Indian J. Phys. **77B** (6), 611-616 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Space-weather – causes, consequences and predictions

Ashok K Singh* and R P Singh

Atmospheric Research Laboratory, Department of Physics,
Banaras Hindu University, Varanasi-221 005, India

E-mail : ashoks_01@rediffmail.com

Received 16 June 2003, accepted 1 September 2003

Abstract : Space-weather defines variation in the plasma speed and density, solar magnetic field and radiation density in the near Earth-space environment and consequences of those variations. It is scientifically interesting and challenging research field that has significant economic importance all over the world. Adverse changes in the near Earth-space environment can diminish the performance and reliability of both spacecraft and ground-based systems. In the present paper, we have described the causes and effects of space weather. Some means for space-weather predictions are also suggested.

Keywords : Space-weather, coronal mass ejection, geomagnetic activity.

PACS Nos. : 94.30.Va, 96.60.Vg

Indian J. Phys. **77B** (6), 617-620 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Radiative excitation of CS molecules in atmosphere of a star*

Suresh Chandra

School of Physical Sciences, S.R.T.M. University,
Nanded-431 606, Maharashtra, India

E-mail : suresh492000@yahoo.co.in

Received 25 March 2003, accepted 5 September 2003

Abstract : We have investigated radiative excitation of CS molecules in atmosphere of a carbon star. Besides those of the observed lines of CS molecule, intensities of some other lines, in the ground $v = 0$ as well as vibrationally excited $v = 1$ states, are computed. Intensities of other lines are found comparable to those of the observed ones, in the corresponding vibrational state, and therefore, those lines are probable candidates for their detection. The lines in the vibrationally excited state, as well as between higher rotational levels in the ground vibrational state, are found to have a tendency of their formation in the regions close to the photosphere of the star, whereas the reverse has been found for the lines between lower rotational levels in the ground vibrational state.

It is found that lines in the vibrationally excited state cannot be generated, even in a high density and high temperature region, unless external infrared radiation field is present.

Keywords : CS molecule, radiative excitation, steller atmosphere.

PACS Nos. : 33.20.Vq, 33.20.Ea, 33.20.Bx, 31.20.-p

Indian J. Phys. **77B** (6), 621-624 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Toroidal distributions in the polar wind plasma

Imad A Barghouthi[1]*, Naji A Qatanani[2] and Mazen S Abu Issa[1]

[1] Department of Physics, AL-Quds University, Abu-Dies, Jerusalem, Palestine
[2] Department of Mathematics, AL-Quds University, Abu-Dies, Jerusalem, Palestine

E-mail : barghouthi2@yahoo.com

Received 5 September 2002, accepted 30 September 2003

Abstract : The energization of charged particles, due to interaction with electromagnetic turbulence, has an important influence on the plasma outflow in space. The effect of wave-particle interaction (WPI) on O^+ and H^+ velocity distributions in the polar wind was investigated by using Monte Carlo method. The Monte Carlo simulation included the effect of WPI, gravity, polarization electrostatic field, and the divergence of geomagnetic field within the simulation tube (1.7–10 earth radii, *Re*) as the ions are heated due to WPI and move to higher altitudes, the ion's Larmor radius a_L may become comparable to the perpendicular wave length $\lambda_\perp$ of the electromagnetic turbulence. As the ratio $a_L / \lambda_\perp$ becomes $\tilde{>} 1$, the quasi-linear perpendicular diffusion coefficient becomes velocity dependent, the heating rate becomes self-limited and the ion ditribution displays toroidal features. This result is consistent with observations of O^+ toroidal distribution in the auroral region.

Keywords : Toroidal distributions, polar wind, auroral region, Monte Carlo simulation.

PACS Nos. : 93.30.Sq, 94.10.Rk, 94.20.Rr, 52.65.Pp

Indian J. Phys. **77B** (6), 625-629 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Whistlers observed at low latitude stations Bhopal and Jammu

Sunil K Singh[1], Sushil Kumar[3] and A K Gwal[1,2]*

[1] Space Physics Research Institute, School of Pure and Applied Physics,
University of Natal, King George V Avenue, Durban-4001, South Africa
[2] Department of Electronics, Barkatullah University, Bhopal-462 026, Madhya Pradesh, India
[3] Department of Physics, School of Pure and Applied Sciences, The University of the South Pacific, Fiji

and

Lalmani and Rajou Kumar

Regional Engineering (Srinagar) College Classes, Canal Road, Old Camp,
Jammu University, Jammu-180 016, India

E-mail : splakg@sancharnet.in

Received 25 June 2003, accepted 08 September 2003

Abstract : The whistler data presented has been observed during nighttime of February-March 1998-99, though the occurrence is very small. The characteristics of whistlers are presented and the discussion indicates that whistlers recorded are strongly indicative of non-ducted propagation for low latitude nighttime whistlers observed at Bhopal (geomag. lat., 13° 47′ N) and Jammu (geomag. lat., $19^0 26'$ N). To explain these results, it is proposed that whistlers recorded are the VLF waves radiated from the return stroke of the lightning discharge launched at the ionosphere with different initial wave normal angles. Such type of whistlers has never been reported from any of the low latitude ground stations so far.

Keywords : VLF emissions, whistler, electromagnetic field, magnetic field

PACS Nos. : 94.30.Tz, 52.35.Hr

Indian J. Phys. **77B** (6), 631-634 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Electron momentum distribution and Compton profiles of tin

Thomas Varghese*, K M Balakrishna[1] and K Siddappa[1]

Department of Physics, Nirmala College, Muvattupuzha, Kerala-686 661, India
[2] Department of Studies in Physics, Mangalore University, Mangalagangotri-574 199, Karnataka, India

E-mail : surajthomas@sancharnet.in

Received 8 May 2003, accepted 28 July 2003

Abstract : The Compton profile of Sn has been measured using a HPGe photon detector. The target atoms were exited by means of 59.54 keV gamma rays from Am-241 radioactive source of strength 300 mCi. Elemental foil of uniform aerial density and purity better than 99.9% was used as target. The data was recorded and analyzed using a 4K multichannel analyzer. The experimental data was corrected for instrumental resolution effects, sample absorption and energy dependence of the differential Compton cross-section. The Compton profiles measured in the present work for Sn constitute the first experimental report for 59.54 keV gamma rays scattered at 165^0. The results are compared with theoretical Hartree-Fock free-atom profiles.

Keywords : Compton scattering; Compton profile; electron momentum density; impulse approximation.

PACS Nos. : 32.80.Cy, 29.30.Kv

Indian J. Phys. **77B** (6), 635-638 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Photoionization of potassium

H Sharma*[1], Kiran Kumari[2] and S K Pandey[3]

[1]University Department of Physics, Veer Kunwar Singh University,
Arrah 802 301, Bihar, India
[2]Department of Physics, R N College, Hajipur (Vaishali)-844 101, Bihar, India
[3] Department of Physics, R P Sharma Institute of Technology,
West Bailey Road, Patna-801 503, Bihar, India

E-mail : drhimanshusharma@yahoo.co.in

Received 5 May 2003, accepted 19 June 2003

Abstract : An analytic atomic independent particle model (IPM) potential is used to investigate the ground state photoionization cross section of the 4*s* electron of atomic potassium as a function of incident photon wavelength in the dipole length approximation . The spin-orbit interaction is included in the model potential and effects of core polarization have explicitly been considered . The predicted photoionization cross sections are in better agreement with experiments than those of earlier calculations from threshold up to about 2600 Å .

Keywords : Photoionization, spin-orbit interaction and core polarization.

PACS No. : 32.80.Fb

Indian J. Phys. **77B** (6), 639-643 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Theoretical analysis of a right isosceles triangular microstrip antenna on ferrite substrate

Vijay Kumar Tiwari, V Bhardwaj, J S Saini and D Bhatnagar*

Microwave Laboratory, Department of Physics, University of Rajasthan,
Jaipur-302 004, Rajasthan, India

E-mail : dbhatnagar_2000@rediffmail.com

Received 30 July 2003, accepted 19 September 2003

Abstract : Radiation characteristics of a right isosceles triangular microstrip antenna (RITMA) structure on a biased ferrite substrate are investigated theoretically in this paper by applying Green's function and vector potential technique. The analysis is carried out in TM_{11} mode of excitation that predicts a larger bandwidth than similar antenna on a non-magnetic dielectric substrate. Far field radiation patterns, impedance characteristics, quality factor and directivity of antenna are computed theoretically as a function of bias field strength. Outcomes of present investigations may be applied in designing switchable and frequency agile ferrite RITMA structures.

Keywords : Microstrip antenna, Ferrites, circular polarization and radiation properties.

PACS Nos. : 84.40.Ba, 75.50.Gg

Indian J. Phys. **77B** (6), 645-650 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Microwave dielectric relaxation and molecular dynamics in ternary mixtures of poly (vinyl pyrrolidone) -poly (propylene glycol) -poly (ethylene glycol)s of varying molecular weights in non-polar solvent

R J Sengwa* and Abhilasha

Microwave Research Laboratory, Department of Physics,
J.N.V. University, Jodhpur-342 005, Rajasthan, India

E-mail : rjsengwa@rediffmail.com

Received 25 March 2003, accepted 4 July 2003

Abstract : Molecular dynamics of ternary mixtrues of poly (vinyl pyrrolidone) (PVP) (Mw = 40000 g mol^{-1}), poly(propylene glycol) (PPG) (Mw = 2000 g mol^{-1}) and poly (ethylene glycol)s (PEGs) (Mw = 200, 400 and 600 g mol^{-1}) with PVP concentration variation has been explored in dilute solutions of benzene using microwave dielectric relaxation times at 10.1 GHz and 35°C. The average relaxation time τ_0, distribution parameter α, relaxation time corresponding to segmental motion τ_1 and group rotations τ_2 has been determined for the PVP-PEGs-PPG mixtures in benzene solvent. The large value of $\alpha \approx 0.3$ to 0.63 of these polymers and their mixtures confirms that besides the overall rotation there is large contribution of the segmental motion and group rotations in dielectric relaxation processes. The dynamics of PEGs molecules has been explored by considering the chain coiling and intra- and intermolecular hydrogen bonding in the complex heterogeneous species with the help of observed values of relaxation times. It is found that the values of τ_0 and τ_1 are independent of the mixture viscosity. The observed values of τ_2 are attributed to the rotation of chain ends hydroxyl groups/ methyl side-groups of these polymer molecules. The free energy of activation ΔF_τ of these systems has also been evaluated. These values are found in the range of $\approx$2–4 kcal mol^{-1}.

Keywords : PVP-PEG-PPG mixtures; dielectric relaxation times; molecular dynamics.

PACS Nos. : 33.15.Fm, 36.20.Hb, 77.22.Gm, 83.80.Rs

Indian J. Phys. **77B** (6), 651-655 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Dielectric relaxation study of intramolecular hydrogen bonded o-hydroxy acetophenone in non-polar solvents

K K Gupta*, M K Sharma and P J Singh

Department of Physics, M. S. J. College,
Bharatpur-321 001, Rajasthan, India

E-mail : kkguptakkg@indiatimes.com

Received 21 July 2003, accepted 28 August 2003

Abstract : The static permittivity of o-hydroxy acetophenone (OHA) in three non-polar solvents namely benzene, 1,4-dioxane and cyclohexane have been measured at 303K and frequency 100 KHz. The data were used to evaluate Kirkwood correlation factor g, excess molar polarization (Δp), excess correlation factor (δg) and excess free energy (ΔG). It is observed that in dilute solutions, b- multimers with antiparallel dipolar orientation predominate for benzene and cyclohexane but in 1,4-dioxane a- multimers with parallel orientation dominate in the entire concentration range. OHA behaves as a rigid molecule because of the intramolecular hydrogen bond between hydrogen and acetyl groups.

Keywords : Dielectric constant, Kirkwood correlation factor, excess molar polarization, excess free energy.

PACS Nos. : 77.22.Ej, 31.70.Dk, 51.30.+i

Indian J. Phys. **77B** (6), 657-661 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Double-diffusive convection in compressible Walters' B′ elastico-viscous fluid in hydromagnetics

R C Sharma* and C B Mehta

Department of Mathematics, Himachal Pradesh University,
Shimla-171 005, Himachal Pradesh, India

E-mail : rcsharmashimla@hotmail.com

Received 11 February 2003, accepted 28 August 2003

Abstract : A layer of compressible, electrically conducting Walters' B′ elastico-viscous fluid heated and soluted from below, in presence of magnetic field is considered. The presence of viscoelasticity, magnetic field and stable solute gradient introduce oscillatory modes in the system which were non-existent in their absence. The sufficient conditions for non-existence of overstability are obtained. For the case of stationary convection, the Walters' elastico-viscous fluid behaves like a Newtonian fluid and compressibility, magnetic field and stable solute gradient have stabilizing effects on the system.

Keywords : Double-diffusive convection, Walters' B′ fluid, hydromagnetics, compressibility.

PACS Nos. : 47.20.Ma, 47.50.+d, 47.55.Mh, 47.65.+a

Indian J. Phys. **77B** (6), 663-668 (2003)

AN INTERNATIONAL JOURNAL
IJP B

Average number of photons present in a single-mode squeezed vacuum state as function of the mean free path

A S Daoud

Department of Mathematics, Faculty of Sciences, Zagazig University,
Zagazig, Egypt

E-mail : aboulyamindaoud@yahoo.com

Received 5 June 2003, accepted 22 September 2003

Abstract : We devote this research paper to construct a relationship between the average of the total number of quanta in a single-mode squeezed vacuum state and the mean free path of atoms of a material through which the natural light passes. This relationship provides a method to measure experimentally the mean number of photons present in this mode of the quantum radiation field.

Keywords : Squeezed vacuum state, near free path, average number of photons

PACS No. : 42.50.Dv

Indian J. Phys. **77B** (6), 669-672 (2003)

Note

A INTERNATIONAL JOURNAL
IJP B

Molecular interaction studies in the ternary mixture of 1-hexanol + acetonitrile + cyclohexane

D Devadoss, M Thairiyaraja and L Palaniappan*†

Department of Physics, TBML College, Porayar-609 307, Tamil Nadu, India
† Department of Physics (DDE), Annamalai University,
Annamalainagar-608 002, Tamil Nadu, India

E-mail : *l*p_au@rediffmail.com

Received 14 February 2003, accepted 1 August 2003

Abstract : The ultrasonic velocities, densities and viscosities have been measured in the ternary system of 1- hexanol + acetonitrile + cyclohexane at 303, 308 and 313 K. From these data, acoustical parameters such as adiabatic compressibility, free length, free volume and internal pressure have been estimated using the standard relations. The results have been analysed on the basis of variations in ultrasonic velocities and free lengths. It is observed that the addition of 1-ol leads to a compact structure. The presence of strong interactions are noticed in the ternary system. The peculiar behaviour of cyclohexane drastically influences the temperature variations.

Keywords : Ultrasonic velocity, acoustic parameters, dipolar and dispersive interactions.

PACS No. : 43.35.Bf

Indian J. Phys. **77B** (6), 673-676 (2003)

Note

AN INTERNATIONAL JOURNAL

IJP B

Dielectric relaxation in para-methyl acetophenone, pyridine and their binary mixtures in benzene solutions

K K Gupta* and P J Singh

Department of Physics, M. S. J. College,
Bharatpur-321 001, Rajasthan, India

E-mail : kkguptakkg@indiatimes.com

Received 6 May 2003, accepted 6 August 2003

Abstract : The dielectric behaviour of para-methyl acetophenone (PMA), pyridine and their binary mixture as liquid dielectric samples have been studied at microwave frequency 8.93 GHz. in dilute solutions of benzene at temperature 303, 313, 323 and 333K. The various dielectric parameters have been evaluated by the observed data for the system and the results have been interpreted on the basis of H- bonding and inductive effect due to the presence of methyl group and compared with the results of acetophenone. The thermodynamical parameters indicate that the cooperative orientation of the pure molecules changes into non-cooperative orientation in 1:1 mixture composition. Comparative study of free energy of activation for the dielectric relaxation and viscous flow suggests the presence of solute-solvent interactions.

Keywords : Dielectric parameters, inductive effect, cooperative and non-cooperative orientation.

PACS Nos. : 77.22.Gm, 31.70.Dk

Indian J. Phys. **77B** (6), 677-680 (2003)

Note

AN INTERNATIONAL JOURNAL

IJP B

Ultrasonic velocity studies in aqueous lithium salts

G Rajarajan, P Revathy and T K Nambinarayanan*

Raman School of Physics, Pondicherry University,
Pondicherry-605 014, India

E-mail : tknambi@yahoo.com

Received 30 April 2003, accepted 11 August 2003

Abstract : The effect of electrolytes *viz* lithium acetate and lithium chloride, on the temperature of sound velocity maximum of water, has been studied by ultrasonic velocity method. Ultrasonic velocity measurements are carried out in aqueous lithium acetate and lithium chloride in the concentration range 0.1–0.5 molar between 303K and 353K with 10K increment in the temperature. The results are discussed in terms of structure breaking effect of acetate and chloride ions, which changes the temperature velocity maximum of water and on the basis of flickering cluster model of liquid water.

Keywords : Ultrosonic velocity, flickering-cluster model, lithium salts

PACS Nos. : 61.20.Qg, 43.35.Bf

Indian J. Phys. **77B** (6), 681-685 (2003)

Note

AN INTERNATIONAL JOURNAL

IJP B

Viscous losses of non-polar solvent at microwave frequency 9.8 GHz

Ram Nihor, S Misra and S K Saxena*

Department of Physics, D. B. S. (P. G.) College,
Kanpur-208 027, Uttar Pradesh, India

Received 6 May 2003, accepted 12 August 2003

Abstract : The dielectric relaxation time and viscosity of two polar molecules *viz*. ethyl acetate and n-butyl acetate in the mixture of paraffin oil (P.O.) and benzene at different concentrations, have been used to measure the viscous losses at microwave frequencies 9.8 GHz. The visco-elastic relaxation of solute molecule has been used to calculate the real part of the viscosity (η'), viscous loss (η''), and corresponding storage modulus(G'), and loss modulus (G'') at microwave frequencies for both the molecules have been investigated. The viscosity lost has also been calculated. The great difference of total viscosity loss for dipolar relaxation process, is interpreted in terms of damped oscillatory motion of polar molecules in viscous medium and losses due to restoring force acting on polar molecules by surrounding flexible viscous solvent molecules. A hypothetical equation has been proposed to interpret the difference in the total viscosity loss for dipolar rotation. It has been observed that the log τ vs log η' and log τ vs log η'' plots deviates from linearity for higher concentration of P.O. and benzene but the plots of η' and η'' were found to be linear.

Keywords : Dielectric relaxation, viscosity, viscous loss, storage modulus, loss modulus, microwave frequency

PACS Nos. : 77.22.Gm, 81.40.Jj, 81.40.Tv, 83.60.Fg