for shaping of pulses used in applications such as plasma generation and probing.

Keywords: Chirped Pulse Amplification, ray-tracing, pulse shaping

TUNABLE FILTERS FROM LYOTROPIC LIQUID CRYSTALS

Leonaş DUMITRAŞCU, Irina DUMITRAŞCU, Dana-Ortansa DOROHOI

The external field influence on the birefringence of the liquid crystalline layer is expressed by using the Cauchy dispersion equation. The basically theoretical elements of the polarization interferential filters of Lyot - Ohmann and Wood type, achieved in a multilayer geometry, are given in this paper. The expressions corresponding to the transmitted maxima and to the spectral bandwidths of the transmitted bands are established here.

Keywords: polarization interference filter, lyotropic liquid crystal, liquid crystal polarization filters, Lyot tunable filter, Wood tunable filter

THE INCREASE OF THE ELECTRICAL CONDUCTANCE IN NANOSTRUCTURES: A THEORETICAL APPROACH

Pavlos D. IOANNOU, Petru NICA, Maricel AGOP

Considering that the charge carrier movements take place on fractal curves, the increase of electrical conductance in nanostructures is explained using an extended model of scale relativity theory. Two major processes result as being responsible for the increase of the electrical conductance. At the macroscopic scale, this increase implies the change of the transport regime of the charge carriers, from transport by means of non-quasi-autonomous structures, to transport by means of quasi-autonomous structures. These two regimes are separated by the experimentally observed 0.7 structure. At the microscopic scale, the process is controlled by means of the nanodilaton's coherence.

Keywords: fractals, nanostructures, charge transport phenomena**.**

EFFICIENCY EVALUATION OF A HIGH RESOLUTION, LOW BACKGROUND GAMMA SPECTROMETER WITH GEANT4

Romeo IONICĂ, Gheorghe CĂTA-DANIL

We present some results on photopeak efficiency evaluation of a high resolution gamma spectrometer for gamma detection based on an HPGe detector working in anticoincidence with a scintillator gamma monitoring system. Using a simplified model and a Geant4 simulation, we have evaluated the efficiency of the system for point and volume sources, for incident gamma energy from 0.2MeV to 2.0MeV.

Keywords: efficiency, Monte-Carlo Simulation, Geant4, gamma detector.

IONIC CONTRIBUTIONS TO NEMATIC LIQUID CRYSTAL - CONDUCTING POLYMER INTERFACE PHENOMENA

Ruxandra ATASIEI, Constanta DASCALU, Nicoleta ESEANU, Matei RAICOPOL, Anca-Luiza ALEXE-IONESCU

The current to voltage response of a nematic liquid crystal (NLC) sample aligned with a conducting polymer has been measured. A deviation from the linear behaviour of the current has been observed for long enough periods of triangular applied voltages. This is connected to the electric charge accumulation at nematic-polymer interface due to the asymmetric carrier injection and to redox phenomena for larger external fields. Our analysis has been carried out in a quasi-static regime in which the nematic director follows the time variation of the applied field without delay.

Keywords: nematic liquid crystals, conducting polymers, asymmetric carrier injection

CHAOTIC DYNAMICS IN ECONOPHYSICS: MODELING THE MARKET FORCES

Eugen I. SCARLAT, Constantin P. CRISTESCU, Cristina STAN, Liliana PREDA, Alexandru M. PREDA, Mona MIHAILESCU

In this work we simulate real time series by using the synthesizing method of the „generalized devil staircase" (GDSC). The weights are reflecting the forces that currently influence the exchange rate markets, namely the economic factors, the political situation, and the environmental psychology driving the economic behaviour; as a fourth factor we use the closure condition representing both the mathematical condition of probability normalization and the long run economic equilibrium. The simulated series are compared with the real one of the exchange rate between the Romanian currency „leu" and the United States Dollar (ROL-USD) over the interval January 1990-December 2007 by considering the quantities that usually characterize the non linear dynamics: the correlation dimension, the Hurst and Lyapunov exponents, and a factor pointing out the deviation from monofractality. The numerical values for the weights are assigned according to the partition in three distinct subintervals corresponding to the main evolutionary features of the Romanian economy. We obtained promising results but supplemental studies are necessary for a better allocation of the numerical weights.

Keywords: market forces, time series synthesis, devil staircase, ROL-USD exchange rate.

DYNAMIC ANALYSIS ON THE HEART ELECTROMAGNETIC ACTIVITY

Dorina CREANGĂ, Mihaela DULCESCU Claudia NĂDEJDE

The heart beat dynamics was analyzed by using computational tools derived from deterministic chaos theory. Poincaré section, correlation dimension and correlation time as well as surrogate data series were the main semi-quantitative tests comparatively discussed in two distinct physiologic situations. The results suggested that the high complexity dynamic trend evidenced in heart activity might be significantly influenced by emotional stress loading generated by the changes in adrenaline metabolism.

Keywords: heart electromagnetic activity**,** deterministic chaos, stress loaded subjects

PARTIAL MOLAR VOLUMES AND DIFFUSION COEFFICIENTS FOR TERNARY SYSTEM WATER-CHLOROFORM-ACETIC ACID AT 25°C FOR DIFFERENT CHOICES OF SOLVENT

Daniela BUZATU, Florin D.BUZATU, R. SARTORIO

The partial molar volumes and the diffusion coefficients, D_{ij}, for the ternary system water-chloroform-acetic acid at 25°C are reported at five compositions using different choices of solvent . The analyzed compositions have a fixed ratio between water and chloroform molar fractions and a decreasing amount of acetic acid, then approaching the binodal curve. The difficulty of interpreting the D_{ij} is stressed and the use of different choices of solvent for the diffusive transport is suggested to extract from the diffusion coefficients all the possible information.

Keywords: ternary system, partial molar volume, diffusion coefficients**,** solvent choices

ELECTRONIC TECHNIQUES IN TIMING MEASUREMENTS FOR NUCLEAR STRUCTURE

Dan Gabriel GHIȚĂ

The present paper describes in detail two electronic methods for determining lifetimes of the excited nuclear states. The Fast Timing Method described below is a very sensitive method for lifetime measurements in a range spanning from tenths of picoseconds to hundreds of nanoseconds and it is basically based on triple β–γ–γ coincidences. The second method presented here is based onto the Single Crystal Scintillation Time Spectrometer method, less sensitive than the previous one, with a sensibility spanning from tenths of nanoseconds to hundreds of microseconds, but having the advantage of high detection efficiency, due to its single scintillation crystal configuration. Experimental results will be presented.

Keywords: timing measurements, nuclear structure, beta decay

NANOPULSED ABLATION RATE OF METALS DEPENDENCE ON THE LASER FLUENCE AND WAVELENGTH IN ATMOSPHERIC AIR

Ionuț VLĂDOIU, Mihai STAFE, Constantin NEGUȚU, Ion M. POPESCU

The dependence of ablation rate of aluminum, titanium and copper on the nanosecond laser fluence with 532 nm and respectively 1064 nm wavelengths is investigated in atmospheric air. The wavelength is varied by using the fundamental and second harmonic of a Q-switched Nd-YAG laser system and the fluence of the pulses is varied by changing the diameter of the irradiated area at the surface target. The results indicate an approximately logarithmic increase of the ablation rate with the fluence for both irradiation regime and a higher efficiency of the ablation in the case of 532 nm pulses.

Keywords: ablation rate, nanosecond laser pulses, metals

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FINITE ELEMENT METHOD IN HIGH INTENSITY PLASMA DISCHARGE MODELING

Mihail CRISTEA

Se arată cum poate fi modelată plasma descărcărilor electrice la presiune ridicată aflată aproape de echilibrul termodinamic local. Rezolvarea ecuațiilor diferențiale cu coeficienți variabili şi termeni sursă neliniari se face prin metoda elementului finit.

It shows how the high pressure electric gas discharge plasma near to the local thermodynamic equilibrium point can be modeled. Partial differential equations with variable coefficients and non-linear source terms are solved using the finite element method.

Keyword: hot-spot cathode mode, mercury arc discharge, numerical algorithm