

C O N T E N T S

GENERAL PHYSICS - THERMODYNAMICS

P.R. VYAS, T. C. PANDYA, C. V. PANDYA, V. B. GOHL

**A simple relation between volume and melting temperature at low pressures** ..... 111

A simple relation between melting temperature,  $T_m$ , and atomic volume  $V$  has been derived. This relation,  $T_m \cdot V^{2/3} = \text{constant}$ , has been derived from Debye's theory, Lindemann's criterion and simple way of estimation of Debye temperature. The presently obtained relation has been compared with experimental results and other previously proposed relations for several metals. It is concluded that a metal at low pressure melting can be regarded as a system of ions oscillating collectively in the background of uniform dielectric electron gas and Gruneisen parameter can be taken as approximately constant equal to 2/3.

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**Thermal convection in Rivlin-Ericksen fluid permeated with suspended particles in porous medium** ..... 119

The thermal convection in Rivlin-Ericksen fluid permeated with suspended particles in porous medium is considered. For the case of stationary convection, the medium permeability and suspended particles have destabilizing effects on the system. The kinematic viscoelasticity has no effect for stationary convection. Also, the dispersion relation is analysed numerically. In the presence of medium permeability, suspended particles and kinematic viscoelasticity, oscillatory modes are not allowed. The sufficient condition for the non-existence of overstability is also obtained.

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C. BIZDADEA, M. T. MIAUTĂ, S. O. SALIU,

**Hamiltonian BRST interactions between an abelian Chern-Simons term and a charged scalar field** ..... 129

Consistent Hamiltonian interactions between an abelian Chern-Simons term and a charged scalar field are derived by means of a deformation technique based on local Hamiltonian BRST cohomology.

GENERAL PHYSICS - ELECTRICITY AND ELECTRONICS

I. HRIANCA, C. CAIZER,

**Researches regarding load adaptation of a radiofrequency generator working in pulses** ..... 139

A system of resistor adaptation to a 95 ns width pulse generator with the time interval between two pulses of 1.71  $\mu\text{s}$  is studied. The system consists of a tuned secondary transformer with a pulse fed primary. We show that the spectral (Fourier) amplitudes and the voltage shape - numerically computed - are wavetrains composed of damped harmonic oscillations and the power transfer is at maximum when one performs a tuning characterized by a certain value of capacitance and coupling coefficient.

GENERAL PHYSICS - GRAVITATIONAL

IORDANA AȘTEFĂNOAEI, GH. MAFTEI,

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In this paper we analyse the behaviour of the gravitational waves in the approximation of the far matter fields, considering the indirect interaction between the matter sources and the gravitational field, in a cosmological model based on the Einstein-Rosen solution. Because the properties of the gravitational waves obtained as the solutions of Einstein fields equations (the gravitational field equations) are most obvious in the weak gravitational fields we consider here, the gravitational field in the linear approximation.

Using the Newman-Penrose formalism, we calculate in the null-tetradic base  $\{e_a\}$ , the spin coefficients, the directional derivatives and the tetradic components of Ricci and Weyl tensors.

From the Einstein field equations we obtained the solution for  $b(z, t)$  what described the behaviour of gravitational wave in Einstein-Rosen universe and in the particular case, when  $t \rightarrow \infty$ ,  $p(z, t)$  lead us to the primordial gravitational waves in the Einstein-Rosen Universe.

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NUCLEAR PHYSICS - NUCLEAR REACTORS

O. SIMA, L. DINESCU,

**Efficiency calibration and gamma-ray spectrometry measurement of a HELEN fuel rod ..... 165**

A fuel rod from the core of the HELEN Subcritical Assembly was measured by gamma-ray spectrometry. The efficiency calibration was achieved using the GESPECOR Monte Carlo simulation package. No evidence of the presence of fission products was found in the spectra. The detection limit for  $^{137}\text{Cs}$  was better than  $1.5 \text{ Bq g}^{-1}$ .

PLASMA PHYSICS

AUREL ARABAGIU, GHEORGHE VLAICU, ANCA ARABAGIU,

**The cathodic sputtering process in the normal-abnormal luminiscent discharge regime applied to ionic nitriding ..... 175**

The cathodic sputtering process in the regime: normal discharge (ND) – abnormal discharge (AD) is not described by the same laws as the ND or AD processes. The deviation from the "cos  $\theta$ " law, established by P. Sigmund [1] and M. W. Thomson [21] is put into evidence for the sputtering in stationary ND regimes. The deviation is analysed by applying a radio frequency (RF) field, inductively coupled to the discharge cathode. The electric field distribution was measured with a double probe.

The main cause of the changing in the sputtering process, in the ND-AD transition regime, is the modification of the electric field distribution and, respectively, of the space charge.

CONDENSED MATTER

V. SANDU, J. JAKLOVSZKY, S. POPA, ELENA SANDU, I. GR. DEAC,

**YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> polytetrafluorethylene superconducting composites ..... 183**

Foils of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>-superconductor in polytetrafluorethylene (PTFE) were obtained by pressing and sintering powder of PTFE and superconductors (95÷55 wt. % superconductor). X-ray diffraction revealed the presence of the orthorhombic phase of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>. In some cases a decomposition of the superconducting cuprate was observed. Magnetic susceptibility indicates an onset critical temperature of 90.8 K but with wide transition. The fine structure of  $\chi(T)$  curves indicates the presence of other phases of lower critical temperature. Owing to their mechanical properties these foils seem promising for flexible magnetic screens at low temperatures.

N. REZLESCU, E. REZLESCU, P. D. POPA, L. SACHELARIE,

**The effect of rare earth ions on the physical properties of a MgCuZn ferrite ..... 193**

Some effects of rare-earth ions on the properties of polycrystalline stoichiometric ferrite with formula Cu<sub>0.3</sub>Mg<sub>0.2</sub>Zn<sub>0.5</sub>Fe<sub>2</sub>O<sub>4</sub> are discussed. The results obtained reveal that the doping of a small amount of rare-earth oxide (2% weight) in spinel ferrite can affect both structure and physical properties.

E. REZLESCU, L. SACHELARIE, N. REZLESCU,

**The role of PbO and CuO on the sintering behaviour of magnesium-based ferrites ..... 201**

In this work the influence of the CuO and PbO on the densification of the MgZn ferrite for various sintering temperatures between 800 and 1100°C was investigated. By Cu substitution for Mg in Mg<sub>0.5-x</sub>Cu<sub>x</sub>Zn<sub>0.5</sub>Fe<sub>2</sub>O<sub>4</sub> ferrite ( $x = 0; 0.1; 0.2; 0.3; 0.4; 0.5$ ) an increase in the density was obtained at relatively low firing temperature.

DIANA MARDARE,

**On the ellipsometric studies applied to TiO<sub>2</sub> heat-treated thin films ..... 205**

TiO<sub>2</sub> thin films were obtained onto unheated glass substrates by a *d.c.* magnetron sputtering method. X-ray diffraction (XRD) patterns showed that the as-deposited films exhibit an amorphous structure. The structure changes to a mixed one, anatase (50%)/rutile (50%), after a heat treatment in air for 2 h in the temperature range 300-673 K. Using ellipsometric measurements and solving with computer the corresponding equations, a modelling technique was elaborated for finding the optical constants of the TiO<sub>2</sub> thin films deposited on substrates with given optical constants. The observed increase in the refractive index and extinction coefficient correlates well with the observed structure changes. A sensitivity analysis was performed.

DIANA MARDARE, G. I. RUSU,

**Optical and structural properties of Ce-doped TiO<sub>2</sub> thin films ..... 213**

TiO<sub>2</sub> thin films, obtained by *r.f.* sputtering method, were deposited onto glass substrates. Undoped TiO<sub>2</sub> films crystallize in a mixed anatase/rutile phase at a substrate temperature of 250°C. The films structure changes by adding cerium impurities, anatase phase being the only one detected. Consequently, the transmittance and optical constants are also modified. Phase and surface morphology were investigated using X-ray diffraction (XRD) and scanning electron microscopy (SEM). The spectral dependency of the refractive index and the extinction coefficient have been determined in the wavelength range between 360 and 830 nm using variable angle spectroscopic ellipsometry (VASE).

GH. MATEESCU, ALICE-ORTANSA MATEESCU,

**The features of the thin films, deposited in vacuum by PVD methods, as result of physical, chemical, thermodynamical and technological parameters influence about the substrate-thin film thermodynamical system ..... 219**

This synthesis work, based on the authors' theoretical and practical considerations, presents the physical, chemical and thermodynamical process parameters of the substrate - thin film - thermodynamic system and its influence about the parameters for qualities characterisation of all the thin films types. The balance temperature ( $T_e$ ), the internal energy of the system ( $U$ ), the system enthalpy ( $H$ ) and the Gibbs energy ( $G$ ) are, after theoretical considerations of any thermodynamical system, the process parameters, therefore for system substrate-thin film too. For chemical processes, that are complementary processes of the vacuum thin films deposition by PVD methods, it must be also used the chemical potential ( $\mu$ ) of the thin film constituent substances. These physical, chemical and thermodynamical parameters are also presented and used in many Growth Theories of the vacuum deposition thin films. Besides these parameters the features of the thin films, deposited by PVD methods [4], are also influenced and determined and by the deposition technological parameters, kept as manufacturing secrets and protected by patents. In the second part of the work it is presented a synthesis of the qualities characterisation parameters for the thin films and also the practical consideration, based on the authors technological experiments about the most important process parameters, presented above. So, in this work are also presented experimental results about the structure, the adhesion and adhesion of the metallic anticorrosion thin films on the steel sheets.

GEOPHYSICS

B. D. ENESCU, D. STANICA, D. ENESCU,

**Estimation of electromagnetic impedance using data recorded in Vrancea zone. An attempt to separate the recorded electromagnetic signals. Basic approach ..... 229**

The first part of this paper contains the results of an attempt to estimate the electromagnetic impedance in the zone of Vrancea deep seismic foci using electromagnetic data obtained at Muntele Roşu Observatory. The second part presents a tentative basic approach to separating the two different categories of natural electromagnetic events caused by geodynamic processes and to improving the signal/noise ratio of the electromagnetic records.

D. ENESCU, B. D. ENESCU, I. MOLDOVAN,

**Contribution to the short-term prediction of Vrancea earthquakes ..... 237**

The theoretical reasons for using ratios  $B_Z(t)/B_X(t)$  and  $B_Z(t)/B_Y(t)$  of the geomagnetic flux density components as earthquake prediction tools are first of all provided. Since the roughly EW-oriented  $B_Y$  component was negligibly small, we found that using  $\zeta(t)$ , the time variation of the mean daily ratio  $B_Z(t)/B_X(t)$ , was both right and advisable. The paper is based on records made at Muntele Roşu Electromagnetic Observatory during the time intervals from December 1997 to September 1998 and from November 1998 to May 1999. The results are given in Figs. 1-17. They prove the ratio  $\zeta(t)$  is an effective short-term precursor factor of Vrancea seisms, as it showed precursor perturbations(anomalies) in 92% of earthquakes of magnitudes  $M_{GR} \geq M_0$  ( $M_0 = 3.6-4.0$ , but mostly  $M_0 = 3.9$ ) occurring during the time periods under investigation. The precursor merit of the  $\zeta(t)$  ratio has been significantly improved by determining relation (8), which makes it possible to estimate the precursor time as a function of earthquake magnitude.

AURELIAN PÂNTEA, ANGELA CONSTANTIN, IREN-ADELINA MOLDOVAN,  
**Attenuation relationships using macroseismic intensity curves.**

**Part II. Crustal earthquakes from Banat region ..... 255**

The present paper is a study of macroseismic intensity attenuation laws, using the isoseismal maps for 10 crustal earthquakes with epicentral, maximum intensity in the range V to VIII degrees (Modified Mercalli scale) and  $M_D$  between 4.2 and 5.5, that occurred in the Banat (Romania) seismic region. The attenuation was analyzed as a function of maximum intensity, distance and azimuth, from the logarithmic attenuation formula that best fits the observed data. The bulk of derived equations is intended to be further used in the assessment of the seismic hazard of Romania. For the correct assessment of seismic hazard, the interpretation of the macroseismic effects distribution from a given seismic zone, as well as the good evaluation of seismic intensity attenuation laws are very important.