Abstracts

of the

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P1 – 1 – C

ATMOSPHERES OF BROWN DWARFS

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Broadening of Sodium (Na) lines by H_2 and He gases: atmospheres of Brown Dwarfs. I simulate the atmosphere of Brown Dwarfs on linear gravitational Heat Pipe Oven (HPO), and record the ascorbic spectra of sample and then compare it with real specters of Brown Dwarfs. The result are some interesting and new conclusions about Brown Dwarfs atmospheres.

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P1 – 2 – C

A QUADRUPLE SYSTEM OF STARS: WR 153 (HD 211853)

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Recent years there have been developed several computer codes for expanding stellar atmospheres. For detailed spectral analysis of massive early type stars (like O type, Luminous Blue Variables and Wolf-Rayet stars) we need to calculate the state of the gas in non-LTE and the transfer of radiation in an expanding atmospheres. We usually assumme spherically symetric stellar wind. There will be presented methods which use Sobolev approximation for line transfer.

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P1 – 3

VIRTUAL OBSERVATORY & VARIABLE STARS

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Using various on-line databases, catalogs (DSS, Simbad...) and applications (IRAF), a simple virtual observatory can be constructed and it can be employed at various tasks, e.g. detection of variable stars.

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SEEING DARK MATTER THROUGH THE COSMIC LENS: RESOLVING THE DISCREPANCY BETWEEN THE X-RAY AND GRAVITATIONAL LENSING MASS MEASUREMENTS FOR ABELL 2218

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Knowledge about the mass distribution and dynamical states of clusters of galaxies is essential to probing large-scale structures in the universe and to understanding dark matter. Clusters such as Abell 2218 emit X-rays and act as a gravitational lens, thus offering two independent approaches for deriving the mass distribution. However, strong gravitational lensing data and X-ray analysis result in significantly different portrayals of the distribution of dark and "visible" matter in Abell 2218. Here, we set out to reconcile the X-ray hot gas model of Abell 2218 with its lensing observations. We model the cluster as one with radially declining temperature, relaxing the key assumption of isothermality that underlies standard X-ray analysis. We find that the cluster Abell 2218 requires a rapidly declining temperature variation with radius for the X-ray and lensing models to agree. However, even with a power or polytropic temperature decline, we show that temperature variation alone fails to reconcile the X-ray and lensing models. Our work disproves the isothermality assumption about clusters and offers new insight into the actual nature of temperature variation in Abell 2218, but further investigation is needed, such as by varying hydrostatic equilibrium and the ellipticity of the cluster, to fully resolve the discrepancy between the X-ray and lensing mass estimates.

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THE ABSORPTION AND FLUORESCENCE SPECTRA OF IODINE VAPOUR (MOLECULAR IODINE)

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The aim of this paper is to present a simple way of measuring the absorption and fluorescence spectra of iodine vapour. The main detail of the experiment is the absorption cell of our own construction. The absorption spectrum of iodine vapour is used for determination of the dissociation limit, dissociation energy and the fundamental vibration frequency of the iodine molecule. The florescence spectrum is the helium-neon (He-Ne) laser inducted. The experimental results provide us the accurate value for fundamental vibration frequency. From these spectroscopic properties we can calculate the bond length, harmonic-oscillator force constant, and a Birge-Sponer estimate of the band-dissociation energy. The florescence spectrum exhibits both Stokes and anti-Stokes emissions and clearly demonstrates the importance of the Frank-Condon factors.

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TRANSPORT PROPERTIES OF PbTe(Mn,Mo)

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The persistent photoconductivity effect and Fermi level pinning were observed in the narrow-gap PbTe(Mn,Mo) semiconductor. We have measured the resistivity temperature dependence in darkness and under infrared illumination for two series of samples of PbTe(Mn,Mo) with various impurity concentration. All samples may be broken into three groups. The conductivity of the first group of samples is most likely to be governed by the potential modulation coming from high Mn content. The persistent photoconductivity at low temperatures has been observed only in this group of samples. In the second group the Fermi level is likely to be pinned by the Mo impurity level in the valence band close to its top. For the third group of samples the resistivity temperature dependence shows the semiconductor type of behavior demonstrating that the Mo impurity level enters the gap. At low temperatures the resistivity is defined by the conductivity via the impurity level. The possible mechanizms of the effects observed are discussed.

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STUDY OF TRANSPARENT FERROELECTRIC THIN FILMS BY OPTICAL REFLECTOMETRY AND ELLIPSOMETRY

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Ferrolectric thin films have attracted much attention due to their potential applications such as high dielectric constant capacitors, non-volatile memories, infrared sensors and electro-optic devices. Their ferroelectric and dielectric properties have been extensively investigated, while their optical properties have been relatively rarely studied. However, the optical constants, e.g., refractive index and extinction coefficient has great importance for waveguiding and other optical applications. In this report optical reflectometry and ellipsometry techniques are combined as an efficient non-destructive tools for measuring thickness and refractive index of transparent ferroelectric thin films. A miniature Ocean Optics CCD spectrometer, model PC 1000, designed as a plug-in PC ISA slot with fibre optics input is used for the reflectivity measurements under normal light incidence geometry. The film thickness of the 0.05-10 m range can be evaluated immediately within 5-10% precision even without an exact knowledge of refractive index. Additional refinement of results for helium-neon laser wavelength can be obtained by variable-angle ellipsometry taking measurements at several different incidence angles, thereby increasing the amount of information available for analysis. Optical constants were determined by fitting the multilayer model function to the measured data. Barium titanate (BT), lead zirconate titanate (PZT) and lead magnesium niobate (PMN) thin films and alternated strontium titanate barium titanate heterostructures deposited on various substrates by rf-sputtering, laser ablation and sol-gel technique have been investigated. The optical properties related to sample fabrication, structure, dielectric properties and composition will be discussed.

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THE TEMPERATURE DEPENDENCE OF CONDUCTIVITY OF AIIBVI LAYERS GROWN ON GAAS

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Semiconductors has been the most investigated material over the last decade. In my work I used the van der Pauw method which is based on Hall effect. The main aim of this work is to describe potential application of semiconductors as temperature sensor and discussing reported data.

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TRANSPORT PROPERTIES OF HIGH-T_C RUTHENOCUPRATE $RuSr_2GdCu_2O_8$

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$RuSr_2GdCu_2O_8$ is a member of the family of ruthenocuprates, relatively new members of the family of High- T_c superconductors. It was first synthesized in 1995 and since then it has caught a great deal of attention. The reason is the coexistence of both antiferromagnetic and superconducting order parameter in $RuSr_2GdCu_2O_8$. This coexistence is unexpected because magnetic field destroys superconductivity. So far, it has been explained by the loose coupling of RuO_2 planes (in which Ru moments order antiferromagneticaly) and CuO_2 planes (in which are electrons who become superconducting).

Measurements of electrical resistivity, thermopower, ac susceptibility and heat conductivity have been performed. Electrical resistivity shows metal behavior at temperatures higher than T_c. The SC transition is wide and starts at 45 K when resistivity starts to fall rapidly with falling temperature. At T_c = 24 K resistivity falls to zero. Magnetic transition is also seen in resistivity and is confirmed by ac susceptibility measurement which shows magnetic transition at T_M = 132 K which is attributed, by other authors, to antiferromagnetic ordering of ruthenium moments. Thermopower is typical for underdoped High- T_c superconductors, also starts to fall at 45 K and falls to zero at 24 K. Heat conductivity measurements on this system have yet not been published anywhere and this is our main contribution. Heat conductivity shows similar behavior as well known YBCO system. Main contribution is phononic. Electron contribution was calculated by the use of Wiedemann-Franz law and it gains only 3% of the total heat conductivity. Magnetic transition seems not to influence heat conductivity which shows that phonon-phonon scattering process is dominant.

Keywords: ruthenocuprate, High- T_c superconductor, antiferromagnet

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THE LEVEL OF COVERAGE DEPENDENCE OF THE ADSORPTION ENERGY – THE Au(111)-THIOL SYSTEM INVESTIGATED BY MEANS OF DENSITY FUNCTIONAL THEORY

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In a series of DFT (Density Functional Theory) calculations we have studied the adsorption of methane thiole and [4,4'-di(ethynyle phenyle)-2'-nitro-1-benzenthiolate] on the Au(111) surface. For both molecules we find that the adsorption energy depends on the level of coverage (modeled by means of periodic boundary conditions) due to different kinds of interaction between the adsorbed molecules and their interaction with the surface. The reason that the latter molecule was chosen for the study is that it functions as a molecular switch and thus may have some application in the growing field of molecular electronics.

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THE RESEARCH OF ACTINOELECTRICITIES ON A HETEROJUNCTION CdS/CuPc

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Full automated installation was created and complex analysis of multilayer organic-inorganic films of CuPc (Cu-phthalocyanine) and CdS photoelectric properties was performed. Followed researches were released: voltage-current characteristics, relation between photovoltage and wavelength, photoconductivity, relaxation of photocurrent. A pronounced photovoltage signal was observed in structures composed of films deposited on CdS substrates and semitransparent Au layer deposited on top of the films. The photovoltage values reaches 0,8 V in the field of absorption CdS.

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ANOMALOUS TRASPORT PROPERTIES IN PBTE(MN,CR)

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The effect of negative magnetoresistance and long-term non-equilibrium processes were observed in the narrow-gap PbTe(Mn,Cr) semiconductor. Depending on Mn and Cr concentration the Fermi level is pinned out of or within the gap nearby the conduction band edge. Previously the giant negative magnetoresistance effect has been reported for Yb doped PbMnTe, in which the Fermi level is pinned in the gap nearby the valence band edge. It is known that in case of Yb doping the Fermi level pinning results from the impurity atom valence instability. The same sort of valence instability results the Fermi level pinning in PbTe(Mn,Cr). But we have the conductivity of n-type in the case of PbTe(Mn,Cr), not as in p-type PbTe(Mn,Yb).

Applying the magnetic field results to substantial drop of resistivity of about 30% at T=4.2K. This is however is much lower then in PbTe(Mn,Yb) where the effect amplitude was about 3 orders of magnitude. The effect disappears at T=35 K.

Possible mechanisms are discussed: impurity atom valence instability, quantum corrections to the conductivity, peculiarities of conductivity via the impurity level, spin-related effects.

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STRUCTURAL PROPERTIES OF THE SOME FERROELECTRIC LIQUID CRYSTAL

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In these paper was investigated the structural properties of the some ferroelectric liquid crystals with 2-alkoxypropionate chiral group with one chiral center and without any lateral group, denoted as Hn/8 (n=6, 8 and 9): The synthesis of these compounds was described earlier1-2. In these compounds, depending on the substance, smectic C*, smectic A*, nematic N*, blue phase and a low temperature crystalline SmN phase were preferable. All substances exhibit wide temperature range of SmC* phase characterized by high Ps value. The substances were characterized by DSC and optical method. These study initiated the more detailed structural investigation of unoriented samples by X-ray diffraction method. A low temperature crystalline SmN phase we have identitified as the SmB phase.

According to the X-ray diffraction data obtained on non-oriented samples, we have calculated the molecular parameters: the layer spacing (d) in the SmC*, SmA* and SmB phase and the average intermolecular distances (D) between neighboring parallel molecules in all investigated phases and isotropic phases. Temperature dependence of the molecular parameters is present. It was established that an intercalated tail-to-tail packing of the molecules, results in the decrease of the layer spacing, and the increase of the intermolecular distances.

Keyword: ferroelectric liquid crystal, phase transition, x-ray diffraction, molecular parameters

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ANTIFERROMAGNETIC RESONANCE SPECTRUM IN $LaMnO_3$

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Recently, great interest in investigating structure of $LaMnO_3$ crystals was arrised by opening the colossal magneto resistance effect in mixtured compounds on the base of this crystal. It seems to be important for correct understanding and describing of new effect to determine structure and properties of pure material. The aim of present research was investigation of frequencies of magnetic resonance in pure lanthanum manganite. For calculating the Hamiltonian of magnetic subsystem which consisted of three parts: exchengive, anisotropic and Zeeman s was used. Within molecular field approximation magnetic free energy was found. As it was shown before [1], orbital structure influences as the first so as the second part of Hamiltonian. Starting from the free energy, ground state of magnetic subsystem and magnetic excitations frequencies were found. The calculation of magnetic resonance in lanthanum manganite was made. On the base of angular dependence of magnetic resonance spectrum the influence of orbital structure on this spectrum of $LaMnO_3$ was investigated.

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References:
[1] L.E. Gonchar, A.E. Nikiforov and S.E. Popov, JETP, vol.91, No. 6, 2000, pp.1221-1229.

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DETERMINATION OF COEFFICIENT OF VISCOSITY USING THE PRINCIPLE OF AMORTIZED OSCILLATIONS

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Coefficient of viscosity characterizes the resistance of fluid when a body is moving through it. We can determine the coefficient of viscosity using the method of amortized oscillations. As a linear harmonic oscillator we use a ball attached to a spring. By measuring the period of oscillations in the fluid and comparing it to the period of oscillations in air (approximating free oscillations), it is possible to determine the coefficient of amortization. By measuring the mass and radius of the ball, the coefficient of viscosity can be calculated from the coefficient of amortization using the Stokes' law.

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CALCULATION OF SURFACE EXCITATION PARAMETER FOR SEMICONDUCTOR ELEMENTS AND Sn BY MEANS OF MONTE CARLO SIMULATION

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Different methods of electron spectroscopy (AES, XPS, EPES, REELS) play important role in modern technology. For precise interpretation of their results a description of electron transport is needed. Several methods (numerical solution of Bolzmann equation, Tougaard theory, Monte Carlo simulation, etc.) are available. These methods, however, are generally not able to deal with inhomogeneous samples. Filling the gap we developed a program based on direct Monte Carlo simulation method, which is capable of describing electron transport in samples with in-depth inhomogenity in the range of 0.1-10 keV primary electron energy. The elastic peaks (EPES) and 50 eV below the elastic peak (REELS) were measured with two different electron spectrometers varying the primary energy between 0.2-5 keV on Si and Ge. Our program was applied to simulate the measured elastic peak and loss spectra. During the transport the electrons suffer elastic and inelastic scattering events which are assumed to be independent in our program. Similarly, surface and bulk energy losses are treated also independently. We take differential cross-section data from NIST database to describe elastic collisions and used our own bulk- and surface energy loss functions for inelastic scattering events. The energy loss is determined by the dielectric function which is however might be different from bulk dielectric function in the surface close region. Thus we have to find a loss function by trial and error method. The loss function extends from 0 to the primary energy. It is well-known, however, that the majority of losses occurs in the low energy region (<50eV). Since we want to fit the measured curve up to 50 eV and the sum (not the shape) of the remainder part of the loss function is considered. Constructing this part of the energy loss functions it is sufficient to choose single Lorentzian type distribution functions for Si and Ge, since in these materials the dominant loss is plasmon excitation. The intensities of energy loss functions was determined according to the IMFP values taken from literature. Similar method is applied for choosing the surface loss function. For all the measured spectra calculations were carried out. The simulated spectra at and above 500 eV agreed well with the measurements, while at lower energies the agreement was acceptable. Differences between the simulated and measured spectra are discussed.

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TRANSPORT OF ELECTRONS IN PHOTOSYNTHESIS

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In this work we present the stochastic model to elucidate the unidirectionality of the primary charge separation process in the bacterial reaction centers (RC) during photosynthesis,where two symmetric ways of electron transfer (ET), starting from the common electron donor, are possible. We have used a model of three sites/molecules with ET beginning at site 1 with option to proceed to site 2 or site 3. If the direct ET between sites 2 and 3 is not allowed and electron can not escape from the system then it is shown that the different stochastic fluctuations in the energy of sites and the interaction between sites on these two ways are sufficient to cause the transient asymmetric electron distribution at the site 2 and 3 during the relaxation to the steady state. It means that overall asymmetric ET can be caused by the transient asymmetric electron distribution if there is a possibility for electron to escape from the three sites system. To explore this possibility we have introduced a sink into the model at the end of the each site 1, 2 and 3. The dependence of the asymmetry in electron transfer on the value of the sink parameter, introduced through an additional imaginary diagonal matrix element of the Hamiltonian, was investigated. We also using standart projection techniques and for our three sites model we gain Master equations which serve us as a starting point for a lot of theoretical analysis and simulations. This theoretical simulations are in a good correspondence with experimental results for wild type RC and several mutants of RC. Results show indeed that the unidirectionality of the electron transfer generated in the system of three molecules depends strongly on the sink parameter value and also on the value of the energy levels of the accessory bacteriochlorophyll molecules. In this cases the dependence of ET asymmetry on temperature was also evaluated.In the future the people would like to utilize solar energy with maximum efficiency and it is not possible without understanding this strong asymmetry in the electron transfer through the reaction centers.

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[2] Pudlak, Pincák, The role of accessory bacteriochlorophylls in the primary charge transfer in the photosynthetic reaction centers. Chemical Physics Letters, 342(2001) 587-592, 20 July 2001

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PHYSICAL METHODS USED IN RESEARCH OF MARGINAL LEAKAGE OF RESIN COMPOSITE

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Composite resin needs to be polymerated, and in that process gap formation appear. In our work with molars it was measured depth of penetration of contrast colour in oclusal cavities. Several factors that effect on polymerisation stress was compared, and therefore on appearance of separation gap. At our work we find that using different kinds of resin composites, techniques and polymerisation devices, we did not nullified marginal leaking.

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DEPTH RESOLUTION IN RBS MEASUREMENTS WITH A TIME-OF-FLIGHT DETECTOR

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The goal of this work was to find out whether it would be possible to gain better surface depth resolution in RBS (Rutherford Backscattering Spectrometry) measurements using a TOF-detector (time-of-flight) instead of the normally used Si-detector (a silicon surface barrier detector). To study this a Matlab-program was written to simulate the measurements. The achieved surface depth resolution with a TOF-detector for a C beam with an energy below 10 MeV, incident on a Si surface, was at best 1 nm. The uncertainty for the timing signal of the TOF-detector system was 300 ps and the distance between the C-foils 60 cm. In the same measurement the achieved surface depth resolution with a Si-detector would have been approximately 10-20 nm. On the other hand when using a H or He beam the achieved surface depth resolution is better with a Si-detector than with a TOF-detector. According to the results a TOF-detector leads to a better surface depth resolution than a Si-detector when heavier ions are used.

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P1 – 20 – C

DIFFUSION OF HYDROGEN IN TUNGSTEN AND MOLYBDENUM FILMS

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In the next step fusion reactor, ITER, the selection of the plasma facing materials is critical. Tungsten and molybdenum are strong candidates for this role because of their low sputtering yields and good thermal properties. On the other hand their disadvantages include the high Z-ion impurity released in the plasma and the ion induced blister formation on the surface. The hydrogen uptake and mobility in tungsten and molybdenum will be of a key interest considering the deuterium and tritium inventory. In the current work, which is a part of the EU fusion energy research program, we have studied the diffusion of deuterium in physical vapour deposited tungsten and molybdenum films. The films used in this study were made using the arc discharge method. An initial constant deuterium concentration was achieved by co-deposition in a deuterium atmosphere (26 - 110 mPa). After the annealing process in vacuum, the resulting deuterium depth profiles were measured by the secondary ion mass spectrometry. From these profiles the deuterium diffusivity could be deduced.

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A NEW INSULATING MATERIAL FOR THE FABRICATION OF InP BASED METAL-INSULATOR-SEMICONDUCTOR DEVICES

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Insulating layers play crucial role on metal-insulator-semiconductor (MIS) structures. Finding a more suitable insulating material and/or layers with high resistivity and high stability is rather demanding. Good insulating layers for indium phosphide (InP) are very much essential since InP based MIS structures find wide and potential applications in the modern high speed, high power as well as optical devices because of its high values of saturation current, breakdown voltage, thermal conductivity and radiation resistance. Generally, realisation of an insulating layer on InP has been carried out mainly by two ways. They are: (i) deposition of the insulating layers such as SiO_2, Si_3N_4, Al_2O_3 etc., using thermal evaporation or sputtering methods (ii) growth of native oxides on InP. High surface state density (of the order of 10^{12} eV^{-1} cm^{-2}, the thermal damage caused during the deposition and/or sputtering is detrimental in the first process. Instability upon exposure to moisture and/or a slightly elevated temperature is the typical problem encountered with the native oxides grown on InP and moreover their oxide resistivity is limited to 10^{13} Ω cm. Hence, with searching of a better insulating material and also to overcome the problems relating to the insulator deposition of InP, effort has been made to find a suitable insulating material as well as a simple method in which materials could be deposited at room temperature with less cost effective. In this present work, barium titanate ($BaTiO_3$, a good dielectric material has been proposed as a new insulating material for InP based MIS structures. $BaTiO_3$ thin films have been deposited on InP substrates using sol-gel technique through organic precursor route. The precursor solution was coated on InP substrate by spin coating method. As-deposited $BaTiO_3$ films are amorphous in nature and post-deposition annealing yields polycrystalline films. XPS analysis confirms the formation and composition of $BaTiO_3$ layer on InP. The MIS structures were fabricated on the $BaTiO_3$ deposited InP samples and they show better capacitance-voltage characteristics. A minimum hysteresis width of 0.5 V and a minimum flat band voltage shift of 0.75 V have been obtained for Au/$BaTiO_3$/InP MIS structures. It indicates a high resistivity and good stability of the insulating layer on InP. Furthermore, a reduced surface state density value of as low as $6x10^{10}$ cm^{-2} eV^{-1} has been achieved and is very much less when compared to other conventional deposited insulators. DLTS measurements were carried out to study the defects incorporation and only one interface trap has been observed at 0.55 eV below the conduction band. The characteristics and properties of this new insulating layer for InP MIS device applications will be presented in detail.

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MAGNETORESISTANCE AND HALL EFFECT IN THE METALLIC STATE OF THE ORGANIC CONDUCTOR $(TMTSF)_2ReO_4$

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Organic conductors are low-dimensional systems, and it is not yet understood in which part are interchain correlation responsible for their physical properties. It is theoretically expected that usual Fermi-liquid picture (successful for explaining 3D metals) seize to work in 1D system with electron-electron interactions. Physical properties should then follow certain characteristic temperature and frequency dependencies. Two recent experimental works performed in independent laboratories, were interpreted in two different theoretical pictures. Trying to answer that question we performed detailed measurements of conductivity, magnetoconductivity and Hall effect in organic conductor $(TMTSF)_2ReO_2$ in temperature range 180 K < T < 300 K, and in a superconducting 9T magnet. Very anisotropic conductivity, small positive magnetoresistivity, and almost temperature independent positive Hall effect were observed. We will compare those results with similar measurements in other organic conductors and theoretical models, in order to try to answer the actual question.

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GENERATION SITES OF INTERNAL SOLITARY WAVES OBSERVED BY ERS SAR OFF THE SW COAST OF PORTUGAL. INTERESTING RESULTS CONCERNING RAY REFLECTION

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Internal waves, either in the atmosphere or in the oceans, are an important part of small scale processes in geophysical flows. The earliest work on the subject of internal waves is due to Stokes (1847) for two layer fluids and Rayleigh (1883) for continuously stratified ones. The importance of the internal waves to mixing in the deep ocean and hence the dynamics of ocean circulation has been recognized in recent years. Many different processes have been found to generate internal waves in the oceans. In this paper we focus on their generation at critical slopes of the bathymetry, extending to the region of our study, the internal tide origin hypothesis, suggested by Justin Small (2000) as being a relevant mechanism of generation off the western coast of Portugal. We analyse the oceanographic section located between (37.113N,9.153W) and (36.765N,11.000W). To determine the possible generation sites, we compute critical slopes of the bathymetry, using topographic data, the ocean stratification calculated from CTD profiles, the local Coriolis acceleration and the semi-diurnal tidal frequency. Beams of internal tidal energy originate from critical slope locations. These rays have pathways parallel to the oceanographic section and are refracted owing to change in vertical stratification. Internal solitary waves (ISWs) are expected to form in the vicinity of the intersection of the ray with the seasonal thermocline. The anisotropic nature of the three dimensional ray structure is responsible for unusual properties of reflection at a sloping boundary. New and Pingree (1990) showed results providing convincing support for the bottom reflection happening in the Central Bay of Biscay. For the first time, we found some evidence of slope reflection resulting in ISWs (further study is needed). The predicted locations for the generation of ISWs are then plotted against the available Earth Research Satellite (ERS) Synthetic Aperture Radar (SAR) images of the region. ISWs signatures are usually present in typical summer conditions, when the seasonal thermocline is fully developed. This is possible because of the effect of the ISWs surface currents on the roughness of the surface waves. Essentially, the surface roughness field is imaged by the SAR. Finally, we present some arguments relating the ISWs signatures to the predicted generation sites.

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MATHEMATICAL MODEL OF CURRENT INDUCED INSIDE A HUMAN BODY POSSITIONED UNDER A POWER LINE

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Power lines carrying high potential between 110 and 400 kV are part of our ecological environment: they pass over many populated places and traffic lines. There has been a noticeable arose in the public meaning of possible harming influence of 'radiation' coming from different electrical devices. However there has been much research done on that field in the past twenty years.

This work is concerned by current induced in a human body due to exposure to an electromagnetic field coming from a power line. It is shown that a body acts like an antenna. If a body is geometrically presented by cylinders and an approximation of thin antennae is made, using Plockington's equation it is possible to calculate the values of induced current in different regions of the body. Cases of arms risen under different angles are considered and values presented. Calculated values are confronted with the recommended exposure limits given by IRPA and WHO.

Although it is still not known how electromagnetic fields and induced currents affect our health, an overview of epidemiological studies related to the subject is given.

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THE NONEQUILIBRIUM GOLDSTONE PHENOMENON

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Dynamics of systems with spontaneously broken continuous global symmetry is in most cases dominated by the massless Goldstone bosons. The way these are excited and damped as well as the relevance of Goldstone theorem in out of equilibrium scenarios are studied. We claim that gapless Goldstone excitations appear and become dominant immediately after the symmetry breaking, well before the onset of equilibrium.

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THE SQUID READOUT SYSTEM FOR THE CRESST DARK MATTER SEARCH

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The CRESST experiment is a dark matter search aiming to directly detect the elastic scattering of WIMPs (Weakly Interacting Massive Particles) off atomic nuclei. The project is now entering its second phase using 10kg of absorber. By detecting both the light and phonons produced by an event we can reject a large fraction of the background radiation. The detectors are read out using a 66 channel SQUID (Superconducting Quantum Interference Device) system provided by Oxford University.

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THE SIMULATION STUDY OF VARIATION OF THE TARGET-BEAM GEOMETRY AND BEAM CHARACTERISTICS FOR THE BARE SPALLATION TARGET

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The spallation target as the external neutron source is supposed to be one of the main parts of the proposed Accelerator Driven Systems (ADS) and therefore the fundamental characteristics of the spallation source such as neutron generation, production of radioactive fragments etc. have been widely studied in many experiments. The results of such experiments could be sensitive to the energy of incident protons as well as to the alignment between the beam and the target axis, the parameters of the beam and the geometry of the target. This work is a simulation study of the influence of these parameters on the calculated results. In the simulations a bare cylindrical lead target (50 cm long, 9.6 cm in the diameter) was bombarded by the proton beam of four energies (0.8, 1.3, 1.5 and 2.5 GeV). The geometrical options of the performed simulations (e.g. the beam diameter, the displacement of the beam hit from the target longitudinal axis etc.) were varied and the effect of these changes on the computed results was evaluated. This study can help to identify whether the source of discrepancies among the simulations and experiment arises from the physical model in the simulation code or from the possible systematic error of experimental set-up. The simulations were performed with the LAHET code and the results were compared with the previous experiments carried out by our group.

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MISSCONCEPTIONS IN ASTRONOMY

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Resaults of one-year work on primary school astromomy program for 9-11 years old pupils.

Focus of research was misconceptions in astronomy (gravity). Testing two different groups, first one was never involved with any kind of astronomy or physics lessons, and second one was involved in one-year program. Particular focus in Program was small projects (both alone and in groups), where pupils built some conventional and nonconventional apparatus buy themselves. It all started with graphic work and painting in a Work Book and continues on practical work on constructions of paper and other models. For example: globe, star globe, compass, different kinds of sundial, time dials, time cylinder, models of planets, telescope, water rocket, planetarium...

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MAG-LEV TRAINS

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The aim of this paper is to present the physical elements on which the mechanism of the Mag-Lev train is based. Scientists have been dreaming of using magnetism to create levitating vehicles for years. In fact, the theory was first proposed as far back as 1912. Unfortunately, these scientists did not have the equipment nor did they have access to the knowledge of magnetism that is readily available today.

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NEW APPLICATIONS OF OCT DEVICE

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This shows a new possible fields of application of The Optical Coherence Tomography. Originally OCT is used to take cross sections of tissue samples. However, there are many new ideas of implementations of OCT systems. OCT can be use to test absorbtion. We know from other sources that oxidize blood have different absorption then unoxidize blood. That way OCT can be use to determine blood oxidizing in eye for example. Finally, OCT is promising for dense record techniques.

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SURFACE ENHANCED RAMAN STUDY OF CYTOSTATIC DNA INTERACTION

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The vibrational study of the biological systems is one of the most important chapters of vibrational spectroscopy due to the obtained results. By means of these techniques the understanding of the structure and the properties of the molecules with biological interest has been possible. A major application of SERS (surface-enhanced Raman scattering) is focussed toward the characterisation of the co-adsorbates interaction at the metal surfaces [1].

The SERS behaviour for molecular structures with N atoms in pyridine ring has been studied by observing the charge transfer from the metal - organic molecule interface. It is the example of cytostatics, with large importance in oncology. As an application here, we report the SERS study of 6-Mercaptopurine (6MP) in free adsorption state and mixed with DNA on the Ag colloidal surface.

6MP is a sulphur analogue of naturally occurring purine. It was firstly synthesised with the idea that chemotherapy with abnormal nucleic acid bases might effectively inhibit tumour growth [2]. A SERS study of 6-MP at the Ag electrode surface has been reported, together with the normal coordinate analysis [2]. The authors compared the different theoretic possibilities of 6-MP adsorption and found the N1-attachment of the pirimidine ring as the most probable.

FT-SERS spectra of 6-MP at different concentrations have been recorded. Notable differences observed allowed concluding about different adsorption geometry of the 6-MP at the surface. FT-SERS spectrum of the DNA reveals bands from adenine only, showing a remarkable chemical specificity when aggregated Ag colloids were used. FT-SERS spectra of the 6-MP-DNA mixture with different molar ratios showed completely different behaviour. At low DNA concentration, the SERS signal is exclusively due o the 6-MP. Increasing 10 times the DNA concentration in the mixture, the fingerprint of the DNA base adenine can be observed, together with a shape change of the 6-MP response. At this level of investigation we can suppose an interaction between DNA and 6-MP at the Ag colloidal surface.

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QFT AND MEMORY

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Most theories of memory use neural networks and describe memory formation in terms of the strengthening of links between different neurons. This theory however has several problems, the major of which is how to describe long-range correlations. If one assumes that there exists a quantum field in the brain (which can arise, according to Frohlich, from dipole oscillations), and when spontaneous symmetry-breaking occurs in this context, then two features jump to the eye: the field mediates long-range correlations between distant brain parts, and it allows for a huge memory capacity in unitarily inequivalent vacua. However, I show that transitions can occur between these vacua due to the bubble solutions of the equations, which can correspond to the confusion of memories and adaptation of them. I also show that memory formation requires synchronised oscillations, something which has also been found in recent neuroscientific research about 40 hz oscillations in the brain.

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ACTIVE DIODE-LASER GYROSCOPE

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The mode-locked region is the main problem to overcome in the Active Laser Gyroscope. The interest in using semiconductors to eliminate the dead-band has recently risen. This is mainly due to costly optics required in a He-Ne –gyroscope. Some methods to eliminate the mode-locked region in the Active Laser Gyroscope are discussed. Preliminary results using a diode-pumped vanadate laser are presented: with a decent measurement technique, a beat note under 100 Hz can be achieved.

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SIMULATIONS OF QUANTUM COMPUTING SYSTEMS

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Investigation of quantum computing scheme which allows to make operations of storage quantum information, the processing of this information using quantum gates and reading out the results.

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INVESTIGATION OF LASER-INDUCED TRANSIENT GRATINGS AT THE OPAQUE SOLID INTERFACE

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Nondestructive interaction of laser pulse with highly absorbing solids in thermal contact with transparent media attracts a special interest in photoacoustic, reflecting thermal lens and beam deflection spectroscopy. Investigations in the field of Forced Rayleigh Scattering (dynamic grating method) have made a noticeable contribution to this problem treatment. In case the results on thermal and acoustic gratings excitation at the interface of two media with one being an opaque solid (Ge, Si, Cu) whereas another being a transparent thick layer (air, liquid) in thermal contact have been represented. The thermal and acoustic gratings are excited due to sample dilatation. At the same time, a small part of heat flax is rapidly transferred into the transparent media. It leads to bulk thermal grating and acoustic wave of frequency recording. In this case determination of the thermal diffusivity of samples, sound velocity V of adjacent liquid and gas are in good agreement with reference values. The problems of thermal diffusivity of gases as well as of porous silicon deposited on crystalline Si substrate are discussed in the report.

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DEVELOPMENT OF THE NEW DESIGN OF STABLE MULTIPASS RESONATORS

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This paper describes the continuing developments in laser resonator and optical beam propagation from traditional resonator up to new design of steady multipass resonators. It also look forward at the programs for account of steady multipass resonators for slab-lasers on personal computer, which allow to calculate stability of the resonator and optical losses for the large number of mod, and the dependence of size diffraction of loss and mod of structure of radiation on number of Frenel and laidding of the resonator is analyzed.

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TELEPORTATION OF A VACUUM-ONE PHOTON QUBIT

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Quantum State Teleportation has been recognized as one of the basic methods of quantum communication and, more generally, as one of the basics idea of the whole field of quantum information. I report the experimental realization of teleporting a one-particle entangled qubit. The qubit is physically implemented by a two-dimensional subspace spanned by the states of a mode of the electromagnetic field, specifically,. the vacuum and the one photon state. We recently achieved the "active" scheme of the teleportation protocol, i.e. Bob performed the unitary operations conditionally on Alice measurement. In our experimental set-up an high-voltage Pockel cell driven by an Alice detector performs a p-phase shift on the teleported state.

E. Lombardi, F. Sciarrino, S. Popescu and F. De Martini Phys. Rev. Lett. 88, 070402 (2002)

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P1 – 38

QUANTUM NEURAL NETWORK

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I will present algorithms for the implementation of a quantum neural network (learning and classification). A complete implementation for the classification and learning algorithms is given in terms of unitary quantum gates.

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THEORETICAL STUDY OF PHASE SINGULARITY BIRTH UNDER THE ACTION OF GAUSSIAN BEAM.

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We present theoretical study of optical singularity birth in a wave front of light beam with stigmatic and astigmatic Gaussian profile with initially smooth wave front passing through a homeotropically aligned nematic liquid crystal (NLC) cell. A linearly polarised astigmatic Gaussian light beam illuminates the cell. Strong director anchoring at the cell walls is assumed. Equilibrium director profile is determined by the minimum of the total free energy. Functional minimum is calculated numerically by two methods: solving Euler-Lagrange equations and using Ritzas variational method (i.e. the amplitude of director reorientation is considered to be similar to Gaussian profile). We find the threshold intensity for light induced Fredeericksz-type. Utilizing the Huygens-Fresnel principle and geometrical optics approximation we calculate the amplitude distribution in spase for different distances from the cell. In the case of stigmatic Gaussian beam we have a ring of zero amplitude of the beam. Thus the edge dislocation of a wave front is born. It is obtained that the trajectory of zero amplitude in the case of astigmatic Gaussian beam resembles a deformed rubber ring symmetrical in the xz-, yz- planes and stretched along z-axis.

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QUANTUM MANIFESTATION OF CLASSICAL STOCHASTICITY IN THE MIXED STATE

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A Hamilton system with a few local minima in the potential energy surface represents a model in frame of which one can describe the dynamics of transitions between different equilibrium states, including such important transitions as chemical reactions, nuclear fission and others. Systems of such type allow existence of several critical energy values even for a fixed set of potential parameters. That leads to a possibility of existence of so-called mixed state [1] for such potentials: different dynamic regimes (regular or stochastic) are realised in the same energy interval in different local minima. It gives new possibilities for studies of the quantum manifestations of classical stochasticity (QMCS), using the following objects: statistical properties of energy spectrum (nearest-neighbour spacing distribution), structure of the wave functions (nodal curves, probability density) and wave packet dynamics. We consider such possibilities in application to quadrupole surface oscillations of nuclei, described by the lowest terms of the deformation potential decomposition in deformation parameters. In that potential the mixed state is observed in that part of the parameter space, where the equilibrium shape of the nucleus can be either spherically symmetric or deformed, i.e. for the potentials with a few local minima. In the case of the potential energy surface of complicated topology numerical calculation based on matrix diagonalization becomes not effective, but the so-called spectral method [2] can become an inspiring alternative. Since the spectral method is fundamentally based on numerical solutions of a time-dependent differential equation, its implementation is always straightforward. Neither special ad hoc selection of basis function is required, nor is it necessary for the potential to have a special analytic form. The spectral method is in principle applicable to problems involving any number of dimensions.

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CHAOS AND SELF-ORGANIZATION IN ACOUSTIC CAVITATION

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A mathematical model, which describes radial and translational motion of spherical cavitation bubbles driven below resonance in a strong acoustic field is obtained. A spherical bubble in a liquid can be viewed as a nonlinear oscillator that can be set into radial oscillations by a sound field. Investigation of the dynamic properties of a single bubble show that within the limits of subharmonic resonances of the system period-doubling cascades to chaos and back to regular dynamics take place. A possible mechanism for the occurrence of “erratic dancing” of bubbles in liquids is proposed. Besides “erratic dancing” the low-frequency quasi-periodic translational motion (“periodic dancing”) is detected at certain values of bubble radii.

For a pair of bubbles the dynamic modes of various character are detected: simple attraction, periodic motion and asymptotic motion, when the bubbles tend to take steady positions on a vertical axis passing through the pressure antinode. In the last two cases bubbles do not coalescence and are bound into couples, that cannot be predicted by the well known linear theory. Their occurrence is explained by the giant response of small bubbles, not being a harmonic and 10 times larger than the main linear resonance. Thus, the non-linear effects can result in self-organizing of bubbles.

Structure formation processes are simulated numerically under the assumption of spherically symmetric oscillations of bubbles. Investigation of the bubbles' oscillations in a cluster revealed a synchronisation phenomenon: bubbles of different initial radii in a cluster collapse in phase. The characteristic sizes of bubbles in structures, as well as size and shape of the structures itself are in good qualitative agreement with experimental observations.

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SELF-ACTION OF ELECTROMAGNETIC FIELDS IN A DENSE PLASMA SUBJECT TO EXCITATION OF LANGMUIR TURBULENCE BY AN INCIDENT WAVE

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An instability of steady-state reflection of an incident electromagnetic wave from the overdence plasma slab subject to the excitation of strong Langmuir turbulence is observed by computer simulations. An amplitude threshold for dynamic regime is specified and the structures of penetrating waves in stratified plasma are studied. It is obtained that the penetration velocity is determined by the growth rate of modulation instability and skin-layer scale but Landau damping of Langmuir waves limits the depth of penetration. Since it can be considerably large than the linear skin-layer scale, the recently predicted in the framework of stationary model effect of rapid plasma transparency is confirmed.

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TRENDS IN APPLIED PHYSICS AND THE 'HI-TECH' DESIGNER

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In the modern world physics is ever gaining new dimensions. From an exact research science, Applied Physics was born. Another step is essential: to link it to everyday people's lives and products. Smart engines, nano-machines, fuzzy logic, industrial approach, biomedical devices, self-sustainable energy sources. This lecture seeks to illustrate this new reality from the Technology Designer perspective, my vision. Also, industry trends drive academic research, via e.g. social motivation and funding. If time allows, a notion of Design Process and Method will be given. The poster also provides information on sponsored design programs in the Netherlands.

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STRINGS

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String theory is the most promising theory for physics beyond the Standard Model. This helps in a pictorial way to illustrate the basic concepts, the fundamental objects of the theory and their interactions.

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THE PROGRESSION OF LIGHT THROUGH HOMOGENEOUS AND TRANSPARENT CRYSTAL

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This problem is solved using the principles of classical electrodynamics. The topic of our observation is the progression of light through homogeneous and anisotropic medium.

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SCHRODINGER EQUATION FOR H ATOM IN N-DIMENSIONAL SPACE

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In this article Schrodinger equation for H atom in n-dimensional space is presented. In three-dimensional space solution is well known Laguerre polynom (radial part) with discrete spectra of energy.

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EURO COIN DIFFUSION

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Euro coins and bills were introduced in twelve EU countries in the beginning of year 2002. All the notes introduced are of the same design, and so are the front sides of the coins. However the backsides of the coins have distinct designs in each country. When people travel within EU countries, they change the Euro coin population in each country they leave or arrive with coins in their pockets. In this study we have modeled the mixing of Euro coins between the EU countries, which have the Euro as their legal currency. We have used data found from the internet as well as Monte Carlo methods to simulate the evolution of Euro coin populations in each country. This study might seem rather unphysical, but in fact this is an example of a diffusion problem, which has been solved using the same technique as many physical diffusion problems, e.g. mixing of liquids on molecular level.

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HETEROGENEOUS NUCLEATION AND CONDENSATION ON FLAT SURFACES

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Heterogeneous nucleation and condensational growth of water droplets have been studied theoretically and experimentally on different surfaces: three kinds of paper, steel, Teflon and cellophane. The experiments were carried out using an environmental scanning electron microscope (ESEM). Theoretical framework included use of the classical nucleation theory and diffusion theory in kinetic regime. The critical water vapour supersaturations and contact parameters between the droplet and surface in order to initiate the droplet formation process were obtained experimentally. Predictions for the initial (critical) radius of newly formed droplets as well as growth rates were obtained using the theories mentioned above. For all surfaces, the measured critical supersaturations were smaller than the ones predicted by the classical nucleation theory.

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SPIN STABILIZED MAGNETIC LEVITATION

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Phenomenon that we would like to present is levitation of the magnetic top above the base of permanent magnet. Existance of levitation point as a function of the magnetic field characteristics and the top mass are considered as the conditions in which appearance of levitation is possible. We have precisely calculated the relation between the potential energy of the described system and precession of magnetic moment around local magnetic field. In the research are also presented experimental results published by other authors which are compared with computer simulations. Since the analysis of the phenomenon is almost new presentation will also include some of the recent results concerning this topic.

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