

Radiation characteristics of two-element array of equilateral triangular patch microstrip antenna in plasma medium

K K Verma* and K R Soni

Microwave Laboratory, Department of Physics, Malaviya National Institute of Technology, Jaipur-302 017, Rajasthan, India

E-mail : kkvermaphd@rediffmail.com

Received 11 December 2002, accepted 16 September 2004

Abstract : The far zone EM-mode and P-mode radiation fields are derived using vector wave function techniques and pattern multiplication approaches. An analytical study of a two-element array of equilateral triangular patch microstrip antenna is presented at a frequency of 10 GHz. The results are obtained both in plasma medium and in free space and compared with those of single-element triangular patch microstrip antenna. Some important antenna parameters such as radiation conductance, radiation efficiency, directivity and quality factor are plotted for different values of plasma to source frequency. It is observed that EM-mode field patterns are modified to a great extent, where as the P-mode field patterns show discrete ray-like structure similar to single element triangular patch microstrip antenna.

Keywords : Microstrip array antenna, radiation properties, plasma.

PACS Nos. : 84.40.Ba, 52.40.Fd

Spectral and normal coordinate analysis on the molecule of bis(thiourea) cadmium chloride single crystal

V Joseph*¹, V Santhanam² and D Anceila¹

¹Department of Physics, Loyola College, Chennai-600 034, India

²Department of Physics, Presidency College, Chennai-600 005, India

E-mail : maryjoseph65@hotmail.com

Received 27 December 2003, accepted 22 July 2004

Abstract : Single crystals of bis(thiourea) cadmium chloride (BTCC) have been grown from saturated aqueous solution by slow evaporation method at room temperature. FTIR and FT Raman spectra have been recorded. The normal coordinate analysis has been carried out with an orthonormal set of symmetry coordinates following Wilson F-G matrix method. The potential energy distribution has also been evaluated.

Keywords : Normal coordinate analysis, FTIR spectra, FT Raman, force constants.

PACS Nos. : 81.10.-h, 33.20.Ea, 33.20.Fb

O^+-O and O^+-O^+ collision frequencies in the auroral ionosphere

Mazen S Abu-Issa*, Amin A Leghrouz, Elias I Elias and Imad A Barghouthi

Department of Physics, Al-Quds University, P. O. Box 20002, Jerusalem, Palestine

E-mail : abuissa12@Yahoo.com

Received 5 March 2004, accepted 16 September

Abstract : We have used Monte Carlo simulations of O^+ ion temperature in the auroral ionosphere (200 km – 450 km) to calculate O^+-O collision frequency and O^+-O^+ Coulomb self-collision frequency. The Monte Carlo model used includes O^+-O resonant charge exchange and polarization collisions as well as O^+-O^+ Coulomb self-collisions; it also includes the effect of $\mathbf{E} \times \mathbf{B}$ drift. The variations of O^+ temperature, O^+-O and O^+-O^+ collision frequencies are discussed with respect to the electric field and at different altitudes. We have found that in the auroral ionosphere O^+ temperature increases as electric field increases due to O^+ frictional heating with the neutrals O. For increasing O^+ temperature, the O^+-O collision frequency increases for a constant altitude while the O^+-O^+ Coulomb self-collision frequency decreases. The relative importance of collision frequencies in the auroral ionosphere is discussed.

Keyword : Auroral ionosphere, Monte Carlo simulation, collision frequency, ion temperature.

PACS Nos. : 52.65.Pp, 52.25.Ya, 94.10.Rk, 94.20.Ji

ANFIS modelling for theoretical evaluation of ultrasonic velocities in binary liquid mixtures

S B Kalyana Raman* and K T Arulmozhi¹

*Physics Wing, DDE, Annamalai University, Annamalainagar-608 002, Tamil Nadu, India.

¹Department of Physics, Annamalai University, Annamalainagar-608 002, Tamil Nadu, India.

E-mail : kau2004@sify.com

Received 31 December 2003, accepted 29 September 2004

Abstract : “Adaptive Neuro Fuzzy Inference System” – the ANFIS, a newly developed technique is applied for the first time to compute the velocity of ultrasonic waves in binary liquid mixtures. To test the validity of this method, three binary liquid systems, each with different nature of molecular interaction are studied. The computed values of U_{mix} are reported and compared with those obtained using some other theories.

Keywords : ANFIS, binary liquid mixtures, ultrasonic velocity.

PACS Nos. : 43.35.Bf, 07.05.Kf

Speeds of sound and isentropic compressibilities of binary mixtures containing dipropylene glycol monobutyl ether with n-alkanols at 298.15 K

Amalendu Pal* and Anil Kumar

Department of Chemistry, Kurukshetra University, Kurukshetra-136 119, Haryana, India

E-mail : palchem@sify.com

Received 5 March 2004, accepted 16 September 2004

Abstract : Speeds of sound have been measured in dipropylene glycol monobutyl ether + methanol, 1-propanol, 1-pentanol, 1-heptanol, across the entire composition range, at the temperature 298.15 K and atmospheric pressure. The speed of sound values were combined with excess molar volume to obtain values for the product $K_{S,m}$ of the molar volume and the isentropic compressibility $\bar{\alpha}_s$, and the corresponding quantities $K_{S,m}^E$ were also calculated. The $K_{S,m}^E$ values are negative for all mixtures. The deviation of the speeds of sound u^D from their values u^{id} in ideal mixtures were obtained for all measured mole fractions. These values are compared with mixing function $\bar{\Delta}u$. The behaviour of u , $\bar{\Delta}u$, u^D , and $K_{S,m}^E$ as a function of composition and number of carbon atoms in the alcohol molecule is discussed.

Keywords : Binary mixtures, acoustical parameters, molecular interactions.

PACS Nos. : 43.35.Bf, 62.60.+v, 82.60.Lf

Radiation characteristics of four-element circular array of equilateral triangular patch microstrip antenna in plasma medium

K K Verma and K R Soni*

Microwave Laboratory, Department of Physics, Malaviya National Institute of Technology, Jaipur-302 017, Rajasthan, India

E-mail : kkvermaphd@rediffmail.com

Received 16 March 2004, accepted 30 September 2004

Abstract : An analysis of a new type of four-element circular array of equilateral triangular patch microstrip antenna is discussed at frequency 10 GHz. The array factor and far-zone EM-mode and P-mode radiation fields of the array geometry are derived using vector wave function techniques and pattern multiplication approaches. The results are obtained both in plasma medium and in free space and compared with those of single element triangular patch microstrip antenna. Some important antenna parameters such as radiation conductance, directivity and quality factor are computed for different ratios of plasma to source frequency. It is observed that radiation characteristics of this array geometry are modified considerably in the presence of plasma medium.

Keywords : Microstrip circular array, radiation properties, plasma medium.

PACS Nos. : 84.40.Ba, 52.40.Fd

On temperature T_{01} for molecular hydrogen

Suresh Chandra

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

Email : sch@iucaa.ernet.in

Received 2 April 2004, accepted 9 September 2004

Abstract : Temperature T_{01} for hydrogen molecule for the transition between the level $J = 1$ (ortho- H_2) and the level $J = 0$ (para- H_2) has been introduced by Spitzer *et al* [1]. The work of Spitzer *et al* [1] has been reinvestigated and we find that the concept of the temperature T_{01} is not valid.

Keywords : Diatomic molecules, interstellar medium.

PACS No. : 33.20.Sn

Neural network representation for electron and positron collisions with sodium and potassium atoms

Salah Yaseen El-Bakry^{1*} and Mahmoud Yaseen El-Bakry²

¹Physics Department, Faculty of Science, King Abdulaziz University Branch, Madinah Munawwarah, P. O. Box-344, Kingdom of Saudi Arabia

²Physics Department, Faculty of Education, Ain Shams University, Roxy, Cairo, Egypt

Email : kemo_zx@hotmail.com

Received 20 April 2004, accepted 24 September 2004

Abstract : An artificial neural network (ANN) has been designed to simulate the collisions of electrons and positrons with sodium and potassium atoms at low and intermediate energies. The ANN model has been trained based on experimental data to produce the total cross sections for each case. Levenberg-Marquardt algorithm (LMA) has been employed to train the ANN. The experimental, trained and calculated total collisional cross sections are compared. The designed ANN shows a good match to the experimental data.

Keywords : Neural network, electron and positron collisions, sodium and potassium atoms, total collisional cross sections.

PACS Nos. : 84.35.ti, 34.80.Dp, 34.85.tx

Overtone spectra of phenol derivatives

Garima Tripathi, Vineet Kumar Rai and S B Rai*

Laser and Spectroscopy Laboratory, Department of Physics, Banaras Hindu University, Varanasi-221 005, Uttar Pradesh, India

E-mail : sbrai49@yahoo.co.in

Received 21 April 2004, accepted 16 September 2004

Abstract : Overtone spectra of 2-chlorophenol, 4-chlorophenol, 2,4-dichlorophenol, 2,6-dichlorophenol and 2,4,6-trichlorophenol have been analyzed in the 2500–14000 cm^{-1} region. The vibrational frequencies and the anharmonicity constants for the C-H and O-H stretching vibrations have been evaluated. The effect of the substitution of chlorine atom at different positions of the phenol ring has been studied. The observations are well supported by theoretical calculations for the charge density and the bond lengths using molecular orbital AM1 method. The possibility of intramolecular hydrogen bonding involving O-H-Cl has also been marked in the case of 2-chlorophenol and 2,4-dichlorophenol. It is noted that in the case of 4-chlorophenol, the shift in C-H stretching frequency is proportional to the sum of the Hammett (Σ) of the substituents while in the case of 2-chlorophenol it is only 55% of the value in 4-chlorophenol.

Keywords : Overtone spectra, phenol derivatives, vibrational constants.

PACS Nos. : 33.15.Mt, 39.30.+w

FTIR and Mössbauer spectroscopic studies of archaeological potteries from Nathikudi, Tamil Nadu

R Venkatachalapathy*, D Gournis¹, C Manoharan, S Dhanapandian and K Deenadayalan

Department of Physics (DDE), Annamalai University, Annamalainagar-608 002, Tamil Nadu, India

¹Department of Materials Science and Engineering, University of Ioannina, GR-45110, Greece

E-mail : venkatr5@rediffmail.com

Received 29 April 2004, accepted 9 September 2004

Abstract : Fourier Transform Infrared (FTIR) and room temperature Mössbauer spectra have been recorded for the recently excavated archaeological potteries from Nathikudi, Tamil Nadu, India. The experimental results explore the technology involved in producing the archaeological artifacts for different purposes. During firing, the iron present in the clay materials undergoes characteristic change in its chemical and physical state, depending on the kiln atmosphere and the maximum firing temperature reached, which can be followed by using FTIR and Mössbauer spectroscopic techniques. From the above techniques, type of clay, firing temperature and firing atmosphere for the production of archaeological potteries were well established.

Keywords : Archaeological potteries, FTIR, Mössbauer, firing temperature.

PACS Nos. : 33.20.Ea, 33.45.+x

A comparative dielectric study of poly(vinyl pyrrolidone) in unlike hydroxyl group number containing polar solvents

R J Sengwa^{1*}, Abhilasha¹, S C Mehrotra² and B R Sharma³

¹Microwave Research Laboratory, Department of Physics, J N V University, Jodhpur-342 005, Rajasthan, India

²Department of Computer Science and Information Technology,

Dr. B A M University, Aurangabad-431 004, Maharashtra, India

³Department of Physics, Pratishthan Mahavidyalaya, Paithan, Aurangabad-431 007, Maharashtra, India

E-mail : rjsengwa@rediffmail.com

Received 29 April 2004, accepted 18 August 2004

Abstract : Time Domain Reflectometry (TDR) technique has been employed to explore the dielectric behaviour of different concentration binary mixtures of poly(vinyl pyrrolidone) (PVP) with ethyl alcohol, ethylene glycol, poly(ethylene glycol) (PEG) and glycerol in the frequency range of 10 MHz – 10 GHz at 25°C. The frequency-dependent measured values of dielectric permittivity ϵ' and dielectric loss ϵ'' of these binary mixtures were fitted to the Havriliak-Negami expression. It is found that PVP-ethyl alcohol mixtures exhibit Debye type dielectric dispersion whereas the complex dielectric behaviour of PVP-ethylene glycol, PVP-PEG and PVP-glycerol mixtures can be represented by Cole-Davidson dielectric relaxation model. The values of static dielectric constant ϵ_0 , high frequency limiting dielectric constant ϵ_∞ , relaxation time τ and distribution parameters n and m of these systems were determined. The types of the formation of homogeneous and heterogeneous cooperative domains in the mixtures due to complexation between hydroxyl group/s of polar solvent with the carbonyl groups of PVP molecular chain, were discussed using the comparative values of evaluated dielectric parameters. Schematic diagrams of the structures of a complexation between PVP and self-associated polar solvents were proposed and their dynamics have been explored in view of their applications in drug control release systems.

Keywords : Poly(vinyl pyrrolidone), polar solvents, dielectric behaviour, molecular dynamics, time domain reflectometry.

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

Ultrasonic study of intermolecular association through hydrogen bonding in aqueous solutions of D-mannitol

M Sethu Raman^{*1} and G Amirthaganesan²

¹Department of Physics, ²Department of Chemistry, Sri Ramakrishna Mission Vidyalaya College of Arts and Science, Coimbatore-641 020, Tamil Nadu, India

E-mail : sethu_muthu2003@yahoo.co.in

Received 30 April 2004, accepted 17 September 2004

Abstract : The density and ultrasonic velocity measurements were carried out in aqueous solutions of D-mannitol in the concentration range of 0.1–1.0 m between 303.15 K and 323.15 K with 5 K increments. Using the measured values of density (ρ) and ultrasonic velocity (u), other acoustical parameters such as adiabatic compressibility (β_{ad}), acoustic impedance (Z), hydration number (H_n) and intermolecular free length (L_f) were evaluated. These parameters were interpreted as due to the formation of intermolecular hydrogen bonding between the hydroxyl groups of D-mannitol and water molecules.

Keywords : Ultrasonic velocity measurement, acoustic impedance, hydrogen bonding, clusters.

PACS Nos. : 43.35.Bf, 33.15. Fm.

Electronic spectrum of octaazacubane (N_8)

R S Prasad*

Department of Physics, Magadh University, Bodh-Gaya-824 234, Bihar, India

and

K Kumar

Department of Physics, Ramgarh-821 110, Bihar, India

E-mail : rsp_phys@rediffmail.com

Received 24 May 2004, accepted 16 September 2004

Abstract : MRINDO/S calculation augmented by singly-excited configuration interaction was performed on octaazacubane. We report ionization potentials, singlet and triplet excitations and the singlet-triplet splittings in octaazacubane. The importance of outer (Rydberg) atomic orbitals is stressed and it is found that none of the transitions leads to an excited state with considerable Rydberg character.

Keywords : Octaazacubane, ionization potentials, electronic spectrum.

PACS Nos. : 31.15.Ne, 33.15.Ry, 33.20.Lg

Semiclassical theory for thermodynamics of molecular fluid mixtures

Shankar S Karki¹ and Suresh K Sinha^{2*}

¹Department of Physics, Trichandra Campus, Kathmandu, Nepal

²Department of Physics, L S College, B B A Bihar University, Muzaffarpur-842 001, Bihar, India

E-mail : sk_sinha_phy@yahoo.co.in

Received 8 May 2003, accepted 1 September 2004

Abstract : An effective pair potential for the semiclassical molecular fluid mixture is expressed in the effective Lennard-Jones (12–6) potential form, which includes the influence of the angle-dependent potential and quantum effects through the expressions of the effective diameter $\tilde{\sigma}_{ab}$ and well depth $\tilde{\epsilon}_{ab}$. We employ the theory to estimate the thermodynamic properties of equimolar binary mixtures at zero pressures. Agreement with experiment for the excess properties such as excess Gibbs's function, excess enthalpy and excess molar volume for $N_2 + Ar$, $O_2 + Ar$, $H_2 + Ne$, $D_2 + Ne$ and $H_2 + D_2$ are found to be good.

Keywords : Semiclassical molecular fluid mixture, effective pair potential, thermodynamic properties.

PACS Nos. : 03.65.Sq, 82.60.Lf, 31.15.Gy

Transverse self-focusing and filamentation of a laser beam in a collisional magnetoplasma

Ghanshyam*

Department of Physics, Birla Institute of Technology, Sindri, Dhanbad-828 123, Jharkhand, India

and

A K Sharma

Centre for Energy Studies, Indian Institute of Technology, Delhi, New Delhi-110 016, India

E-mail : ghanshyam123@rediffmail.com

Received 9 February 2004 , accepted 6 August 2004

Abstract : Anisotropic self-focusing of a Gaussian laser beam in a collisional magnetoplasma is examined analytically. The laser propagates transverse to the static magnetic field. The nonlinearity arises through the Ohmic heating of electrons and subsequent redistribution of plasma along the magnetic field. The magnetic field enhances the rate of self-focusing to a large extent. In the case of a plane-uniform laser beam, it is seen that it is unstable for small scale fluctuations, and the growth rate of instability increases rapidly with magnetic field.

Keywords : Self- focusing, Gaussian-laser beam, ohmic heating, anisotropy, filamentation.

PACS Nos. : 52.32. Hb, 52.20.Hv, 52.40. Nk

OI 6300 Å nightglow emission at Calcutta and its verification by Barbier's equation in terms of solar flare index

S K Midya

Department of Physics, Serampore College, Serampore, Hooghly-712 201, West Bengal, India
and
Centre for Space Physics, Kolkata

R Chattopadhyay*

Haripal G D Institution, Khamarchandi, Hooghly-712 405, West Bengal, India
and
Centre for Space Physics, Kolkata

and

Chandramadhab Pal

Department of Physics, R K Mission Vidyamandira, Belurmath, Howrah-711 202, West Bengal, India

Received 3 September 2003, accepted 28 September 2004

Abstract : The purpose of this paper is to represent the empirical relations between the solar flare index (I_f) and ionospheric parameters for the descending phase of 21st solar cycle and to express Barbier's equation as a function of a single variable I_f for a comparison with observed data. Important results have been obtained from the critical analysis of the observation .

Keywords : Airglow, Barbier's equation.

PACS Nos. : 94.10 Rk, 96.60 Rd, 96.60. Qc.

Infrared spectra of charge transfer complexes of bis(N-ethylsalicylaldiminato)Cu^{II}

J H Prajapati¹, S G Patel and A T Oza*

Department of Physics, Sardar Patel University, Vallabh Vidyanagar-388 120, Anand, Gujarat, India

¹Sir P. T. Science College, Modasa-383 315, Gujarat, India

E-mail : headphyspu@rediffmail.com

Received 19 February 2004, accepted 23 July 2004

Abstract : Charge transfer complexes of bis(N-ethylsalicylaldiminato)Cu^{II} with organic acceptors like TCNQ, TCNE, TNF, DDQ, chloranil and iodine have been prepared and studied with Fourier transform infrared spectroscopy. The electron donating chelate is isostructural to the methyl analog in which metal chains are found in one crystallographic direction. The spectra obtained in the range of 400–4000 cm⁻¹ are mainly governed by the donor spectrum. Only above 1700 cm⁻¹, the acceptor bands are visible. DDQ and chloranil both containing chlorine atoms interact more strongly as compared to other acceptors. The electronic absorption envelopes are identified. The nature of transition, band tailing effect and free-carrier absorption are also analyzed. Observed steric effects of ethyl groups compared to methyl groups are discussed.

Keywords : Charge transfer complexes, organic acceptors, infrared spectra, optical conductivity, band assignment.

PACS Nos. : 71.20.Nr, 78.30.-j, 87.15.Mi
