

No evidence of circumsolar dust ring during solar activity minimum phase

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Abstract : A circumsolar dust ring is believed to be situated at $4 R_{\odot}$ and temporally variable in anti-phase with the solar activity cycle. The observable signatures of such a ring is : (i) its thermal radiation in near IR and (ii) a highly polarised scattered solar radiation by the ring constituents. During the past attempts the ring signatures were mostly observed at the time of the solar activity minimum phase. Extensive observations at the time of 1991 total solar eclipse did not show any signature of the circumsolar dust ring. The 1995 total solar eclipse in India provided a unique opportunity to test the “solar activity dependence” hypothesis for the existence of the dust ring. We designed a computer-controlled, laboratory calibrated, wide-field imaging polarimeter to make measurements through three filters centred at 6500, 8100 and 9500 Å for detecting the ring signature. The polarimeter was calibrated using various laboratory test facilities at Space Application Centre. The experiment was carried out at Kalpi, UP during the 24 October 1995 total solar eclipse. The observed coronal polarization and surface brightness were found to be consistent with the overall expected corona at the solar minimum phase. We report that no ring signature was observed by our experiment and conclude that the circumsolar dust ring might be a temporary feature.

Keywords : Dust ring, interplanetary dust, solar eclipse.

PACS Nos. : 95.10.Gi, 96.50.Dj, 96.60.Pb.

Attenuation g_t in dB/km

Loss cone profile on the imaginary surface just enclosing the resonance surface in 14.4 GHz ECR ion source

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Abstract : A 14.4 GHz ECR ion source was designed [1] recently for the superconducting cyclotron. The concept of local mirror ratio at a point has been defined. A relationship between mirror ratio and the loss cone is deduced. The mirror ratio giving the loss cone profile on the surface of an imaginary box just enclosing the resonance surface (assumed plasma volume) are evaluated. Electron reflection and loss is discussed in the plasma chamber.

Keywords : Magnetic mirror, loss cone, plasma confinement.

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Spectral study on solar radio bursts in the microwave-millimeterwave transition

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Abstract : In order to evaluate the spectra of solar radio bursts in the microwave-millimeterwave transition region, the multifrequency burst data of Berne observatory have been used. The bursts give spectral nature which resemble inverted-U (IU), increasing (I), decreasing (D), U and Zigzag types. The spectral peak of these spectra occur at 11.8 GHz in most of the cases. The directivity and optical thickness of the absorbing layer above the source of bursts are determined. The results are discussed in light of the different emission and absorption mechanisms responsible for the generation of radio bursts.

Keywords : Spectra, solar bursts, microwave-millimeterwave region.

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Current-driven oblique whistler mode by cold plasma injection in the magnetosphere of Uranus

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Abstract : The effect of cold plasma injection on oblique whistler mode wave in the presence of a perpendicular AC field in a background plasma having a bi-Maxwellian and also a loss-cone distribution function has been examined separately in the magnetosphere of Uranus. In both the cases the effect of cold plasma injection and other plasma parameters have been compared. It is found that the magnitude of the AC field has almost no effect on the growth rate or on the real frequency of the wave. But the growth rate increases with the increase of AC field frequency. For loss-cone background, the growth rate increases by more than an order of magnitude in comparison to bi-Maxwellian background. Increase of temperature anisotropy also increases the growth rate, thus the source of free energy for this instability is not only the temperature anisotropy but also the AC field frequency. There is marginal effect on the growth rate with increase of the angle of incidence and drift velocity of the electrons, but increase in the ratio of cold injected plasma to background plasma (n_c/n_w) reduces the growth rate. In all the cases there is no change in the value of the real frequency for all other plasma parameters suited to the magnetosphere of Uranus. But in case such a situation as mentioned, exists in the magnetosphere, it may give rise to emissions over a broad frequency range and would be more appropriate for explaining the entire frequency spectrum of VLF emissions.

Keywords : Oblique whistler mode, cold plasma injection, magnetosphere of Uranus.

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Latitudinal variation of OI 6300 Å line intensity reviewed in the light of Barbier's equation

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Abstract : Latitudinal variation of OI 6300 Å line intensity has been computed and a least square fitted curve has been obtained for the same. OI 6300 Å line-intensity, as observed at Narendrapur (Lat. 22°35' N, long. 88°21' E) during the period 1984-1986 has been compared with the values of the same quantity obtained from empirical relation as given in Barbier's equation (*J. Geophys. Res.* **68** 5605 (1963)) [7] using ionospheric parameters $h'F$ and f_oF_2 at Ahmedabad (Lat. 23°01' N, long. 72°36' E) for the same period. The correlation coefficient between them has been calculated and is found to be of sufficiently high values. An empirical equation relating the two above mentioned variables has been established. Similarly using the ionospheric parameters f_oF_2 and $h'F$ of Kodaikanal (Lat. 10°44' N, long. 77°29' E) station the corresponding OI 6300 Å line intensity for each month for the period 1984-1986 has been computed using the Barbier's empirical relation. This curve is again compared with the corresponding values of the same parameter obtained separately from the latitudinal variation-fitting equation and the corresponding values of OI 6300 Å line intensity at Narendrapur. Except at a few portions both the curves has been found to compare well with each other. Lastly as a possible cause of such variation of OI 6300 Å line intensity the similar variation of electron density has been referred.

Keywords : OI 6300 Å line intensity, ionospheric parameters, latitudinal variation.

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A new, non-local quantum electrodynamics : its effect on multiphoton single and double ionization*

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Abstract : By considering a new, non-local quantum electrodynamics, we have shown that the non-sequential double ionization of atoms occur due to the phase correlated two-photon excitation of electrons. For this phase correlated excitation, two-photon rate depends linearly on laser intensity. However, the local nature of the radiation field gives rise to conventional multiphoton transitions, where the two-photon rate is proportional to the square of the laser intensity. We have shown that n -photon transitions in an experiment can be modeled as a series of these two types of transitions and hence several channels will run parallel to each other. The channels for n -photon transitions are (i) a series of phase correlated transitions giving rise to non-sequential double ionization, (ii) a series of conventional dipole transitions giving rise to sequential ionization and (iii) a mixture of phase correlated and phase non-correlated transitions. We have shown that, with the increase in laser intensity the channel comprising of only the phase correlated excitations becomes significant and gets saturated before the sequential channel can dominate, giving rise to a kink-like structure in the intensity variation of double ionization. This feature has been observed in the experiments on double ionization of He. We have also provided a physical basis for the damping of non-sequential double ionization at the smaller wavelength, which is also an experimentally observed feature.

Keywords : Multiphoton ionization, double ionization, non-local QED.

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Coherence in positron (electron) scattering by lithium atoms

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Abstract : The study of alignment and orientation parameters provides complementary information on the anisotropic charge cloud distribution (alignment) and the rotation of atomic excited state (orientation), which is not available from the measurement of differential and total cross sections alone. A two potential approach is used to study these parameters in the positron (electron) impact $2s-3p$ excitation of lithium atom. Results are obtained for the angular variation of the angular momentum transfer ($L_{\wedge}$), the polarization components (P_1, P_2), linear polarization, polarization $|P|$ and the alignment angle (g) at impact energies of 20 eV and 30 eV. Comparison with the corresponding parameters in electron scattering is made to see the role of various interaction potentials in the process. It is found that for this transition, a significant change appears in between positron and electron impact excitation.

Keywords : Coherence, polarization, positron, electron, scattering.

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Einstein A -coefficients for rotational transitions in the ground vibrational state of Si_2C molecule

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Abstract : We have calculated Einstein A -coefficients for rotational transitions in the ground vibrational state of the Si_2C molecule between the rotational energy levels up to 21 cm^{-1} . The coefficients are used to calculate the mean radiative lifetime of the levels. These A -coefficients may be used as input parameters for analyzing the spectra of Si_2C , as and when it would be observed in an astronomical object. The transitions $7_{07} \leftrightarrow 6_{16}$ (5.34 GHz) and $8_{08} \leftrightarrow 7_{17}$ (14.74 GHz) may play important role for the search of the Si_2C molecule in astronomical objects.

Keywords : Si_2C molecule, Einstein A -coefficients.

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Compton profile of samarium

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Abstract : The Compton profile of Sm has been measured using IGP Type Coaxial photon detector. The target atoms were excited 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 were recorded and analyzed using a 4K multichannel analyzer. The present experimental Compton profiles of Sm constitute the first measurement. The results are compared with theoretical Hartree-Fock free-atom profiles.

Keywords : Compton scattering, Compton profile, electron momentum density.

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Ultrasonic, volumetric and viscometric study of molecular interactions in binary mixtures of 2,2,4-trimethyl pentane with *n*-hexane and cyclohexane at 308 K

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Abstract : Experimental values of density, ultrasonic speed and viscosity for the binary mixtures of 2,2,4-trimethyl pentane with *n*-hexane and cyclohexane are presented at 308 K over the entire mole fraction range. From these data, isentropic compressibility, relative association, acoustic impedance, molar sound speed, molecular association, deviations in isentropic compressibility, excess volume, deviations in ultrasonic speed, excess acoustic impedance and deviations in viscosity have been calculated. These parameters were used to study the nature and extent of intermolecular interactions between component molecules in the present binary mixtures. The ultrasonic speeds and viscosities were theoretically evaluated using different empirical relations and theories. The relative merits of these relations and theories were discussed.

Keywords : Ultrasonic speed, viscosity, liquid mixtures.

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On the short-wave Bénard-Marangoni stability of a fluid layer with surface deformation

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Abstract : An analytical description of the marginal stability curve for the onset of oscillatory Bénard-Marangoni convection in a horizontal fluid layer bounded above by a deformable free surface and bounded below by a thermally conducting planar boundary in the asymptotic limit of short waves is obtained.

Keywords : Convection in fluid, Bénard-Marangoni stability, surface deformation.

PACS Nos. : 47.20.Bp, 47.20.Dr, 47.27.Te
