

Meetings in Physics 2010 – Abstracts
(in alphabetical order of the names of the presenting authors)

1.

Title: Magnetic methods for detection of soil erosion of agricultural land

Authors: Anna Atanasova¹, Diana Jordanova¹, Petar Petrov²

Abstract: Magnetic methods are successfully applied during the last decade to map and estimate soil loss and erosion rates due to the observed systematic variations of magnetic parameters along the depth of soil profiles. Magnetic susceptibility variations within small test area of 8.4ha is mapped at a grid of 6m using portable field kappameter KT6. Statistical significance of the data is evaluated through standard descriptive statistic, using 10 replicate measurements at each grid point. In total 256 grid points build up the grid.

Surface soil material was gathered for laboratory magnetic measurements. Additionally, a soil profile from non-disturbed, not used for agriculture place close to the field site was dug, cleaned and sampled at each 5cm.

All the extensive field and laboratory magnetic measurements for the studied test site suggest that significant soil loss has taken place in the upper slope direction, resulting from plough activities. In order to discriminate the contribution of pedogenic magnetic fraction from that one of strongly magnetic parent material, the ratio of saturation remanent magnetization (SIRM) and magnetic susceptibility (X) is successfully used. The effect of grain size distribution of soil materials from different slope positions will be also discussed.

Keywords: magnetism, soil, erosion

PACS: 75.30.Cr; 75.47.Lx; 92.40.Lg; 92.40.Gc

Address: 1Sofia University, Faculty of Physics, Dept. Meteorology and Geophysics, 2Geophysical Institute, BAS, Acad. Bonchev str. bl.3, 1113 Sofia

E-mail: anypetkova@yahoo.com

2.

Title: Search for MSS in ^{140}Nd

Authors: Antoaneta Damyanova¹, K. Gladnishki¹, G. Rainovski¹, M. Danchev¹, R. Topchiyska¹, D. Karagyozov¹, A. Dewald², J. Jolie², A. Blazhev², C. Fransen², T. Pissulla², W. Rother², M. Rudigier², N. Pietralla³, O. Möller³, M. Reese³

Abstract: The states with mixed proton-neutron symmetry (MSSs) are of utmost importance for understanding the proton-neutron interaction. Recently, it has been shown that these collective isovector excitations in the valence shell are sensitive to the underlying single-particle structure through the mechanism of shell stabilization. This mechanism was primarily suggested to explain the characteristics of the one-phonon MSS of ^{138}Ce and lately confirmed by the features of MSSs in all stable $N=80$ isotones. However proton structure of these isotones is based exclusively on $\pi g_{7/2}$. In order to completely prove this mechanism it is necessary to identify the one-phonon MSS in the radioactive $N=80$ nucleus ^{140}Nd . For this we have performed a lifetime measurement of the abovementioned nucleus at the University of Cologne. Details about the experiment, the data analysis and some preliminary results will be presented and discussed.

Keywords: mixed symmetry, lifetime measurement

PACS: 21.10.Tg, 21.10.-k, 21.60.Ev, 27.60.+j

Address: 1Faculty of Physics, St. Kliment Ochridski University of Sofia, 1164 Sofia, Bulgaria, 2Institut für Kernphysik, Universität zu Köln, 50937 Cologne, Germany, 3 Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany

E-mail: adamyanova@phys.uni-sofia.bg

3.

Title: Instability indices as an indicator of thunderstorms developed over inland and along the coast in East Bulgaria

Authors: Boriana Markova¹, Rumjana Mitzeva²

Abstract: The study is directed to test the ability of some instability indices to be used as an indicator of lightning from convective clouds. This work is continuation of the previous study presented on Meeting in Physics, 2009 showing that none of the analyzed instability indices alone is able to discriminate between ordinary precipitating clouds (without lightning) and thunderstorms (clouds with lightning).

Three instability indices - CAPE, Lifted Index and K Index, were calculated using environmental conditions of 112 days with precipitation over East Bulgaria from April-September 2006. Aerological sounding at 1200 UTC (obtained by the numerical model GFS) for 11 stations close to the location of the storms development was used for their calculations. Two different statistical performances were carried out. All precipitating cases (508) were divided into two samples – ordinary precipitating clouds (329) and thunderstorms (179). The same samples were considered separately for two groups based on geographical location - storms developed above the inland (183 ordinary and 102 thunderstorms) and storms developed along the coast (146 ordinary and 77 thunderstorms).

General discriminant analysis was used to obtain classification function for the type of the studied convective clouds (ordinary or thunderstorm). The results reveal that the separation of the cases into two groups based on geographical locations does not improve the diagnostic ability of classification function.

Keywords: Rain, Thunderstorm, Instability indices

PACS: 92.60.Pw – Atmospheric electricity in Earth's atmosphere, 92.60.Qx – Storms atmospheric, 92.60.N-, 92.60. Nv – Clouds meteorology

Address: ¹National Institute of Meteorology and Hydrology – Varna, Bulgaria, ² Faculty of Physics, University of Sofia, Bulgaria

E-mail: b_markova@abv.bg

4.

Title: Degree of environmental pollution in Sofia deduced by magnetic proxy studies of urban street dust

Authors: Daniela Todorova, Diana Jordanova

Abstract: Magnetic methods for qualitative evaluation of the degree of pollution of soil, sediments, dust and vegetation with toxic heavy metals are widely used as an initial easy, cheap and fast way to obtain high-resolution maps of relative degree of environmental pollution. These are subsequently used for sampling and classical chemical analyses. Street dust was collected in Sofia city from the main stations of the public transport, resulting in a collection of 98 samples. Magnetic measurements were carried out in Paleomagnetic laboratory at the Geophysical Institute (Bulg. Acad. Sci.), including mass-specific magnetic susceptibility, isothermal remanent magnetization, anhysteretic remanent magnetization and calculation of interparametric ratios. Lateral changes in these characteristics are interpreted in terms of relative degree of pollution of street dust with heavy metals, which is important for humans' health. Data suggest that the highest degree of environmental pollution is to be expected in the central parts of the city. Additional investigations were carried out on the fine grained dust fraction ($d < 0.63 \mu\text{m}$) in order to evaluate the importance of sub-micron fraction.

Keywords: environmental magnetism, environmental pollution, magnetic oxides

PACS: 91.25.fd; 91.62.Rt; 75.47.Lx

Address: Sofia University; Faculty of Physics, Dept. Meteorology and Geophysics

E-mail: danita_rose@abv.bg

5.

Title: Band Gap Dependence on Carbon Nanotube Diameters and Vacancy Density in Single Wall Carbon Nanotubes

Authors: Vladislav Antonov, Dobrina Borisova, Stoyan Pisov, Ana Proykova

Abstract: The Single Wall Carbon Nanotubes (SWCNT) change their band gap - both the width and the energy level distribution when vacancies are present. A perfect SWNT can be semiconductor, while the defective one could be metallic or semi-metallic. The vacancy density can be controlled in irradiation experiments thus making the defective SWCNT interesting for nanoelectronics. The effect of vacancy density on the band gap of the zigzag (10,0) and the armchair (5,5) SWCNT has been computed with the help of the Quantum Espresso code which is a plane-wave realisation of the density functional theory. For the zigzag nanotube the energy gap shrinks and the states split as the vacancy density increases while the armchair SWCNT is less sensitive to the vacancy concentration.

Keywords: Density-functional theory, Ab initio calculations, vacancies, semiconductor, band gap, single-wall carbon nanotube

PACS: 61.46.Fg, 68.55.Ln, 31.15.E-, 31.15.A- , 81.05.U-

Address: University of Sofia, Faculty of Physics, Atomic Physics Department, 5 James Bourchier Blvd. 1164 Sofia, Bulgaria

E-mail: dobrina@mc.phys.uni-sofia.bg

6.

Title: Study of states with mixed proton-neutron symmetry of ^{94}Mo and ^{96}Ru

Authors: N. Pietralla¹, C. Bauer¹, L. Coquard¹, and J. Leske¹, G. Rainovski², M. Danchev², K. Gladnishki², Doycho Karagyozov², A. Damyanova², R. Topchiyska², M. Carpenter³, R.V.F. Janssens³, K. Lister³ and S. Zhu³

Abstract: Understanding the basic mechanisms of how the interactions between protons and neutrons lead to the formation of complex nuclear structures is a prime interest of modern nuclear structure physics. The structure proton-neutron (pn) mixed-symmetry states (MSSs) is particularly sensitive to a certain parts of the proton-neutron interaction which cannot be observed in the structure of fully-symmetric states. In this work we report on a data analysis of two Coulomb excitation experiments in inverse kinematics, devoted to study the MSSs of ^{94}Mo and ^{96}Ru . The experiments were performed at Argonne National Laboratory with Gammasphere. These experiments are the first step towards the identification of two-phonon 2^+ MSSs in these nuclei. The main aim is to determine the quadrupole moments of the known one-phonon MSSs. Details about the experiment, the data analysis and some preliminary results will be shown and discussed.

Keywords: Coulomb excitation reactions, B(E2) transition strenghts, Collective models – IBM-1

PACS: 25.70.De, 21.10.Re, 21.60.Ev, 23.20.Js

Address: 1Institut für Kernphysik, TU Darmstadt, 64289 Darmstadt, Germany, 2St. Kliment Ohridski, University of Sofia, Bulgaria, 3 Argonne National Laboratory, Argonne, IL 60439

E-mail: dkaragyozov@phys.uni-sofia.bg

7.

Title: Liposomes as model membrane systems in biophysical experiments

Authors: Hristo Kolev, Ivaila Pancheva, Mariana Mitewa

Abstract: The recent tendency in experimenting with biophysical objects like phospholipid membranes, mono- and bilayers calls for the development of new experimental methods and procedures. Our laboratory has developed and used analytical techniques based on luminescence to study processes occurring in the phase boundary between the aqueous and the lipid phase in the form of phospholipid vesicles. The greater performance and sensitivity of luminescent methods allows very precise experiments to be carried out.

Keywords: liposome, bilayer, luminescence

PACS: 87.16.D- Membranes, bilayers, and vesicles, 87.15.mq Luminescence

Address: Sofia University “St. Kliment Ohridski”, Faculty of Chemistry, Department of analytical chemistry, Laboratory of biocoordination and bioanalytical chemistry, “James Bourchier “ 1 blv., Sofia, 1164

E-mail: HristoKolev@chem.uni-sofia.bg

8.

Title: Tunnel effects in AlN/GaN heterostructures

Authors: Iglika Asenova, Evgenia Valcheva

Abstract: We are concerned in electronic states in barrier semiconductor heterostructures, such as double barrier systems and superlattices. Features like resonant transmission and minibands are reviewed. We also present a model of superlattice AlN/GaN, put into an external electric field. This model takes account of the spontaneous and piezoelectric polarization in the layers AlN and GaN and is based on the transfer matrix formalism.

Keywords: superlattice, transfer matrix, resonant tunneling, transport properties

PACS: 73.21.Cd

Address: University of Sofia, Faculty of Physics, 5 James Bourchier Blvd., 1164 Sofia, Bulgaria

E-mail: iglika@gbg.bg

9.

Title: Drop Breakage in Highly Concentrated Emulsions

Authors: Ivan Lesov, Slavka Tcholakova, Konstantin Golemanov, Nikolai Denkov

Abstract: The process of drop breakage in sheared highly concentrated emulsions was studied experimentally, in relation to industrially relevant procedures for emulsion formation. The experimental results for the average volume-surface diameter and the maximal diameter of the drops, formed in the emulsification process, are described by (still empirical) “master” curves.

Keywords: emulsification, drop breakage, turbulent flow

PACS: 47.27.wj; 47.55.db; 47.55.df Br; 82.70.Kj; 83.80.Iz

Address: Department of Chemical Engineering, Faculty of Chemistry, University of Sofia James Bourchier Avenue 1, Sofia 1164, Bulgaria

E-mail: lesov@lcpe.uni-sofia.bg

10.

Title: Ellipsometric characterization of new quaternary chalcogenide glasses of Ge-Sb-(S,Te) system

Authors: Kalina Todorova, V Pamukchieva and A Szekeres

Abstract: The optical properties of new quaternary telluride glasses with composition of $\text{Ge}_x\text{Sb}_{40-x}\text{S}_{50}\text{Te}_{10}$ and $\text{Ge}_x\text{Sb}_{40-x}\text{S}_{55}\text{Te}_5$ ($x= 10, 20, \text{ and } 27$) are studied by ellipsometry performed in the spectral range of 400-820 nm. The compositional dependence of complex refractive index, single-oscillator energetic parameters and optical band gap energy values are considered. The observed increase of the optical band gap energy value with increase of Ge content or decrease of Te content is explained in terms of chemical bonds formation and density of states, both affected by compositional variation.

Keywords: Multicomponent chalcogenide glasses, Spectroscopic ellipsometry, Optical constants

PACS: 61.43.Fs; 61.43._j

Address: Institute of Solid State Physics, Bulgarian Academy of Sciences, Tzarigradsko Chaussee 72, 1784 Sofia, Bulgaria

E-mail: kalina26@abv.bg

11.

Title: Theoretical study of gas pressure influence on surface-wave-sustained discharge

Authors: Kaloyan Pavlov, M. Pencheva and E. Benova

Abstract: Surface-wave-sustained discharges (SWD) are studied theoretically in pressure range from a few mTorr to one atmosphere on the base of a self-consistent model. The model includes the complete set of equations describing both the electrodynamics of the wave propagation and the kinetics of the discharge. The spatial distribution of charged particles and excited atoms density, the wave characteristics, the EEDF and electron mean energy as well as the wave field components with pressure increasing are obtained and compared with the experimental results.

Keywords: Microwave discharges, Surface-wave-discharge, Plasma modelling

PACS: 52.25.b, 52.50.b, 52.50.Sw, 52.80.Pi

Address: St. Kliment Ohridski University of Sofia, Sofia, Bulgaria

E-mail: kenio@abv.bg

12.

Title: Near Field Measurements of Planar Antennas and Microwave Devices

Authors: Kaloyan Zlatkov and Plamen Dankov

Abstract: The Near Field measurement technique is one of the most favourable and workable methods for practical determination of the electromagnetic fields, radiated from given microwave structure. It is widely used for measuring crucial properties of microwave antennas like antenna gain, directivity, efficiency, far field radiation pattern, axial ratio, beamwidth etc. Providing in most cases considerable advantages (like high measurement accuracy, high throughput, elimination of weather effects) before other techniques like Open Test Range, Compact Test Range or Anechoic Chamber, the Near Field Test Facility is an integral part of every modern microwave laboratory. We have started a new research in determining the radiated fields not only from antennas, but also from other microwave structures like microstrip filters and diplexers, using a Near Field Test Facility. This is a totally new technique for investigation of the electromagnetic compatibility of all types of microwave structures, providing us with the opportunity to obtain fundamental information about the physics of the processes, taking place in such structures. The base of the near field measurement technique is in obtaining the field amplitude and phase of the device under test with a high accurately movable microwave probe in the near field region of the radiated structure and transforming them via Fast Fourier Transformation to the equivalent far field radiation pattern. This data is used for determining all the crucial properties of an antenna under test and can be used for building a picture with high resolution of the radiated fields from all types of measured microwave devices. In this presentation we introduce the physical principles of the near field measurement technique. Next we demonstrate the power of this technique, presenting measurement data of classic planar antennas with known parameters and comparing them with the measurements of the same antennas with other techniques (Anechoic Chamber and Open Test Range). Finally we present the first series of measured data of planar microwave microstrip, filter and diplexer, analyse the results and share our future plans for further research and development on this outfield.

Keywords: microwave measurement; near field; planar microwave structures

PACS: 84.40.Dc : Microwave circuits

Address: Sofia University, Faculty of Physics, Department of Radio physics and Electronics, 5 J.Bourchier Blvd, 1164, Sofia

E-mail: kaloyan_zlatkov@abv.bg, dankov@phys.uni-sofia.bg

13.

Title: Bubble breakup in steadily sheared foams

Authors: Konstantin Golemanov¹, Slavka Tcholakova¹, Nikolai Denkov¹, K. P. Ananthapadmanabhan², and Alex Lips².

Abstract: Bubble breakup in foams, subject to steady shear flow at constant rate was studied experimentally. Different surfactants were used to check how foam rheological properties and bubble breakup process depend on surface viscosity of the foaming solution. Experiments

showed that the bubble breakup always started at certain critical ratio between the foam viscous stress and the capillary pressure of the bubbles.

Keywords: foam rheology, viscous stress, bubbles, bubble break-up

PACS: 83.80.Iz, 47.57.Bc, 82.70.Kj, 82.70.Rr

Address: 1Department of Chemical Engineering, Faculty of Chemistry, University of Sofia James Bourchier Avenue 1, Sofia 1164, Bulgaria; 2Unilever Global Research Center, Trumbull, Connecticut 06611, USA.

E-mail: kg@lcpe.uni-sofia.bg

14.

Title: Лазерна спектроскопия на LiCa

Authors: Милена Иванова, Alexander Stein, Асен Пашов, Horst Knockel, Eberhard Tiemann

Abstract: След създаването на свръхстудени двуатомни молекули на алкални метали чрез фотоасоциация, от интерес сега са също така смесените алкални - алкалоземни молекули, например SrRb, LiSr, LiCa и т.н. За тяхното получаване от студени атоми, обаче е необходимо познаването на тяхната електронна структура. За съжаление такава спектроскопска информация почти напълно отсъства. Ще бъдат представени първи резултати от експерименталното изследване на молекулата LiCa. Получени са потенциални криви на основното и на едно възбудено състояние, които са първа стъпка за моделиране на студени удари в смесени свръхстудени ансамбли на Li и Ca атоми.

Keywords: лазерно охлаждане, студени атоми, студени молекули, LiCa, потенциални криви

PACS: 31.50.Bc, 33.20.Kf, 33.20.Vq, 33.50.Dq.

Address: Department of Optics and Spectroscopy, Faculty of Physics, University of Sofia

E-mail: milena_ii@abv.bg

15.

Title: Construction of a bilayer ion-beam shielding - a Monte Carlo simulation

Authors: Nickolay Todorovsky and Ana Proykova

Abstract: Monte Carlo simulations were implemented to obtain a proper thickness of a bimetallic shield to stop ion (H, N, U) beams with energy of 500 keV and 1000 keV. Bilayers Cu-Zn of thicknesses between 0.05 μm and 4.2 μm proved to be appropriate for the purpose.

Keywords: ion beam-matter interaction, radiation shielding, Monte Carlo simulation, SRIM code

PACS: 02.50.Ng, 34.50.-s, 34.50.Bw

Address: University of Sofia, Faculty of Physics, Atomic Physics Department, 5 James Bourchier Blvd. 1164 Sofia, Bulgaria

E-mail: nickolaicho@gmail.com

16.

Title: Preparation and optical properties of transparent zirconia sol-gel materials

Authors: Nina Petkova, S. Gutzov

Abstract: The sol-gel technology is a low temperature method for preparation of different oxide materials like SiO₂, ZrO₂, Al₂O₃ or SnO₂ from liquid precursors. Varying the conditions of synthesis, as solvents, catalysts, organic ligands, pH, different types of products like coatings, fibers, or solid electrolytes can be prepared. The sol-gel chemistry of zirconia is more complicated in comparison with silica alkoxide, because of the low chemical stability of zirconium alkoxides against water. In the present contribution the preparation and optical properties of sol-gel zirconia prepared via three different schemes are discussed. The sol-gel materials are characterized with UV/Vis/NIR reflectance spectroscopy, SEM/TEM microscopy, IR spectroscopy and X-ray diffraction. The preparation of sol-gel zirconia from

alcoxides without protection agents results in formation of nanocrystalline agglomerates, visible by SEM and TEM microscopy. The use of chelating ligands like acetylaceton (AcAc) and acetic acid (AA) leads to transparent, stable gels with a high optical quality. The complex formation between Zr and AcAc is also proved by UV/Vis IR spectra. The series of samples, prepared with AcAc as a protective ligand are characterized by a yellow-brown coloration, which suggests a complex formation between zirconium and acetylaceton. There is a dependence between amount of acetylaceton and gelation time. The kinetic of the process can be changed by using some inorganic acids like HCl, which influence the gelation time. The UV/Vis/Nir reflectance spectra of the produced powders suggest, that zirconia gels, obtained by different methods are characterized with different optical properties. The absorption spectra are characterized by two peaks at 290 nm and 450 – 550 nm due to ligand to metal charge transfer transitions (LMCTT) which intensity and spectral position depend on the concentration of AcAc and AA. The optical band gap of the prepared sol-gel glasses, calculated using the Tauc equation changes from 2.97 eV for gels containing AcAc and AA to 4.85 eV for materials produced without protection agents. The value of 4.85eV coincides with the optical band gap of yttria stabilized cubic zirconia, while complex formation decrease the optical band gap.

Keywords: Sol-gel materials, optical properties, UV/Vis/NIR spectra

PACS: 81.20.Fw, 78.20.-e, 78.40.-q

Address: University of Sofia “St. Kliment Ohridski”, Department of Physical Chemistry, 1164 Sofia, J. Bourchier Blvd. 1, Bulgaria.

E-mail: nina_gpetkova@abv.bg

17.

Title: Multipolarity measurements in ^{118}Te nucleus

Authors: Rositsa Topchiyska¹, Georgi Rainovski¹, Miroslav Danchev¹, Kalin Gladnishki¹, Antoaneta Damyanova¹, Doycho Karagyozov¹, Jan Jolie², Christoph Fransen², Christian Bernards², Kevin Moschner², Janis Endres², Moritz Dannhoff², Desireé Radeck², Thomas Möller³, Michael Reese³, Coquard Laurent³

Abstract: The states with mixed proton-neutron symmetry (MSS) are collective quadrupole excitation of valence shell in which protons and neutrons are moving with opposite phases. The purpose of this study is to search for MSS in ^{118}Te . The low spin states of ^{118}Te were populated in $^{116}\text{Sn}(^4\text{He},^2\text{n})$ reaction and experimental data were taken in $\gamma\gamma$ -coincidence mode. Several new transitions were established and for some of the transitions E2/M1 multipole mixing ratios were deduced by the means of angular correlation analysis. Details about the experiment, the data analysis and the some preliminary results will be shown and discussed.

Keywords: correlation measurements in nuclear electromagnetic transitions; nuclear energy levels

PACS: 23.20.En, 23.20.Lv

Address: ¹St. Kliment Ohridski, University of Sofia, Bulgaria, ²Institut für Kernphysik, Universität zu Köln, 50937 Köln, Germany, ³ Institut für Kernphysik, TU Darmstadt, 64289 Darmstadt, Germany

E-mail: rtopchiyska@phys.uni-sofia.bg

18.

Title: Fast-timing measurements in ^{103}Cd , ^{105}Cd and ^{107}Cd nuclei

Authors: Stanimir Kisyov, S. Lalkovski, L. Atanasova, D. Radulov, P. Detistov, A. Dikova

Abstract: The talk will concern preliminary results from fast-timing experiments, performed at NIPNE-Magurele. The aim of the experiments was to measure lifetimes in ^{103}Cd , ^{105}Cd , ^{107}Cd nuclei, produced in beam. A technique, based on triple coincidences between detectors of $\text{LaBr}_3(\text{Ce})$ and HpGe detectors, will be discussed. The half-life of the first

excited state in ^{107}Cd was confirmed. New experimental results on ^{105}Cd and ^{107}Cd will be presented.

Keywords: gamma-ray spectroscopy, fast-timing, $\text{LaBr}_3(\text{Ce})$ scintillators, centroid shift method

PACS: 07.85.Fv, 29.40.-n, 29.30.Kv, 23.20.Lv

Address: Faculty of Physics, University of Sofia “St.Kliment Ohridski”, 1164 Sofia, Bulgaria, 5 James Bourchier Blvd.

E-mail: stanimir.kisyov@gmail.com

19.

Title: Monte Carlo simulation in a sputtering hollow-cathode discharge for laser applications

Authors: Stefan Karatodorov^{1,2}, D. Mihailova³, J. van Dijk³, J. van der Mullen³, and M. Grozeval

Abstract: A simple Monte Carlo model for the description of the electron behaviour in a hollow cathode discharge (HCD) is reported. The model is compared with existing models and its output is verified. It is applied to the case of a HCD for lasing applications. Analysis of the electron energy distribution function and the mean electron energy, is done. Future developments of the model are discussed.

Keywords: Discharge modeling; Hollow cathode discharges; Monte Carlo method ; Metal ion laser;

PACS: 52.65.Pp, 52.25.Dg, 42.55.Lt

Address: 1Institute of Solid State Physics, Bulgarian Academy of Sciences, Bulgaria, 2Faculty of Physics, Sofia University, Bulgaria, 3Department of Applied Physics, Eindhoven University of Technology, The Netherlands

E-mail: s.karatodorov@gmail.com

20.

Title: MMRD relationship for novae in M31 galaxy

Authors: Tito Trifonov, Ovcharov, E.; Valcheva, A., Nedialkov, P.

Abstract: MMRD (Maximum magnitude versus rate of decline) relationship for novae is a basic tool for measuring the extragalactic distances. For many decades the Andromeda Galaxy (M31), together with our own galaxy Milky way played the main role in precisising the shape of MMRD. We determined the maximum magnitudes and obtained rates of decline of newly discovered novae in M31. We aimed at adding points to r' -band MMRD relation constructed by Darnley et al. (2004) according to results of POINT-AGAPE project. We used mainly web-based data on M31 novae to selected a sample, appropriate to construct detailed red-light curves (well defined maximum, well sampled magnitude estimates down to 1.5 mag after the maximum light). For nova 2004-11a we perform

aperture photometry with IRAF on 7 CCD images taken with 2m telescope of NAO Rozhen, Bulgaria. These data were combined with literature data to determine maximum magnitudes and reliable rates of decline for 6 fast ($\log(100v_d) > 1$.) novae in M31. The combined r' -band MMRD relation seems to follow S-shaped rather than the linear MMRD relation.

Keywords: novae, M31 galaxy, MMRD relation

PACS: 97.30.Qt, 98.56.Ne

Address: Astronomy Department, University of Sofia, Faculty of Physics, 5 James Bourchier Blvd., 1164 Sofia, Bulgaria

E-mail: tito_trifonov@abv.bg

21.

Title: Coaxial discharge: modelling and applications

Authors: Todor G. Bogdanov and E. T. Benova

Abstract: Coaxial discharge is a new type of surface-wave-sustained discharges. Electromagnetic wave travelling along a dielectric tube with a metal rod at it axis can produce

plasma outside the tube. Since the plasma is acting as outer conductor, this configuration is named coaxial discharge. The modelling research provides valuable physical insight into the basic phenomena taking place and help the design and optimization of the different reactors. The purpose of this work is to present the achievements in the theoretical and experimental investigations of the coaxial discharge.

Keywords: Microwave discharges, Surface-wave-discharge, Coaxial discharge, Plasma modelling

PACS: 52.25.b, 52.50.b, 52.50.Sw, 52.80.Pi

Address: St. Kliment Ohridski University of Sofia, Sofia, Bulgaria

E-mail: t.g.bogdanov@gmail.com

22.

Title: Stellar populations in the bulge of M31 galaxy

Authors: Tosho Karadzhov, Valcheva A., Tikhonov N. and Nedialkov, P.

Abstract: Aims: The present paper is aimed at the study the optically resolved stars in the central region of M31 bulge with the first part focussed on photometry and the second – on the distinguishing among the detected stellar populations and their radial distribution. Methods: We exploited the HST archive of WFPC2 UVI images and performed photometry of the resolved stars. Results: The constructed color-color and two-color diagrams reveals the existence of two distinct populations: ~1000 young and massive AGB stars and ~100 OB-stars candidates. The younger stellar populations show more severe radial concentration.

Keywords: M31 bulge, stellar populations, AGB stars

PACS: 98.56.Ne, 98.62.Js, 98.62.Lv

Address: Astronomy Department, 5 J. Bourchier Blvd, Sofia 1164, Bulgaria

E-mail: karadzhov@phys.uni-sofia.bg

23.

Title: Dark matter in galaxies and galaxy clusters

Authors: Vesselina Kalinova

Abstract: Dark matter is a hypothesized form of matter that does not reflect or emit electromagnetic radiation. The existence of dark matter is inferred from gravitational effects on visible matter, such as stars and galaxies. We estimate the gravitational mass of our galaxy Milky way using 21-cm spectral lines, which were observed with a Small Radio Telescope (SRT). SRT is located at Sofia Observatory. Hydrogen radiation is not impeded by interstellar dust, because of that this kind of measurements are accurate. We observed deviation from the Keplerian prediction for the velocity of the hydrogen in a circular orbit. It is turned out that the dark matter in Milky way is approximately 56% from the entire mass of the Milky way on distance 8.5 kpc and the visible matter is 44% on the same distance. Coma Galaxy Cluster is one of the strongest evidence that the Universe is predominantly composed of some form of unseen matter. We use new data in order to estimate the virial and the visible mass of Coma Galaxy Cluster. It turns out that after 76 years since the hypothesis for existing of dark matter was propounded, the problem with the missing mass in galaxies and clusters is still unresolved.

Keywords: dark matter, galaxy, galaxy cluster, radio telescope, 21-cm line of emission

PACS: 95.35.+d Dark matter (stellar, interstellar, galactic, and cosmological)

Address: Faculty of Physics, Sofia University, BG-1164 Sofia, Bulgaria

E-mail: andromeda86@abv.bg

24.

Title: Total internal reflection microscopy

Authors: Yana Baldzhiyska, M. Bivolarska, S. Stoitsova, D. Marinkova, T. Velinov

Abstract: Total internal reflection microscopy (TIRM) is a simple high-resolution, non-fluorescent imaging technique.

With the TIR microscope the contact area of *Saccharomyces cerevisiae* and *Escherichia coli* cells with a surface was observed. Using transmitted light we found that *Saccharomyces cerevisiae* cells have deposited in three layers. Only the layer closest to the surface could be seen with the TIR microscope because of the short penetration depth of the evanescent waves. From a movie of the cells we could determine their vertical oscillations. The cell adhesion, division and biofilm formation of *Escherichia coli* for several hours were observed. With the time the quality of the pictures decreases because of the produced polysaccharides.

Keywords: TIRM, biofilm, cell adhesion

PACS: 87.64.M-

Address: University of Sofia, Faculty of Physics, Department of Solid State Physics and Microelectronics

E-mail: yanab@mail.bg

25.

Title: 1.3 μm Nd:YVO₄ laser, mode locked by second-harmonic generation in bismuth triborate (BiBO) nonlinear crystal

Authors: Hristo Iliev, Ivan Bucvarov

Abstract: Experimental results on a passively mode-locked Nd:YVO₄ laser working at the $4F_{3/2} \rightarrow 4I_{13/2}$ transition, emitting at 1.3 μm is reported. Negative $\chi(2)$ cascaded lensing assisted by frequency doubling nonlinear mirror (FDNLM) technique are exploited for the laser mode-locking. This hybrid technique enables generation of stable trains of pulses with several picosecond pulse width. The laser operates at 120 MHz repetition rate with average output power of 0.9 W and 3.7 ps pulse duration.

Keywords: 1.3 μm lasers, mode-locking, cascaded second order nonlinearity, picosecond laser system

PACS: 42.55.Xi Diode-pumped lasers, 42.60.Fc Modulation, tuning, and mode-locking, 42.65.Ky Frequency conversion; harmonic generation, including higher-order harmonic generation

Address: Faculty of Physics, Department of Quantum Electronics, Sofia University, 5 James Bourchier Blvd., BG-1164 Sofia, Bulgaria

E-mail: h_iliev@phys.uni-sofia.bg