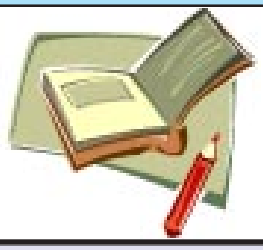
isamp
NEWS LETTER

Vol.: 1 Issue: 2
June 25, 2005



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FROM THE EDITOR'S DESK

The first issue of ISAMP News Letter (*electronic version*) was brought out on 21 April, 2005.

We are bringing out the second issue (*electronic version*) of the ISAMP News Letter. We sincerely thank the contributors for providing us input. We do hope to receive support from all the members in the future.

We are happy to inform you that from this issue onwards, we are starting "***Letters to Editor***" column. In this issue, we are including a small write up which the author preferred to be included as a Letter to the Editor. While we accept such small write up as ***Letter to Editor***, we urge the members to write to us mails which reflect your opinion on any relevant issue, your appreciation/comments about the News Letter etc. In general, ***Letter to Editor***, as in news paper and scientific magazine, is a column provided for members to express their general, noncritical opinion about concurrent and relevant issues.

We are also publishing a popular level article in science and do hope that the readers will find it interesting. This is a column which is going to be highly useful, especially to our younger colleagues. We request the authors contributing to this section to prepare their serious research work in a very general and simple way, so that it is understandable even to non-experts in the field. Ample references, preferably from review articles and text books and web are highly desirable, if not mandatory, for such articles.

K.P. Subramanian
EDITOR, ISAMP Newsletter
June 25, 2005

LETTER TO THE EDITOR

Sir,

I think, your readers would find the following information came out as our research work interesting. I request you to publish this as a "Letter to the Editor" in your electronic News Letter.

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Effect of solar activity on photodissociation of ions in atmosphere

The stratosphere covers an altitude from 15 to about 40 km in earth's atmosphere. The UV radiation coming from sun in wavelength region 200-300 nm can reach this altitude. The lower wavelengths will be absorbed at higher altitudes with change in solar activity. The intensity of solar radiation also changes. For X-ray region and the Lyman-α, it can be 100% from low to high solar activity. But in 200-300 nm it can change by about 5%. This change can affect the ion-molecule composition in stratosphere. The main source of ion production in stratosphere is cosmic rays. The cosmic ray intensity varies inversely with solar activity. The conductivity of stratosphere is a function of ion density and collision frequency.

We have measured conductivity in stratosphere using a balloon borne technique at low altitude station Hyderabad (India). Three different techniques namely, Langmuir Probe, Relaxation probe and longwire probe were used. The data from each technique were compared for low and high solar activity period. It was observed that ion conductivity was high by 40% during high solar activity period. This can be explained by ion composition values. During high solar activity period the heavier ions gets dissociated to lighter ions, which can result in high conductivity values. We were the first to make such measurements and explain the result in terms of ion composition. Figure 1. shows conductivity values for low and high solar activity period.

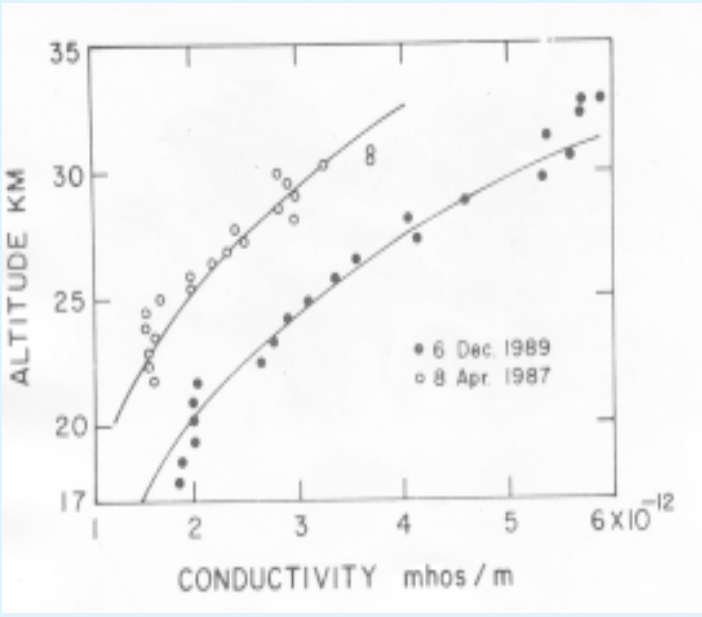

Figure 1: Conductivity values for low and high solar activity period.

ABSTRACTS OF RECENTLY PUBLISHED PAPERS

Abstract#1

Four-level and two-qubit systems, sub-algebras, and unitary integration

A. R. P. Rau, G. Selvaraj and D. Uskov

Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803-4001, USA.

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Four-level systems in quantum optics, and for representing two qubits in quantum computing, are difficult to solve for general time-dependent Hamiltonians. A systematic procedure is presented which combines analytical handling of the algebraic operator aspects with simple solutions of classical, first-order differential equations. In particular, by exploiting su(2) + su(2) and su(2) + su(2) + u(1) sub-algebras of the full SU(4) dynamical group of the system, the non-trivial part of the final calculation is reduced to a single Riccati (first order, quadratically nonlinear) equation, itself simply solved. Examples are provided of two-qubit problems from the recent literature, including implementation of two-qubit gates with Josephson junctions.

STATUS: In Press

Reference: Phys. Rev. A (2005), arXiv quant-ph/0501048

Abstract#2

Time-dependent treatment of a general three-level system

A. R. P. Rau and Weichang Zhao

Department of Physics and Astronomy, Louisiana State University, Baton, Rouge, Louisiana 70803-4001, USA

email: arau@phys.lsu.edu

Both unitary evolution and the effects of dissipation and decoherence for a general three-level system are of wide interest in quantum optics, molecular physics, and elsewhere. A previous paper presented a technique for solving the time-dependent operator equations involved but under certain restrictive conditions. We now extend our results to a general three-level system with arbitrary time-dependent Hamiltonians and Lindblad operators. Analytical handling of the SU(3) algebra of the eight operators involved leaves behind a set of coupled first-order differential equations for classical functions. Solution of this set gives a complete solution of the quantum problem, without having to invoke rotating-wave or other approximations. Numerical illustrations for multiphoton couplings and quantum control are given.

STATUS: submitted to Phys. Rev. A, arXiv quant-ph/0502109

Abstract#3

Supersymmetry in quantum mechanics: An extended view

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The concept of supersymmetry in a quantum mechanical system is extended, permitting the recognition of more supersymmetric systems, including very familiar ones such as the free particle. Its spectrum is shown to be supersymmetric upon taking into account physical reasonableness of the wave functions involved. Space-time symmetries are used for the construction of the supercharges without explicit invocation of fermionic or Grassmann variables. Most notably, while the free particle in one dimension has generally been regarded as having a doubly degenerate continuum throughout, the construction clarifies that there is a single zero energy state at the base of the spectrum.

Reference: J. Phys. A **37**, 10421 (2004)

Abstract#4

Perspectives on the Fano Resonance Formula

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The general profile of a resonance, as given by Fano in 1961, is well known throughout physics. This Comment provides some of the simplest derivations of this formula, together with a discussion of subtleties in handling continuum states with regard to their normalization, orthogonality, and completeness. Inadequate appreciation of these subtleties has led to misconceptions and errors in analysis. Recent, novel applications of the Fano formula in condensed matter systems include systems with decoherence and lack of time reversal symmetry which make the resonance profile parameter complex.

Reference: Phys. Scripta **69**, C10 (2004)

Abstract#5

An apparatus for studying momentum-resolved electron-impact dissociative and non-dissociative ionisation

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A spectrometer for recoil ion momentum measurements has been built for studying electron impact ionisation and dissociation of molecules. The apparatus is described in detail, highlighting its capabilities, as well as differences in design from the ones already in use elsewhere. Momentum spectra of ions resulting from 1300~eV electron impact on CO_2 are presented. In particular we observe a broad momentum distribution for the dissociative ionisation reaction leading to the formation of C^+ and two momentum groups in the CO^+ and O^+ channel. By recording multiple ions arising from the same dissociative ionisation event, we also demonstrate the formation of fragment pairs O^+:CO^+, C^+:O^+, and O^+:O^+.

Submitted to: Euro. Phys. J. D. (2005)

Abstract#6

Spin Asymmetry in an Intense-Field Ionization Process

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A relativistic analysis of the rate of spin flips in ionization of an ensemble of Dirac H atoms subjected to intense circularly polarized laser fields is made. A remarkable intensity-dependent asymmetry between the spin up and spin down electron currents is found. It is nonzero even when the retardation effect, hence the magnetic component of the field, as well as the spin-orbit interaction responsible for the well-known Fano effect, is negligible. Transformation properties of the amplitudes show that the sign of asymmetry can be controlled by changing the helicity of the laser photons from outside.

DOI: 10.1103 /PhysRevLett. **93**.053002 PACS numbers: 32.80.Rm, 32.80.Fb, 42.50.Hz

Abstract#7

Dissociative Electron Attachment to Formic Acid

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# Tribhuvan University, Kathmandu, Nepal
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Dissociative electron attachment (DEA) to formic acid (HCOOH) is studied in a crossed beams experiment using mass spectrometric detection of the product ions in the electron energy range 0 to 15eV, including the measurement of absolute cross sections. Unlike the previous reports, we observe the formation of H^- from this molecule, in addition to the fragment negative ions namely O^- / OH^- and $HCOO^-$, which were observed earlier. The absolute cross sections indicate that H^- formation is one of the important DEA channels in this molecule.

Chemical Physics Letters **405**, 172-176 (2005)

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Abstract#8

Velocity Slice Imaging for Dissociative Electron Attachment

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#Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai – 400 085, India
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A Velocity Slice Imaging method is developed for measuring the angular distribution of fragment negative ions arising from dissociative electron attachment (DEA) to molecules. A low energy pulsed electron gun, a pulsed field ion extraction and a two-dimensional position sensitive detector consisting of microchannel plates and a Wedge-and-Strip anode are used for this purpose. Detection and storage of each ion separately for its position and flight time allows analysis of the data offline for any given time slice, without resorting to pulsing the detector bias. The performance of the system is evaluated by measuring the angular distribution of O^- from O_2 and comparing it with existing data obtained using conventional technique. The capability of this technique in obtaining forward and backward angular distribution data is shown to have helped in resolving one of the existing problems in the electron scattering on O_2.

(PSCS No: 34.80.Ht)

† Corresponding author. Fax: +91 – 22 – 2280 – 4610

A NEW KIND OF BINDING

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The discovery of positronium (Ps), a hydrogen (H) like atom formed by a positron (e^+) and an electron (e^-) in 1953 by Deutsch, is an invaluable achievement to modern science. The atom is itself its anti-atom. Interesting property is that its charge and mass centers coincide.

The existence of Ps was first predicted by S. Mohorovicic (1934) and later on by Ruark [1945] based on their theoretical investigations which insisted Deutsch (1949) to carry on his experimental investigation. The concept of anti-particle was introduced by Dirac in 1928 as an anti-electron which was later experimentally observed by Anderson in 1932 and was named as positron.

The collision physics is the most important area of the modern science. The most successful atomic model by Bohr (1913) and Sommerfeld (1916) was based on the well known Rutherford scattering [1911] experiment and theory; needless to say that the atomic concept was conceived one century ago by Dalton (1808), Gay-Lussac (1808), Avogadro (1811), Maxwell (1811), Mendeleef (1869) and others.

In collision physics, the resonance is an important phenomenon. When a microscopic moving object which is a wave, enters into the scattering chamber near the target, it faces interactions. When it comes out of the scattering zone, the original incident wave gathers a phase shift and the new wave is known as scattered wave. The change in phase which is known as phase shift is the parameter that carries the information of the scattering process. A rapid change in phase shift by π radian in a very narrow energy interval of the incident wave is known as resonance. It indicates the existence of a bound system if in the s-wave elastic scattering and below threshold of excitation. One can calculate the width of resonance to get the life time (τ) of the newly formed system.

It is an extremely difficult job to detect a resonance since successful identification needs (i) a very accurate calculation and (ii) sufficient computation facilities. A large number of mess-points in a very small energy interval, generally $\sim 10^{-2} - 10^{-3}$ eV is required. It necessitates a high-speed computer with a sufficient memory, the knowledge of mathematical computation and programming languages e.g. FORTRAN.

The close coupling approximation (CCA) is the most successful theory to study the low energy scattering phenomenon in atomic physics. This theory was predicted by Massey (1932); he is known as the father of atomic physics. Massey applied the theory in e^- – atom scattering. Later Burke et al [1962] successfully used this theory for e^+ – atom scattering. Nowadays many different groups of the world are using this theory for e^-/e^+ – atom scattering. It was Fraser [1961] who used it first for Ps–H scattering. Ray and Ghosh [1996, 1997] merit the credit because they are the first who supplied detailed and converged results. They used a momentum space formalism introduced by Calcutta group [Ghosh et al 1982] whereas Fraser [1968] used a coordinate space formalism to write the coupled integral equations. They again add more channels in the CCA basis [Ray et al 1998, Ghosh et al 1998]. The studies of Fraser [Fraser 1961, 1962, 1968; Fraser et al 1966, Hara et al 1975] were confined to static-exchange model i.e. considering only the elastic channel in the basis and the H and He targets. The author [Ray 1999, 2000, 2002] had extended the CCA theory in Ps and lithium (Li) scattering using the static-exchange and a two-channel CCA models.

The theory is based on the very basic principle of quantum mechanics i.e. the eigenstate expansion (ESE) methodology which states that the total wave function of a quantum mechanical system is expressed as a sum of all possible states. So one has to use a wide channel space, but practically it is not possible. The number of unknowns exceed the number of equations when non-spherical orbitals like p- and d- states of an atom are considered in channel space. So arose the necessity of an approximation. We should conserve the total angular momentum quantum numbers e.g. 'J' and 'M'. It makes the equations closed i.e. the number of unknowns are equal to the number of equations. This is known as CCA. The accuracy of the method depends on the choice of basis set.

The electrons are indistinguishable particles. Two electrons can interchange their positions, the phenomenon is known as exchange. The exchange is highly important at low incident energies in presence of more than one electron. The electron spins can be up and down. If both the spins are parallel and total spin is 1, it is known as triplet (–) state; if antiparallel, the total spin is 0 and is known as singlet (+) state.

We study Ps and H scattering taking both the atoms at the ground states. We use a CCA theory. H is our target and Ps is the projectile. The present system has two electrons, one on Ps and one in H. So both type of scattering processes, singlet (+) and triplet (–) are possible. We have chosen a basis of expansion with the projectile inelastic nine channels, three of which are primary and six are intermediate. They are as follows:

$$
\begin{aligned}
\mathrm{Ps(1s)} + \mathrm{H(1s)} &\longrightarrow \mathrm{Ps(1s)} + \mathrm{H(1s)} \\
\mathrm{Ps(1s)} + \mathrm{H(1s)} &\longrightarrow \mathrm{Ps(2s)} + \mathrm{H(1s)} \\
\mathrm{Ps(1s)} + \mathrm{H(1s)} &\longrightarrow \mathrm{Ps(2p)} + \mathrm{H(1s)} \\
\mathrm{Ps(2s)} + \mathrm{H(1s)} &\longrightarrow \mathrm{Ps(1s)} + \mathrm{H(1s)} \\
&\longrightarrow \mathrm{Ps(2s)} + \mathrm{H(1s)} \\
&\longrightarrow \mathrm{Ps(2p)} + \mathrm{H(1s)} \\
\mathrm{Ps(2p)} + \mathrm{H(1s)} &\longrightarrow \mathrm{Ps(1s)} + \mathrm{H(1s)} \\
&\longrightarrow \mathrm{Ps(2s)} + \mathrm{H(1s)} \\
&\longrightarrow \mathrm{Ps(2p)} + \mathrm{H(1s)}
\end{aligned}
$$

We perform the exact calculations for all the nine direct and exchange matrix elements considering all the possible Coulomb interactions. The transition matrix element for the direct channel in the first-Born approximation vanishes if the parity of Ps remains fixed.

We study the s-wave elastic phase shifts, s-wave elastic cross sections for both the singlet (+) and triplet (–) scattering processes at the incident energies below the excitation threshold. We also study the total/integrated cross section. The concept of quantum mechanical approach is that although below threshold of excitation the elastic scattering is the only open channel but other closed channels also have influence on it and it is considered in ESE methodology. If the basis channels are closer in energies, the overlap should be more. In the present Ps–H system, the projectile inelastic channels are closer to the elastic channel than the target inelastic channels [Ray et al 1998]. Again according to the existing literature [Burke 1962] lowest p-states of H i.e. H(2p) can provide 66.65% effect of dipole polarizability of H. In present system, the polarizabilty of Ps is eight times higher than H, so the impact of Ps(2p) channel is expected to be more than H(2p) [Ray et al 1998]. These two pre-knowledge motivated the present reinvestigation [Sinha et al 1997].

We obtain perfect resonances in s-wave elastic phase shifts at both the singlet (+) and triplet (–) channels; both are found for the first time using a CCA methodology. We also study the s-wave cross sections which are derived directly from scattering amplitudes and both satisfy the Breit-Wigner like formulations. In the singlet (+) channel, the non-resonant phase shift is ~ 0.5 radian at the resonant energy region whereas in the triplet (–) channel, it is $\sim -\pi/2$.

The singlet resonance supports the earlier prediction [Drachman & Houston 1975] of a PsH bound system and perfectly in agreement with existing physics. The triplet resonance carries the information of a new bound system. The cause of the present triplet resonance is inclusion of Ps(2p) channel. More specifically intermediate 9th channel. According to literature [Walters 1973] it includes a non-adiabatic effect. We define the same as dynamic effect of dipole polarizability. This type of binding information in triplet channel is a new addition in existing physics.

We found a dip or minimum in the s-wave elastic cross section curve for triplet channel as well as in the integrated or total cross section curve; it carries information of clustering / condensation. It is to be noted that the present theory should be applicable for slowly moving atoms and to a dilute system in which the inter-atomic separation is much greater than the atomic dimension. The resonance energy corresponds to a temperature ~10^{-4} degree Kelvin.

Author likes to thank DST, India for Grant No.SR/FTP/PS-80/2001 on 'SERC Fast Track Young Scientists Scheme' for full financial support.

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National Symposium on Spectroscopy and its Applications (NSSA-2006)

Indian Association for the Cultivation of Science
Jadavpur, Kolkata - 700 032, India

The Department of Spectroscopy, Indian Association for the Cultivation of Science, Jadavpur, Kolkata 700032, INDIA is organizing the NATIONAL SYMPOSIUM ON SPECTROSCOPY AND ITS APPLICATIONS (NSSA-2006) during January 18 - 20, 2006 to celebrate the 60th year of its existence.

The scientific programme will include invited talks, in-depth discussion and oral/poster presentation of contemporary research.

The organizing committee cordially invites interested researchers and young scientists to submit their research papers and actively participate in the symposium.

Topics to be covered:

- Supramolecular and Macromolecular Photochemistry
- Ultrafast Laser phenomena and techniques
- Time/space resolved spectroscopy
- Molecular dynamics and switching dynamics in strong and week fields
- Molecular dynamics and spectroscopy of mesomorphic phases
- Spectroscopy and microscopy of single molecule
- Non-linear optics
- Lasing without inversion
- Atom optics
- Raman Spectroscopy
- Photoinduced electron transfer dynamics
- Organic and inorganic photo physics and photochemistry
- Artificial photosynthesis
- Solar light energy conversion and photo catalysis

Dead lines to remember

Registration	:	September 01, 2005
Submission of abstract	:	September 01, 2005
Acceptance of abstract	:	November 01, 2005
Request for accommodation	:	November 01, 2005

Conveners :

Prof T. Ganguly — tapcla@rediffmail.com, sptg@mahendra.iacs.res.in

Prof. Krishna Rai Dastidar — krishna_raidastidar@yahoo.co.in, spkrd@mahandra.iacs.res.in

Web: http://mywebpage.netscape.com/iacsnasa2006/nssa.htm

The 20th National Symposium on Plasma Science and Technology (PLASMA-2005)

INTERNATIONAL SCHOOL OF PHOTONICS

Cochin University of Science and Technology, Cochin, Kerala

PLASMA-2005 is being organized by the International School of Photonics, Cochin University of Science and Technology, Cochin, Kerala during 5-7 December, 2005.

The symposium is organized to provide a scientific forum for the presentation of new results and to discuss recent developments in various fields of plasma science and technology. The focal theme of the symposium is "LASER PRODUCED PLASMA".

Topics

- Basic Plasma Studies
- Plasma Processing & Industrial Applications
- Fusion Plasma
- Plasma Diagnostics
- Space and Astrophysical Plasma
- Wave and Exotic Plasma
- Dusty Plasma
- Laser Plasma
- Computational and Simulation Plasma
- Interdisciplinary Plasma

IMPORTANT DEADLINES

Submission of Abstracts	15	Aug. 2005
Acceptance of Abstracts	15	Sept. 2005
Registration	31	Oct. 2005

TECHNICAL PROGRAM

Submission of Full paper	31	Oct. 2005
Accommodation Booking	31	Oct. 2005

Convenor

Prof. P Radhakrishnan
plasma@photonics.cusat.edu
Web http://www.photonics.cusat.edu/plasma.htm

DAE-BRNS Symposium on Electron Beam Technology and Applications (SEBTA 2005)

Bhabha Atomic Research Center, Mumbai

The DAE-BRNS Symposium (SEBTA 2005) will be held at the BARC Mumbai during 28-30 September, 2005 in association with the Power Beam Society of India (PSI). The symposium will provide an opportunity for active researchers, scientists and industries to review the current scenario, to share the available expertise and to consider directions for future developments.

There will be review and invited talks by eminent engineers and scientists with long years of practical experience in this field.

Major themes to be covered:

- Overview of electron beam technology in India
- EB systems and thermal processing of materials
- EB accelerators for non thermal processing of materials
- Beam characterisation“l Beam and process modeling
- Physical processes during EB welding, melting and evaporation
- EB irradiation for polymers, medical sterilization etc.
- Instrumentation related to monitoring, control and diagnostics
- High voltage DC and pulsed power sources
- Maintenance and trouble shooting of EB equipment

Date and Venue

The symposium will be organized at the Multipurpose Hall of BARC Training School Hostel at Anushaktinagar, Mumbai - 400094 during September 28-30, 2005.

Important Dates

Submission of pre-registration form and abstract:	June 15, 2005
Intimation regarding acceptance:	June 30, 2005
Submission of full manuscript:	July 31, 2005

Participation

The participation of the symposium is open to all active workers in the field. The registration fee for the symposium is as follows:

Student Participation:	Rs 250
PSI Members:	Rs. 500
Participants from Academic and Research Institutions:	Rs. 600
Participants from Industries:	Rs. 1000

Convener

Shri D.P. Chakravarthy dpc@apsara.barc.ernet.in

Co-convener

Dr. Archana Sharma arsharma@apsara.barc.ernet.in

National Symposium On Vacuum Science & Technology And Its Application to Plasmas
Indian Vacuum Society National Symposium-2005 (IVSNS-2005)
November 16-18, 2005

Institute for Plasma Research, Bhatt, Gandhinagar, Gujarat

Indian Vacuum Society National Symposium-2005 (IVSNS-2005) will be organised and Hosted by Institute for Plasma Research, Gandhinagar, Gujarat, between 16th and 18th November 2005.

This is a biannual symposium of Indian Vacuum Society. Theme subject of this symposium is Application of Vacuum Science and Technology to Plasmas. Plasma is used for many scientific research, fusion and accelerator research, surface modification study, semiconductor and thin film technology, industrial applications etc. Plasma production and its applications to these areas require gas pressure from sub-atmospheric level down ultra high vacuum range. Gas load during plasma operation for different applications also varies over a wide range from few tens of mbar-liter/sec to a very small fraction of a mbar-liter/sec demanding for variety of pumping systems. As pressure and gas load vary over a very wide range, appropriate control and monitoring systems for such processes play a vital role.

Main topics to be covered in IVSNS-2005 are,

- Vacuum production, and measurement
- Leak detection
- Residual gas analysis
- Vacuum applications in plasma production
- Vacuum applications in material processing AND Surface treatment Using Plasmas.
- Large volume vacuum systems
- Vacuum systems for fusion and accelerator systems
- Vacuum evaporation and thin film coating
- Data acquisition and control for vacuum systems
- Vacuum and Plasma applications in industries
- R & D in Indian vacuum industries, problems and Solutions.

DEADLINES

Pre-registration :	30 June, 2005
Abstract submission :	30 June, 2005
Abstract acceptance Intimation :	31 July, 2005
Final Announcement :	31 July, 2005
Final manuscript submission :	30 September, 2005

Convener: **Prof. Y.C. Saxena** Co-convener: **Shri H.A. Pathak**

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