

Hydrodynamic interaction between an accretion flow and a strong wind around a black hole

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Abstract : Outflows in a black hole environment necessarily emerge from the accretion flow. When the outflow is very strong it interacts with the accretion flow and can affect the inflow pattern. As a result of this non-linearity, accretion flow develop instability which is a complex form of the shear instability (Kelvin-Helmholtz Instability). In a time dependent numerical simulation using Smoothed Particle Hydrodynamics method we demonstrate this instability and show that this instability is present independent of whether cooling process is turned on or not. We also show that the effect is not symmetric with respect to the equatorial plane.

Keywords : Accretion disks, black hole physics, hydrodynamics.

PACS Nos. : 97.10.Gz, 04.70.-s, 67.55.Fa

Transition assignments to Lb_1 satellites in X-ray emission spectra of first transition series

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Abstract : The X-ray satellite spectra, arising due to $\overline{2p_{1/2}3x-3x3d}$ ($x \equiv s, p, d$) transition array, in elements with $Z = 26$ to 30, have been calculated. The bar at the top denotes that these are the positions of ionization in the atom. While the energies of various transitions of the array have been determined by using available HFS data on $1s-2p3x$ and $\overline{2p_{1/2}}-(3x, 3x')$ Auger transition energies, their relative intensities have been estimated by considering cross sections of singly ionized $\overline{2x}$ ($x \equiv s, p$) states and then of subsequent Coster Kronig and shake-off processes. The calculated spectra have been compared with the measured satellite energies in Lb_1 spectra. Their intense peaks have been identified as the observed satellite lines. The one to one correspondence between the peaks in calculated spectra and the satellites in measured spectra has been established on the basis of the agreement between the separations in the peak energies and those in the measured satellite energies. It has been established that two satellites observed in the Lb_1 region of the X-ray spectra of the elements with $Z = 26$ to 30 named β_1^I and β_1^{II} in order of increasing energy can be assigned to $\overline{2p_{1/2}3d-3d^2}$ transitions. The satellite b_1^I has been assigned to the superposition of the transitions $^3F_2-^3F_2$, $^3P_2-^3P_2$ and $^3P_2-^3P_1$, contributing in order of decreasing intensity, and the line b_1^{II} , has been assigned to mainly the $^3F_3-^3F_3$ transition. The possible contribution of other transitions of the $\overline{2p_{1/2}3x-3x3d}$ ($x \equiv s, p, d$) array having intensities comparable with the above transitions, and the corresponding lines which have not yet been observed, have also been discussed.

Keywords : Lb_1 satellites, M -vacancy Lb_1 transitions.

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Theoretical study of intermolecular interactions in nematogens : TBMA

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Abstract : In view of the key role of molecular interactions in governing the nature and characteristics of mesomorphism, intermolecular interactions between a pair of TBMA molecules have been evaluated using modified second order perturbation treatment along with multicentered-multipole expansion method. An all valence electron method, CNDO/2, has been employed to compute the net atomic charge and corresponding dipole components located at each atomic centre of the molecule. On the basis of stacking and in-plane interaction energy studies, an attempt has been made to elucidate the nematogenic behaviour of the system.

Keywords : Intermolecular interactions, mesogens, CNDO.

PACS Nos. : 61.30.-v, 34.20.Gj, 31.15.Md

Molecular interaction study in binary mixtures of dimethylsulphoxide with 1,2-dichloroethane and 1,1,2,2-tetrachloroethane at 303 K

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Abstract : Densities (ρ) and viscosities (η) of pure dimethylsulphoxide (DMSO), 1,2-dichloroethane (DCE), 1,1,2,2-tetrachloroethane (TCE) and those of their binary mixtures with DMSO as common component were measured at 303 K over the entire composition range. Several useful parameters, such as, excess volume, excess viscosity and excess Gibbs free energy of activation of viscous flow have been calculated from the measured densities and viscosities to study the intermolecular interaction between the component molecules. The changes in these parameters with composition suggest that the interaction between DMSO and DCE is weak, while its interaction with TCE is quite strong. The experimental viscosity data of these mixtures were used to test the validity of the empirical relations of Grunberg-Nissan, Tamura-Kurata, Hind-McLaughlin, Katti-Chaudhary and Heric for the present systems.

Keywords : Binary liquid mixtures, intermolecular interaction, density and viscosity.

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Generation of circular polarization from microstrip scanned array antenna on YIG ferrite substrate

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Abstract : Two modes of circular polarization are generated when the magnetic bias is applied to an antenna geometry designed on ferrite substrate. In this communication, circular polarized properties of a 4×4 element planar array of circular patch microstrip antenna printed on YIG ferrite with a normal bias field and em wave propagation parallel to the biasing field, are presented. The computed values of antenna parameters of array geometry like directive gain, efficiency and bandwidth are also presented for both the modes of circular polarization for four different values of biasing fields.

Keywords : Microstrip antenna, circular polarization, ferrite substrate.

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Vibrational spectra and force fields for 2,3-; 2,4-; 2,5- and 3,4-dihydroxybenzaldehydes

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Abstract : Raman and IR spectra of 2,3-; 2,4-; 2,5- and 3,4-dihydroxy benzaldehydes have been recorded. The observed frequencies have been assigned to various normal modes of vibration in light of the normal coordinate calculation using Wilson's classical FG-matrix method. All the 42 normal modes have been assigned for all the molecules for the first time.

Keywords : Vibrational spectra, force fields, normal modes.

PACS Nos. : 33.20.Ea, 33.20.Fb, 33.20.Tp

Wavevector and frequency dependent complex dielectric function and the dynamical structure factor of two-dimensional weakly-coupled quantum and classical hot plasmas

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Abstract : Complete expressions for the wavevector and frequency dependent complex dielectric function for two-dimensional quantum and classical weakly-coupled one-component thermal plasma have been obtained and computed in the entire domain of plasma frequency. The dynamical structure factor and other related quantities have been computed to obtain full knowledge about the collective dynamics of the two dimensional plasma. Comparisons have also been made with other models suitably modified for the two dimensional case.

Keywords : Surfaces and interfaces, thin films, dielectric response.

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Self-focusing of electromagnetic waves in collisional plasmas

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Abstract : A collisional plasma causes self-focusing of electromagnetic waves via ohmic heating and density redistribution. The self-focusing leads to enhancement of wave intensity, elevation of electron temperature and reduction of local electron density, leading to diminished attenuation rate. For a Gaussian ansatz the competing processes of self-focusing and nonlinear absorption appear through a single quantity f called the beam width parameter. At low power, attenuation weakens the self-focusing effect. However, at high power, where saturation effect of nonlinearity becomes important, the situation is different.

Keywords : Self-focusing, Gaussian-electromagnetic wave, absorption.

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On the effects of drift motion and negative ions on ion-acoustic solitary waves and double-layers in plasmas

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Abstract : Higher order contribution to the ion-acoustic solitary waves and double-layers in a multicomponent plasma consisting of warm positive and negative ions and two-temperature electrons have been theoretically investigated using pseudopotential method. The effects of drift motion and negative ions on the solitary waves and double-layers have been graphically discussed. It is observed that the concentration of negative ions and drift velocity modify the profiles of the ion-acoustic solitary waves and double layers in the plasma.

Keywords : Ion-acoustic solitary wave, double-layers, multicomponent plasma.

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Junction conditions on the boundary of two different spacetime manifolds

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Abstract : This paper shows how we can glue two different spacetime manifolds along a common spacelike or timelike boundary in the framework of distributional approach. Junction conditions along this common boundary are derived and from physical point of view, equations for dynamics of these boundaries are given.

Keywords : Differential geometry, general relativity, junction conditions.

PACS Nos. : 04.20.-q, 02.40.Hw

Nonstatic global monopole in higher dimensional space time

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Abstract : We have obtained a class of nonstatic solutions around global monopole in higher dimensional space time. We have used a field theoretic energy momentum tensor for monopole configuration. This paper extends earlier work of Chakraborty (*Physica Scripta* **98** 294 (1998)) to its five dimensional analog.

Keywords : Nonstatic global monopole, higher dimension, deficit angles.

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Thermodynamic functions of 2-anilinopyridine from IR and Raman spectra

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Abstract : On the basis of vibrational assignments, the thermodynamic functions, namely, the enthalpy, the heat capacity, the free energy and the entropy of 2-anilinopyridine have been calculated at a pressure of 1 atmosphere in the temperature range 100–1500 K under rigid rotor-harmonic oscillator approximation.

Keywords : Vibrational spectrum, thermodynamic functions, rigid rotor-harmonic oscillator.

PACS Nos. : 33.20.Tp, 82.60.–s
