Physics Activities in Nepal

Raju Khanal
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South Asian High Energy Physics Instrumentation Workshop on Detector Technology and Applications (SAHEPI) 20170620 and 21, KU, Dhulikhel

Universities in Nepal

Far-western University

Kathmandu University

Lumbini Bouddha University

Mid Western University

Nepal Agriculture and Forestry University

Nepal Sanskrit University

Pokhara University

Purbanchal University

Tribhuvan University

Tribhuvan University

Kathmandu

1959

MSc (Physics) courses started in 1965

At present: more than 750 students !

(in 9 Campuses)

26 PhD students

(Central Department of Physics)

Central Department of Physics
Tribhuvan University

Kathmandu University

November 1991

BSc (applied physics)

MPhil

PhD

Physics Research in Nepal

- Astrophysics and Cosmology
- Atmospheric Physics
- Biomedical Physics
- Condensed Matter Physics
- Nuclear
- Plasma Physics
- Seismology
- … … …

Physics Research in Nepal

- **Astrophysics and Cosmology**
- **Atmospheric Physics**
- **Biomedical Physics**
- **Condensed Matter Physics**
- **Nuclear**
- **Plasma Physics**
- **Seismology**
- **… … …** **High Energy Physics !**

ICTP - BCSPIN Summer School 1991, Nepal (Photo: Sushan Konar)

5th ICTP / BCSPIN Kathmandu Summer School on Selected Topics in Field Theory, High-energy and Astroparticle Physics

22 May - 7 Jun 1994. Kathmandu, Nepal

CNUM: C94-05-22

Proceedings
Contributions

Email: forza@ictp.trieste.it
TEL: +39-40-2240357 FAX: +39-40-224163
SELECTED TOPICS IN FIELD THEORY, HIGH ENERGY AND ASTROPARTICLE PHYSICS: proceedings. Edited by J. Pati and C
347p. (Kathmandu Summer School Lecture Notes, v.3)

6. **The CERN research programme**
P. Darriulat (CERN). May 1994. 18 pp.
Prepared for Conference: C94-05-22, p.79-96 Proceedings
References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
Detailed record

7. **Accelerator experiments for the next century**
P. Darriulat (CERN). 1994.
Published in **In *Kathmandu 1994, Selected topics in field theory, high energy and astroparticle physics* 97-114**
Prepared for Conference: C94-05-22, Prepared for Conference: C94-08-01 Proceedings
References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
Detailed record

8. **Electroweak precision tests: A Status report**
Guido Altarelli (CERN). Oct 1994. 28 pp.
CERN-TH-7464-94
Conference: C94-06-27.3, p.419-518, Conference: C94-05-22, p.1-30 Proceedings
References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
KEK scanned document; CERN Document Server; CERN Library Record
Detailed record

9. **Physics at the Fermilab Tevatron proton - anti-proton collider**
Steve Geer (Fermilab). Aug 1994. 44 pp.
Published in **In *Kathmandu 1994, Selected topics in field theory, high energy and astroparticle physics* 33-76.**
FERMILAB-CONF-94-275-E, CDF-PUB-CDF-PUBLIC-2787, C94-05-22
Lectures given at Conference: C94-05-22, p.33-76 Proceedings
References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
OSTI Information Bridge Server; Fermilab Library Server (fulltext available); Link to Fulltext
Detailed record

The Abdus Salam
International Centre
for Theoretical Physics

IAEA

Research | Scientific Calendar | Programmes

Administration

Search

Search in Conferences:

Overview

Programme

Speakers

Support

smr982@ictp.trieste.it

BCSPIN KATHMANDU SUMMER SCHOOL IN PHYSICS "CURRENT TRENDS IN HIGH ENERGY PHYSICS AND COSMOLOGY" (to be held in Kathmandu, Nepal) | (smr 982)

Starts 19 May 1997
Ends 3 Jun 1997
Central European Time

Kathmandu,

Cosponsor(s)

National Science Foundation, Tribhuvan University, Royal Nepal Academy of Science and Technology In cooperation with: Tribhuvan University, Royal Nepal Academy of Science and Technology

Secretary Forza

BCSPIN Summer School

improved quality

created interests

International collaboration

… … …

Could not be continued; unfortunately !

more than 1200 physics graduates currently engaged abroad (Ref.: CDP, 2016 May 19)

It was a great experience being a part of "ICTP/CERN Experimental Physics Masterclass" organised at Kathmnadu University.
I wanna thank Ms.Abha Eli Phoboo, DrKate Shaw , Dr. Suyog Shrestha and Dr.Joerg Stelzer for organizing such a great programme and providing us an oppurtinity to be a part of it.

ICTP CERN Experimental Physics Masterclass 2014

On the occasion of National Science Day 2072, we would like to announce for one day

Seminar on Particle Physics

Programs:

Talk by Prof. Udaya Raj Khanal

Topic: General Overview of Particle Physics and Discussion Session

Video Conference with CERN (ATLAS)

Topic: Experimental Aspects of Finding Particles and Interaction

Opportunity on CERN for students by

Mr. Santosh Parajuli, CERN summer student 2015

Date: Bhadra 29, 2072, / Sep 15, 2015

Time: 2:00 pm to 5:00 pm

Venue: Ministry of Science, Technology and Environment, Singhdarbar, Kathmandu

Any interested can apply to participate on this program. Please send your application letter to **astronmahesh@gmail.com** , including your basic information with phone number and a motivational letter is necessary explaining why you want to participate, in not more than 300 words before September 12, 2015. Among all the applicants, few will be selected based on their motivation and academic history.

For more details please contact,

Mr. Mahesh Thakuri 9846266522

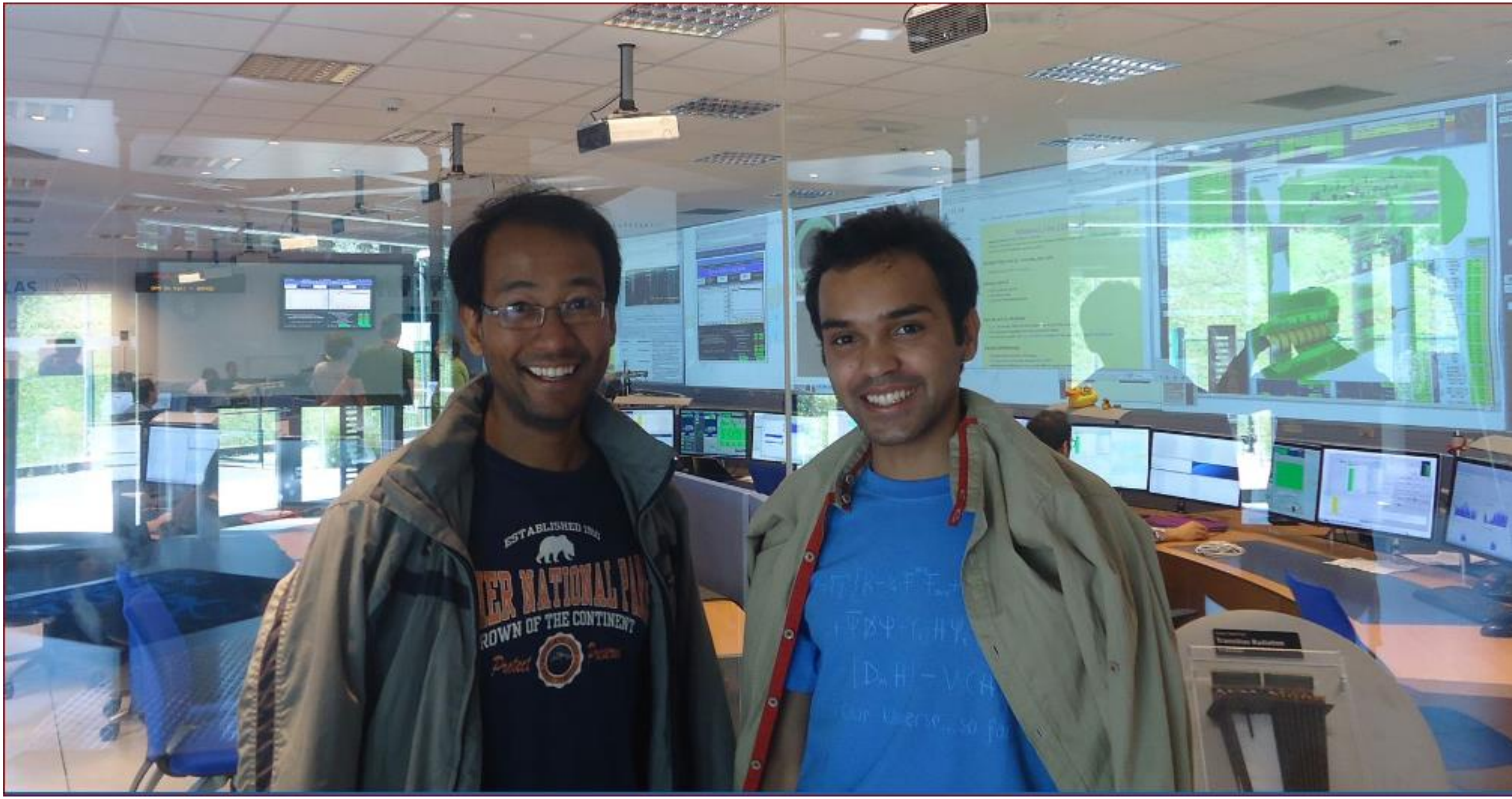
Mr. Naresh Adhikari 9849699491

Mr. Pradip Sharma 9847486064

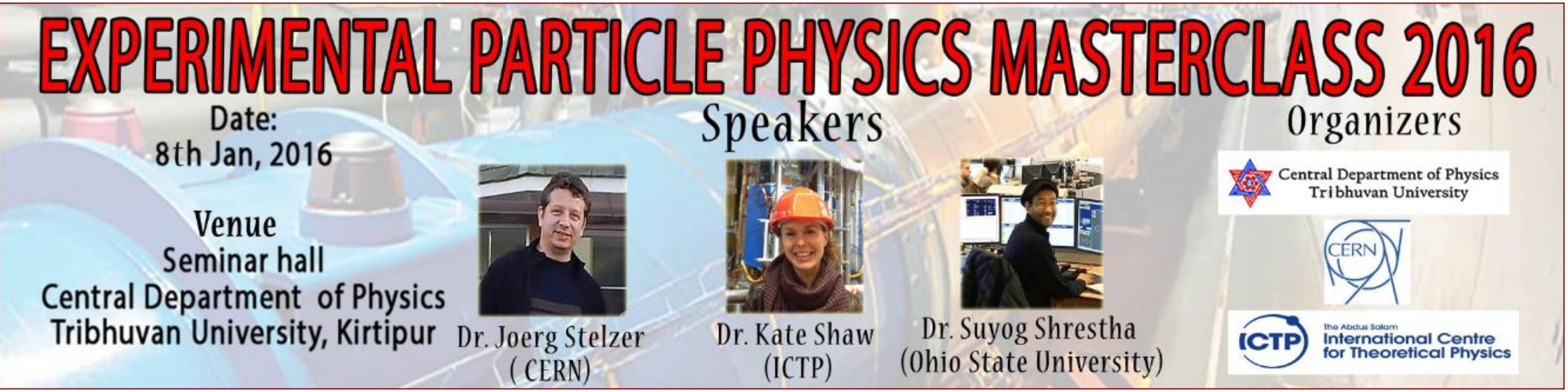
Mr. Y.P. Kandel 9849165045

Students from Tribhuvan University and Kathmandu University look at real LHC data, collected by the ATLAS detector.

ATLAS 2015



ATLAS 2015


EXPERIMENTAL PARTICLE PHYSICS MASTERCLASS 2016
Date:
8th Jan, 2016
Venue
Seminar hall
Central Department of Physics
Tribhuvan University, Kirtipur
Speakers
Dr. Joerg Stelzer
(CERN)
Dr. Kate Shaw
(ICTP)
Dr. Suyog Shrestha
(Ohio State University)
Organizers
Central Department of Physics
Tribhuvan University
CERN
ICTP
The Abdus Salam
International Centre
for Theoretical Physics

Kamala High School, Sindhuli 2016

KU 2016

Suyog Shrestha added a new photo — with Shanker Bairagi.
June 17 at 7:20am · OS X ·

The President of Nepal visits CERN. She is interested in and supportive of science for development. 🙂

Like Comment

You, Sitaram Byahut, Binil Aryal and 333 others

President of Nepal in CERN 17 June 2017

President Bidya Devi Bhandari (centre) signing a visitor book while visiting CERN, the European Organization for Nuclear Research, physicists and engineers, in Switzerland, on Friday, June 16, 2017. Photo: RSS

Recently modified courses

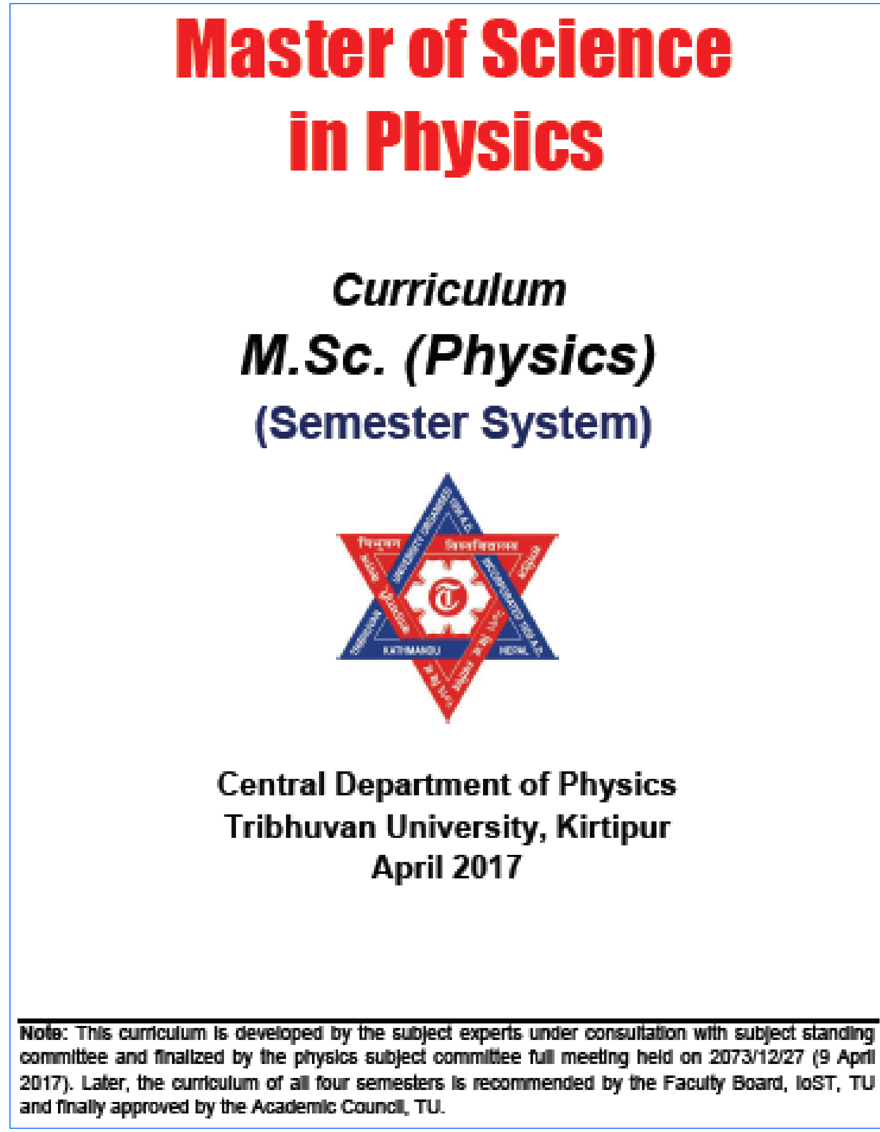
Includes fundamental courses

on Field Theory,

Math Physics,

Nuclear & Particle,

Computational, etc.



Master of Science in Physics

Curriculum

M.Sc. (Physics)

(Semester System)

Central Department of Physics
Tribhuvan University, Kirtipur
April 2017

Note: This curriculum is developed by the subject experts under consultation with subject standing committee and finalized by the physics subject committee full meeting held on 2073/12/27 (9 April 2017). Later, the curriculum of all four semesters is recommended by the Faculty Board, IoST, TU and finally approved by the Academic Council, TU.

Computational Condensed Matter Physics

The remarkable work was started in collaboration to Prof. TP Das, State University New York, Albany (SUNY, Albany) in 2000. Quantum computational package called Gaussian 98 was introduced in the Department. Now, there are about 10 PhD and 100 MSc students using the package.

Computational Physics at CDPTU

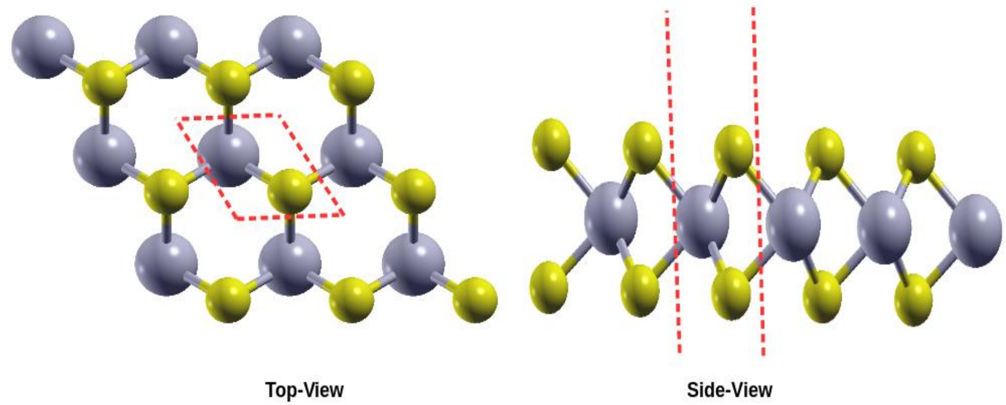
- Electronic structures of
  - -molecular solids
  - alloys like PdMn, PtMn, NiMn
  - perovskite materials like $KNbO_3$
  - Electronic structures & Magnetic properties of 2D materials
  - novel materials like graphene, graphene/MoS_2 hetero structure to store energy

- Classical molecular dynamics of
  - heavy water in water
  - inert gases in water
  - oxygen, nitrogen, carbon monoxide in water

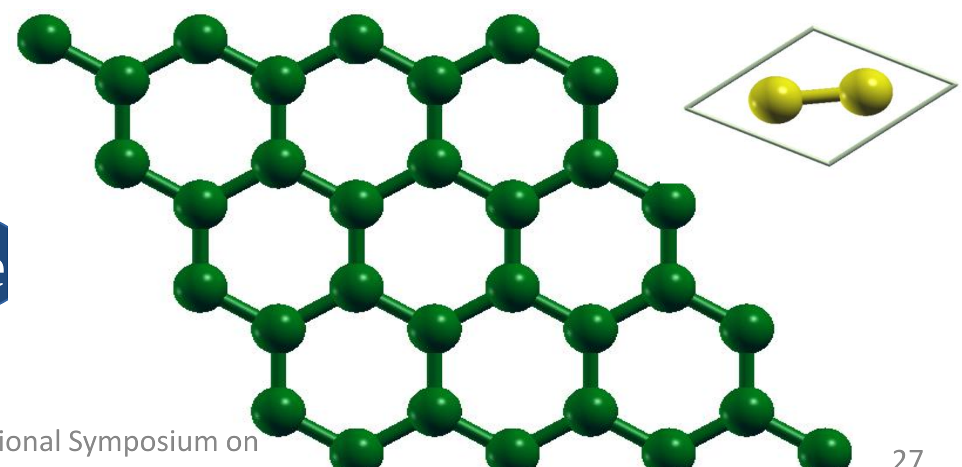

Kate Shaw shared a link.
June 15 at 9:51am ·
Theoretical physics in Nepal
Kathmandu is dusty, dirty and very loud. Power cuts are a daily problem and Internet connectivity is patchy. But in Nepal's biggest university at the heart o...
YOUTUBE.COM

Modeling Heterostructures

MoS2, 3x3 super cell size

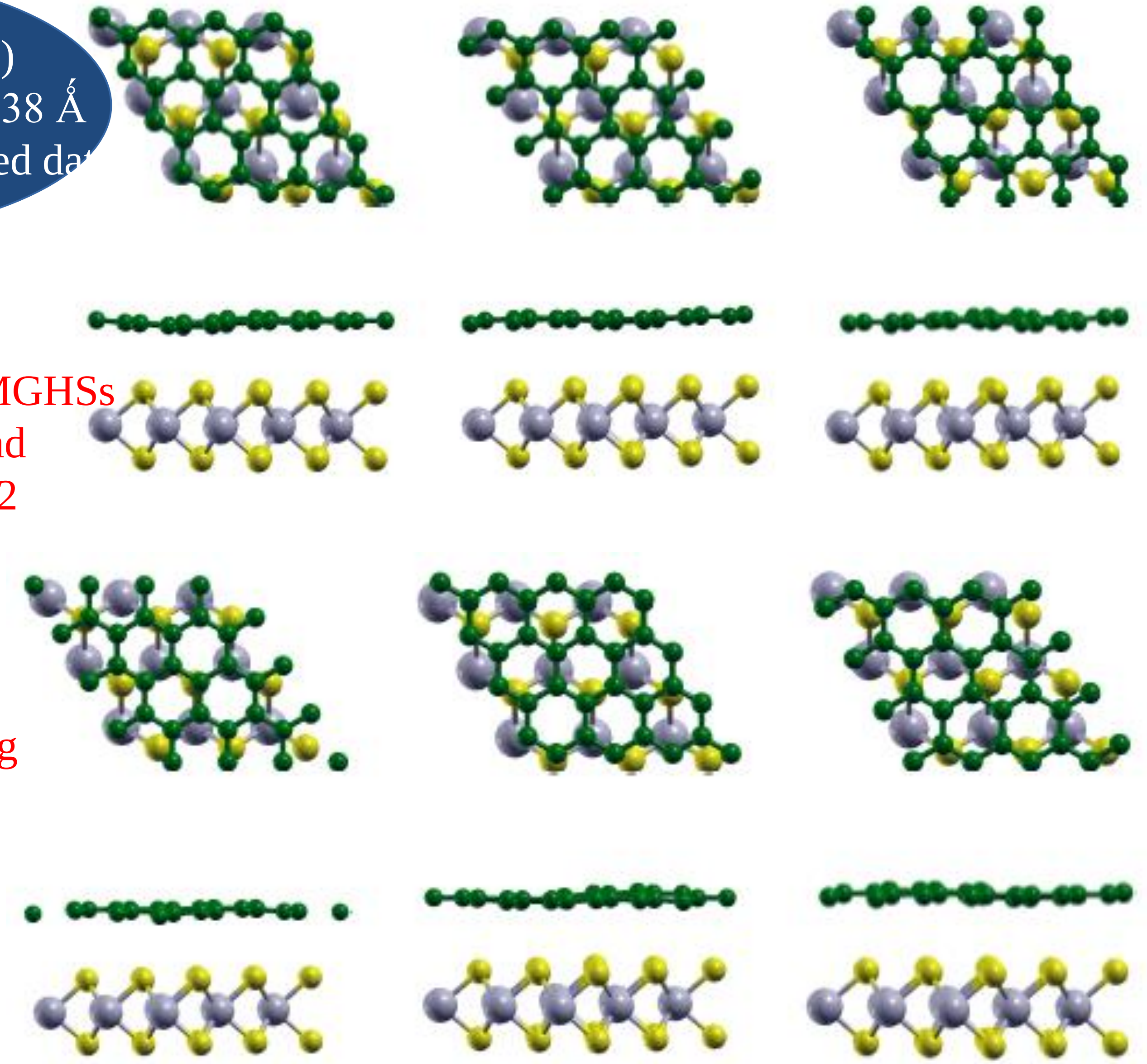


Consideration of lattice mismatch
18.006 Bohrs for MoS2
and 18.600 Bohrs for graphene



Graphene, 4x4 super cell size

Highest B.E. (1.39 eV)
With interlayer distance 3.38 Å
grees to previously reported da

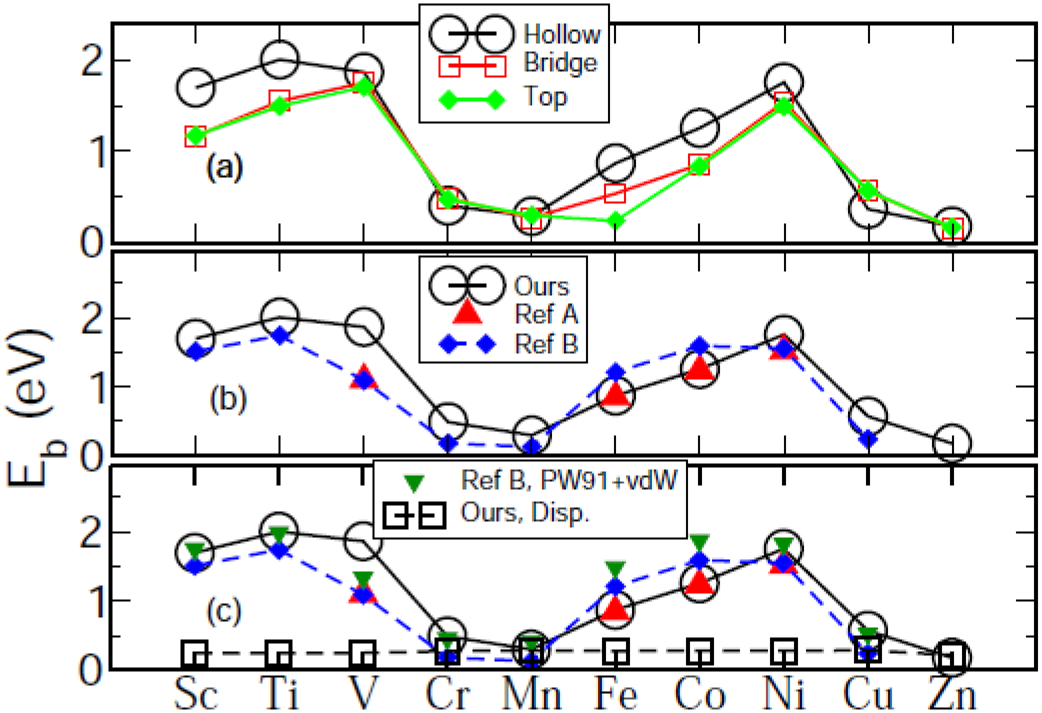


Optimized structures of MGHSs
With different stacking and
Configurations with MoS2
as reference system

Maximum change in
dihedral angle in forming
a MGHs is 3.7^0

Buckling of 0.38 Å due
to strain

Adsorption of metal atoms on graphene



(a) Adsorption energies of metal atoms at 3 different sites of graphene

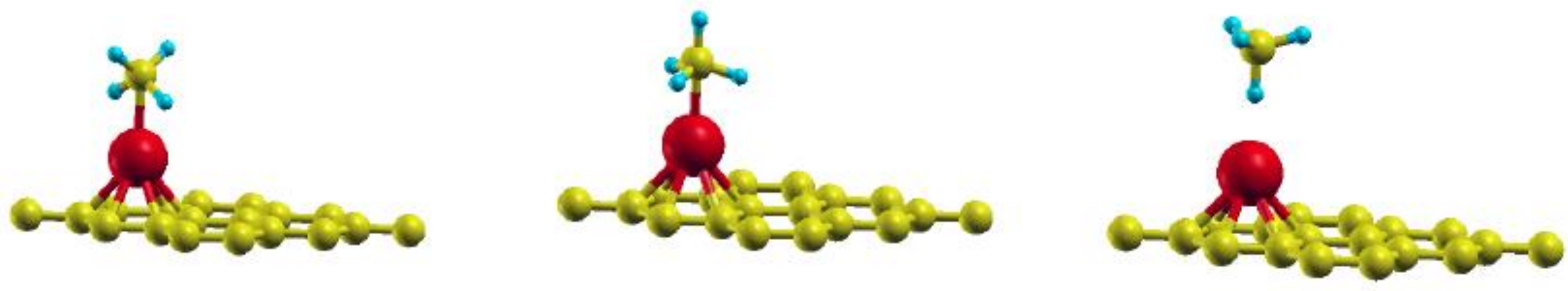
(b) Comparision of present calculations with the references

(c) Additional green triangles represent addition of dispersion calculations to Ref B.

Ref. A: Liu et al., Phys. Rev. B **83**, 235411(2011)

Ref. B: Valencia et al., J. Phy. Chem. **114**, 14145(2010)

Adsorption of methane on Fe-doped graphene



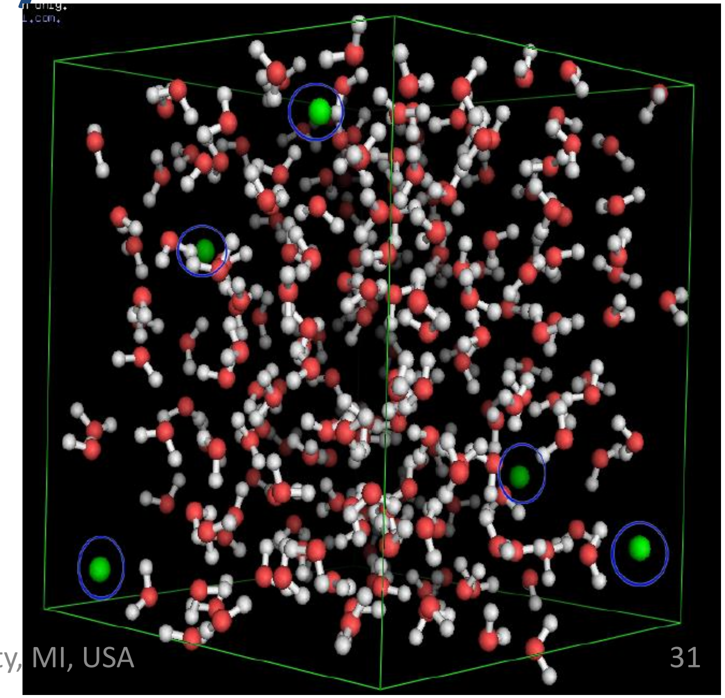
(a)$E_{ad} = 0.656$ eV (b)$E_{ad} = 0.655$ eV (c)$E_{ad} = 0.276$ eV

- Adatom in between graphene and methane enhances the adsorption energy of methane.
- The adsorption energy of methane for S and TT configurations are comparable, however, is low for TA configuration.
- TA configuration is either less preferable or not useful for the purpose of optimal adsorption energy.

Molecular Dynamics

- Method for the study of dynamic properties of the system like diffusion coefficient, viscosity etc.
- Classical MD solves Newton's equation of motion for N particle system

$$m_i \frac{\partial^2 \mathbf{r}_i}{\partial t^2} = -\nabla_i U(r) = \mathbf{F}_i.$$



☎ 4331054

Institute of Science & Technology

TRIBHUVAN UNIVERSITY

CENTRAL DEPARTMENT OF PHYSICS

Kirtipur, Kathmandu, Nepal

Ref. No.: (F.No ....) CDP .... Date ....

2074/03/02

TALK ANNOUNCEMENT

Speaker: **Dr. Prem Chapagain**

Associate Associate Professor of Physics

Affiliation: Florida International University

Miami, Florida, USA

Time/Date: **11:15 – 12:15 / 19 June 2017 (Monday)**

Venue: Seminar Hall, CDP, TU, Kirtipur

TITLE

Transformer-like molecular nanomachines

Abstract

Proteins are the molecular machines responsible for maintaining the biological self-organization in living cells. However, in order to perform their molecular functions, protein molecules themselves must fold into

Astrophysics

Gained momentum after 2006

areas of interest:

- Orientation of galaxies in the cluster and superclusters
- Interaction in the interstellar medium
- X-ray cluster & their active galactic nuclei
- Chirality of large scale structure
- Modeling Dark energy
- Photodissociation Region

Astrophysics

collaborating with:

- IAU
- Prof. Ronald Weinberger, Prof. Walter Saurer. Innsbruck university, Austria
- Prof. Noam Soaker, Prof. Bruce Ballik, University of Washington, Seattle, USA
- Prof. J. Okamura, Prof. Y. Kashikawa, University of Tokyo, Japan
- Prof. A. Lattanzi, University of Napoli, Italy
- Prof. W. Godlowski, Krakow Observatory, Poland
- Prof. J. Stutzki, University of Koeln, Germany
- Prof. S. N. Chakraborty, SNBose, India

Atmospheric Physics

National Resource and Environmental Research Laboratory (NARERL) at CDP incepted in 2008

- to developed as a center of excellence for atmospheric resource and environmental research over the Himalayan region
- innovative utilization of prevailing natural resources and marginal environments of the Himalayan complex terrain
- conduction of academic and sponsored research in the area of atmospheric resource and environmental protection
- … … …

Atmospheric Physics

Collaboration:

- Alternative Energy Promotion Center Department of Hydrology and Meteorology
- CTBTO, Vienna, Austria
- PNNL, USA
- Swedish Defense Research Institute
- Toyohashi University of Technology, Japan
- Hannover University, Germany
- National Center for Atmospheric Research Laboratory, USA
- National Center for Medium Range Weather Forecasting (NCMRWF), India

Plasma Physics

Laser-Plasma Interaction and magnetic field generation
L. N. Jha and J. J. Nakarmi (CDP)

Surface Modification of Polymers
Deepak Subedi (KU)

Atmospheric Discharge Plasma
Lekha Nath Mishra (Patan)

Plasma-Wall Transition Studies
Raju Khanal (CDP)

Laser-Plasma Interaction and magnetic field generation

L. N. Jha and J. J. Nakarmi
Central Department of Physics
Tribhuvan University, Kirtipur, Kathmandu

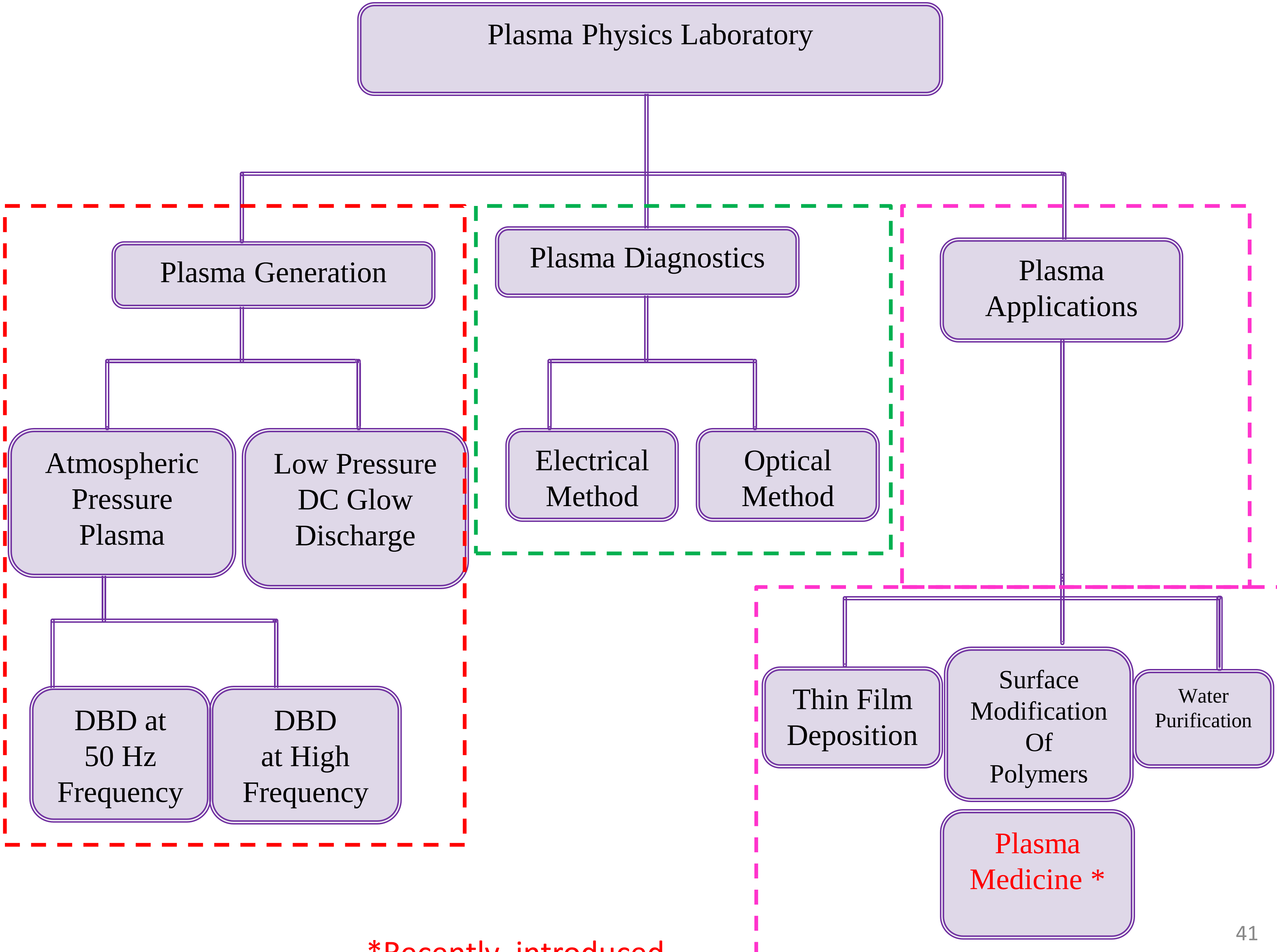
High Frequency Conductivity and Absorption Coefficient of Fully Ionized Plasma

Microwave Generation of Plasmas

High frequency Power Absorption by Inverse Bremsstrahlung in Plasma

Physics of electron cyclotron resonance microwave discharge

Plasma activities at KU

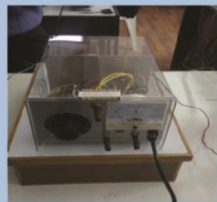


*Recently introduced

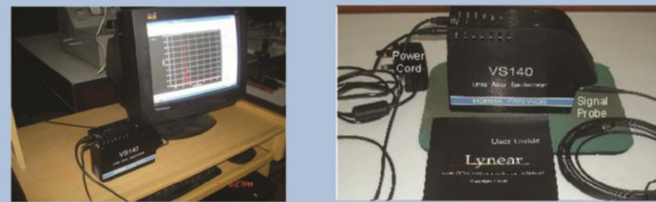
Research Areas in Progress

- Surface modification of polymer by low pressure DC glow disharge.
- Generation and application of atmospheric pressure gaseous discharges for Surface treatment of polymer
- Ozone generation and application for treatment of water.
- Plasma Diagnostics by Optical and Electrical methods
- Deposition and characterization of ZnO thin films

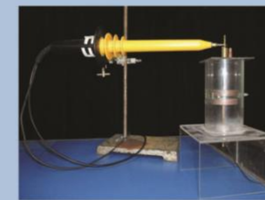
Plasma Physics Laboratory at KU



High Voltage Transformer
Adjstable Voltage (0-20) kV
and Frequency (0-30)kHz



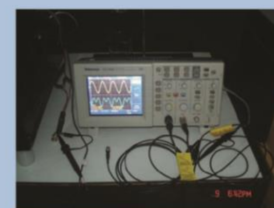
Optical Emission Spectometer (VS140) and Recorded Spectra



Photograph of High
Voltage Probe

Step up Transformer Which Gives
78.26 Time of the Input Voltage

High Voltage and High
Frequency Power Supply

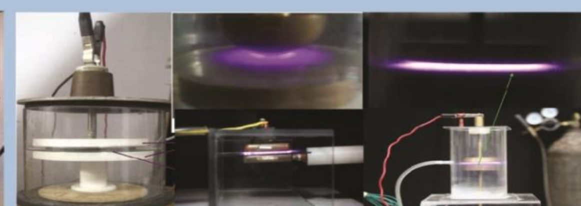


Digital Oscilloscope

Hind High Vacuum Box
Coater Model BC-300

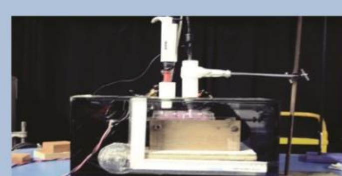
Low Pressure DC Glow
Discharge Devices

Goniometer for Measurement
of Contact Angle

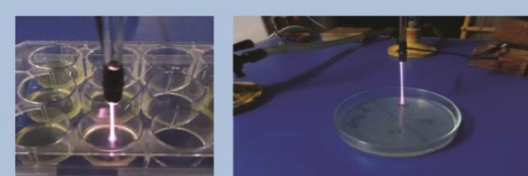


Dielectric Barrier Discharge Generated with Different
Electrode System

Treatment in Cell Culture
Media (DMEN)



Treatment in Breast Cancer
(MDA-MB-231)



Treatment in Prokaryotic &
Eukaryotic Cells

Longest Plasma
Jet Generated at
K.U. Lab

Kinetic trajectory simulation model for bounded plasmas

Plasma diodes

plasma sheaths (magnetic)

Particle induced emissions

Fluid analysis of multi-component plasma sheaths

Plasma focus device: Numerical Expt. using Lee model code

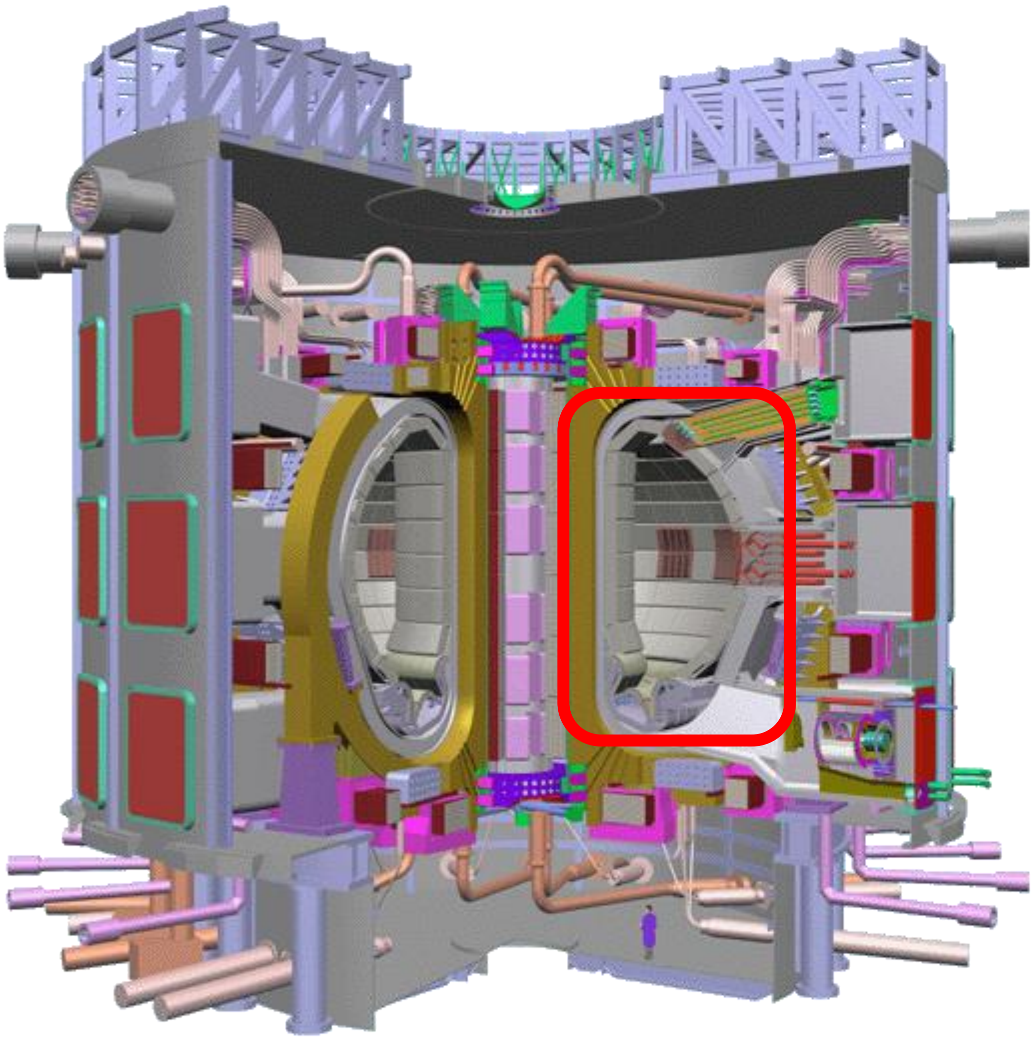
Seeded-arc plasma experiments

Ionization cross section for electron capture process

Gamma Ray Spectrometry

'ITER' - the way

International Thermonuclear Experimental Reactor



steady-state, high-gain fusion device - Under construction in France

First plasma: Dec. 2025

High gain (Q=10),

long pulse (15 min)

full power (~ 500 MW)

operation: + 5 years !

Various issues not yet finalized (e.g., first-wall materials, divertor)

Plasma-wall interaction:
A key issue in fusion energy development

Core plasma

Radiation, Dilution, Accumulation

Technology

Actively cooled components, Neutron resistivity, low activation

Plasma Facing Materials

Edge plasma

Radiation (power exhaust), instabilities

First Wall

Erosion & Deposition, off normal heat loads,

Lifetime, Tritium Retention

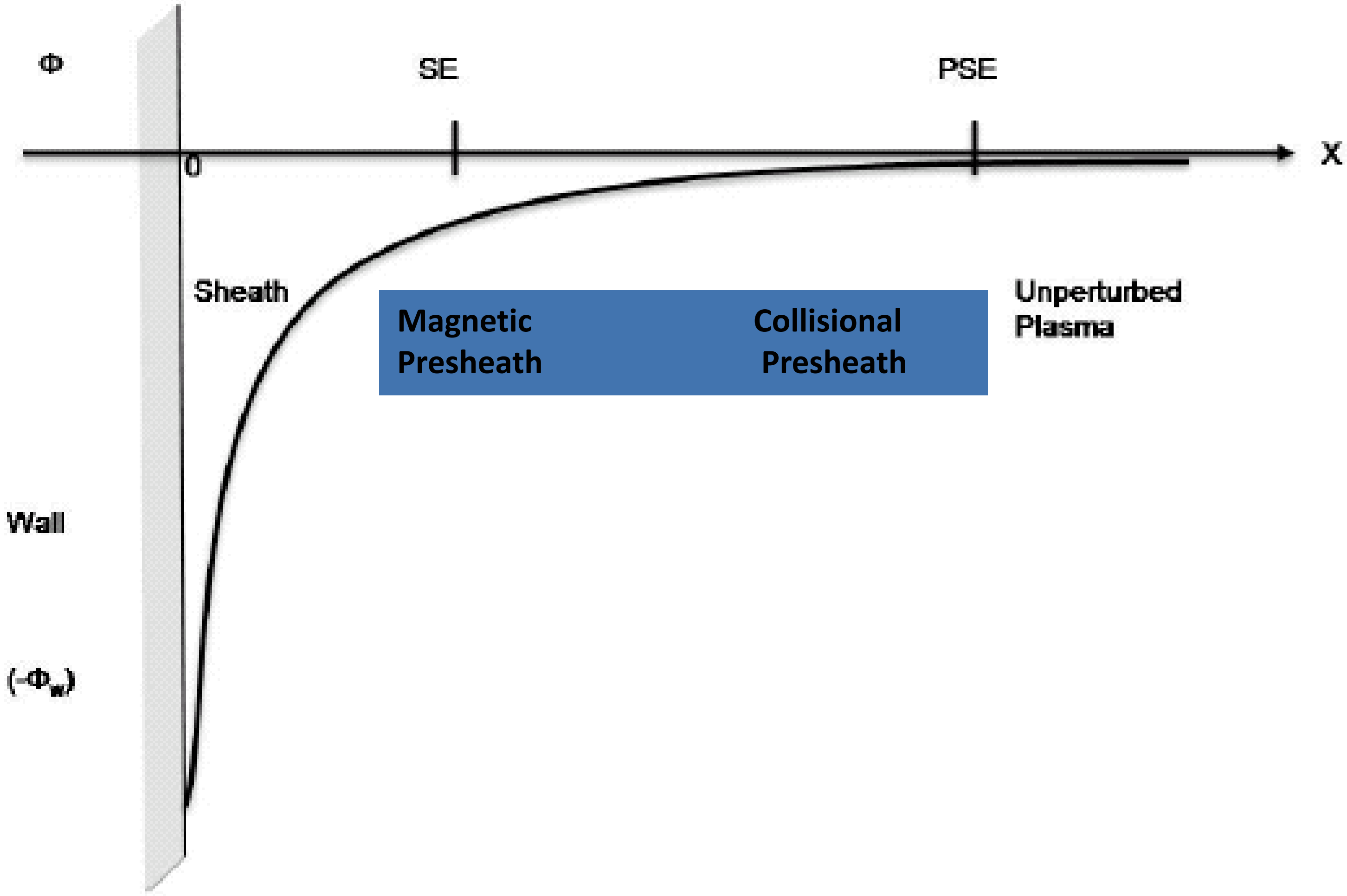
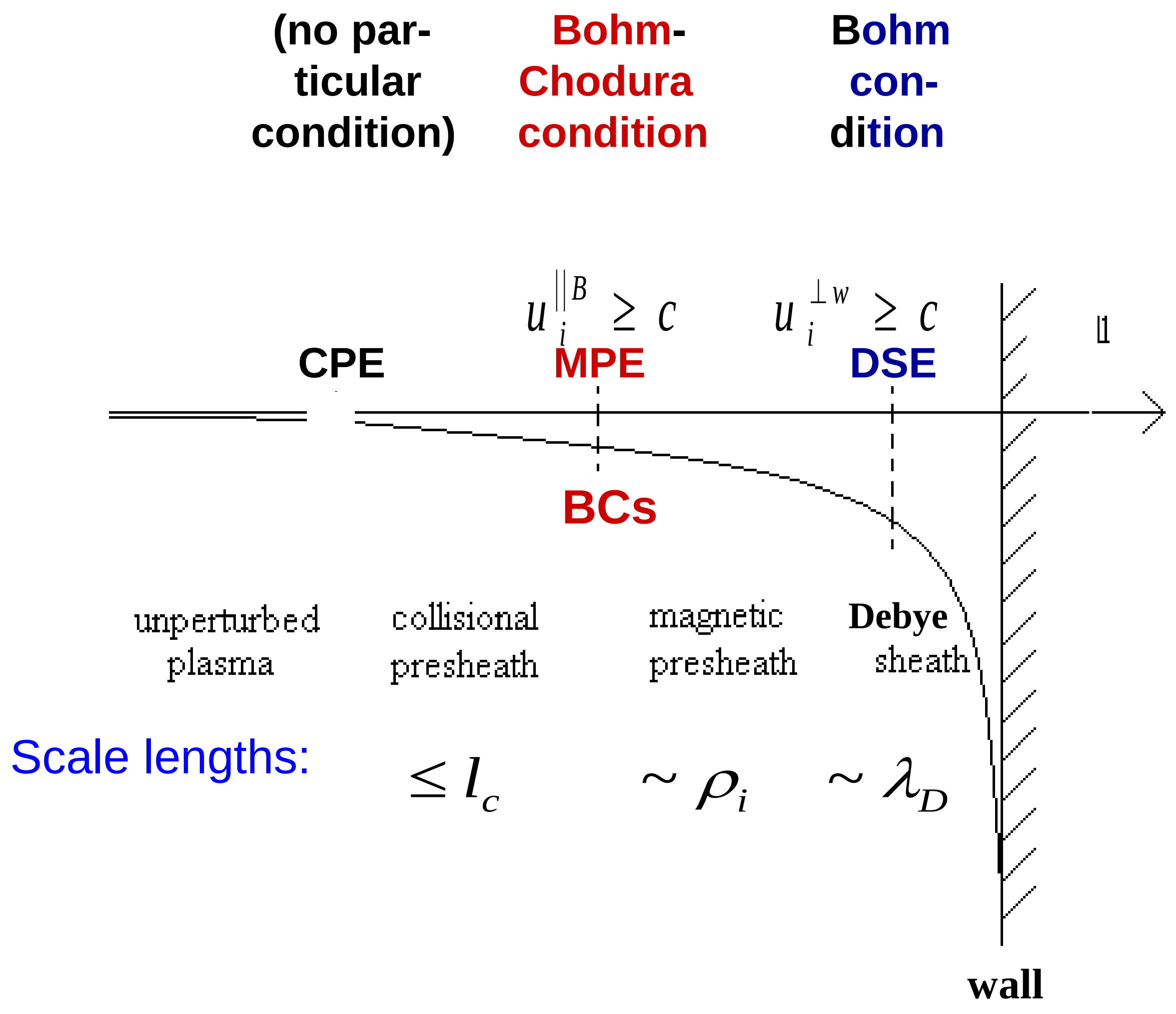


Fig. General structure of plasma-wall transition region

in presence of magnetic field

GENERAL STRUCTURE OF THE MAGNETIZED PLASMA-WALL TRANSITION (PWT)

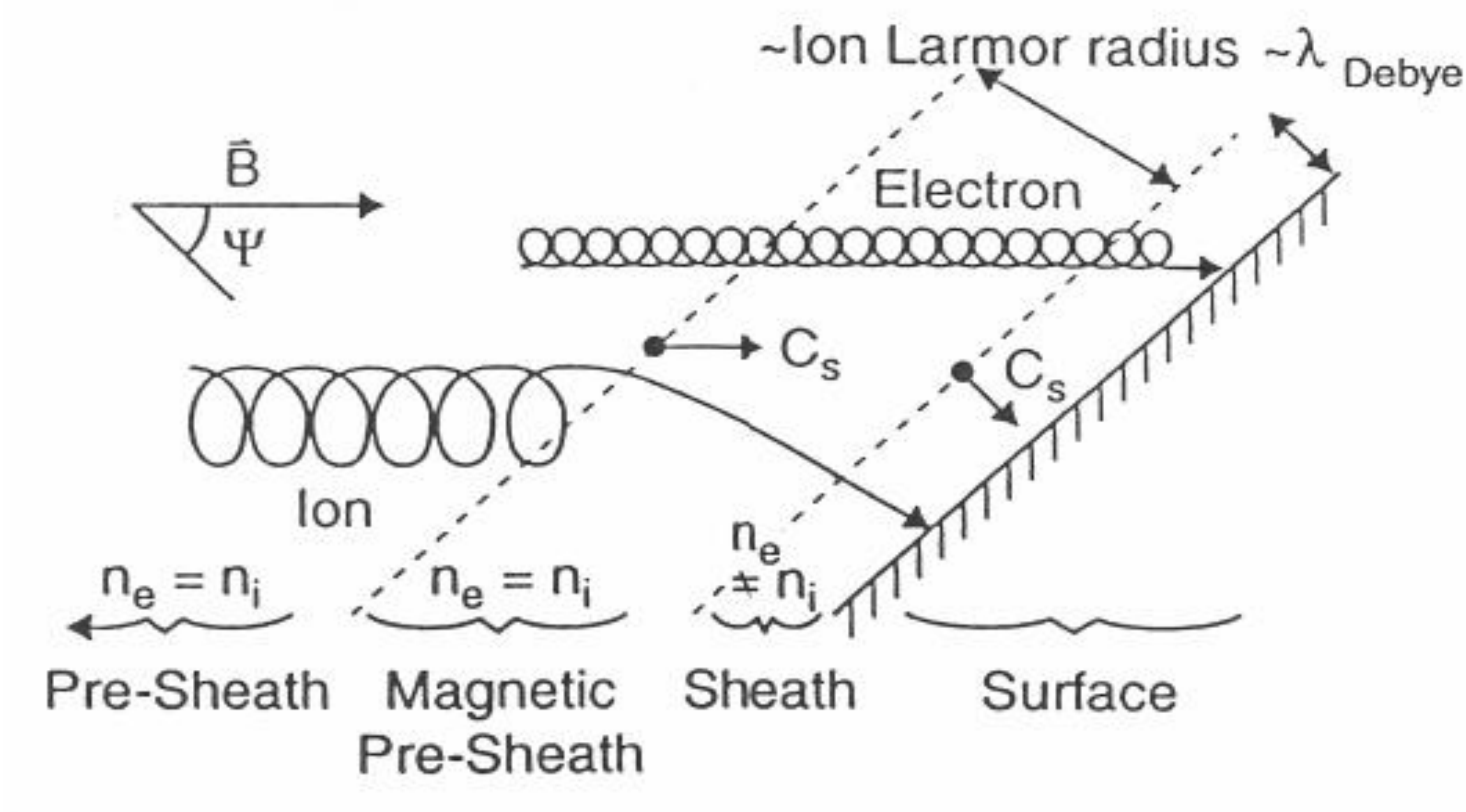
Magnetic field oblique to the wall



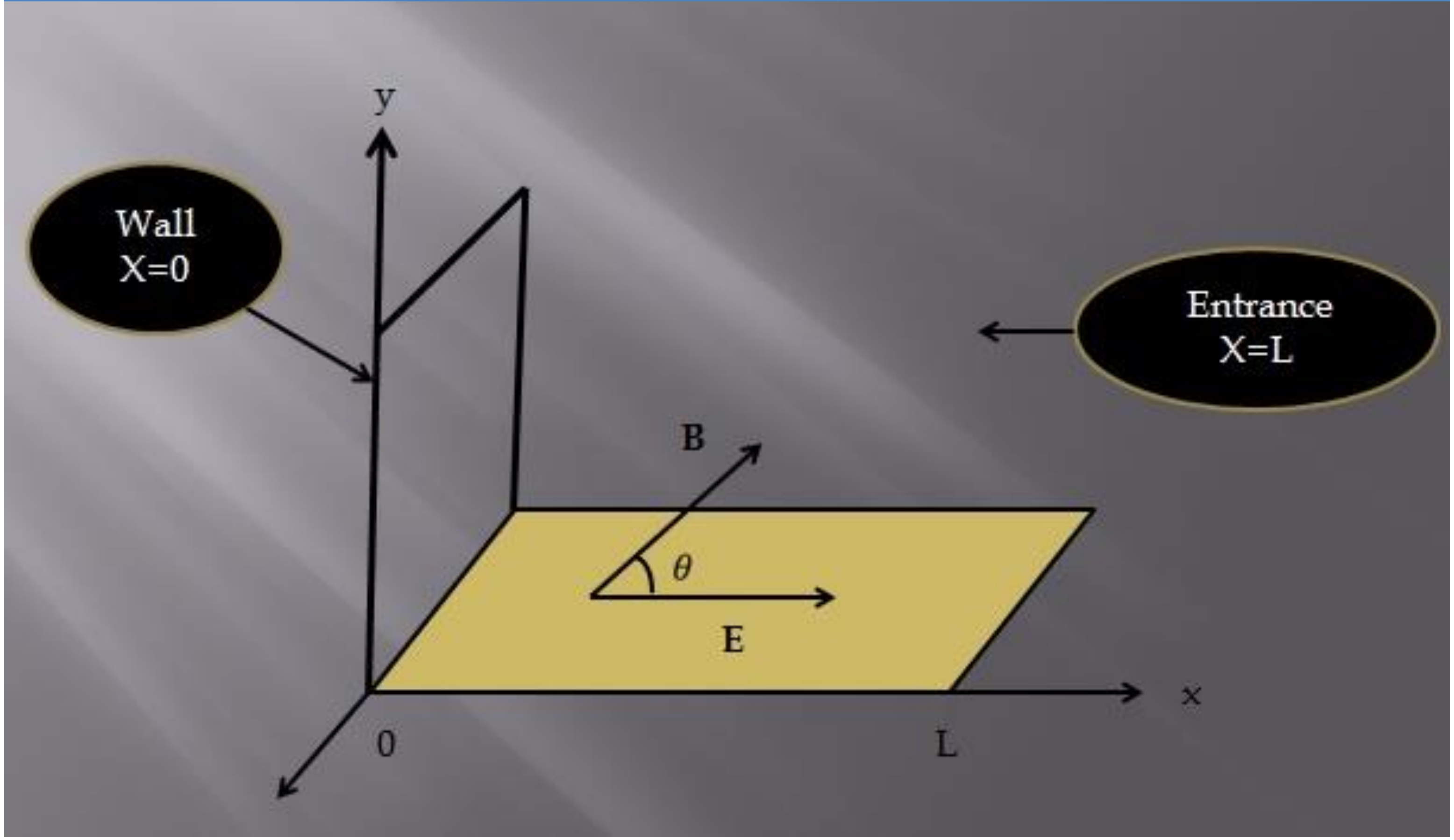
- The magnetized plasma-wall transition is a crucial element in overall tokamak behavior.
- Understanding it is of utmost importance to tokamak modeling and operation.
- The vast majority of existing plasma-wall transition models is of an approximate character.
- Better understanding contributes to more accurate simulations, especially via improved fluid boundary conditions.

The magnetized PWT, more physical view

(Stangeby, 2000)



We have developed a Kinetic Trajectory Simulation (KTS) model for bounded plasmas and used it to study plasma sheaths



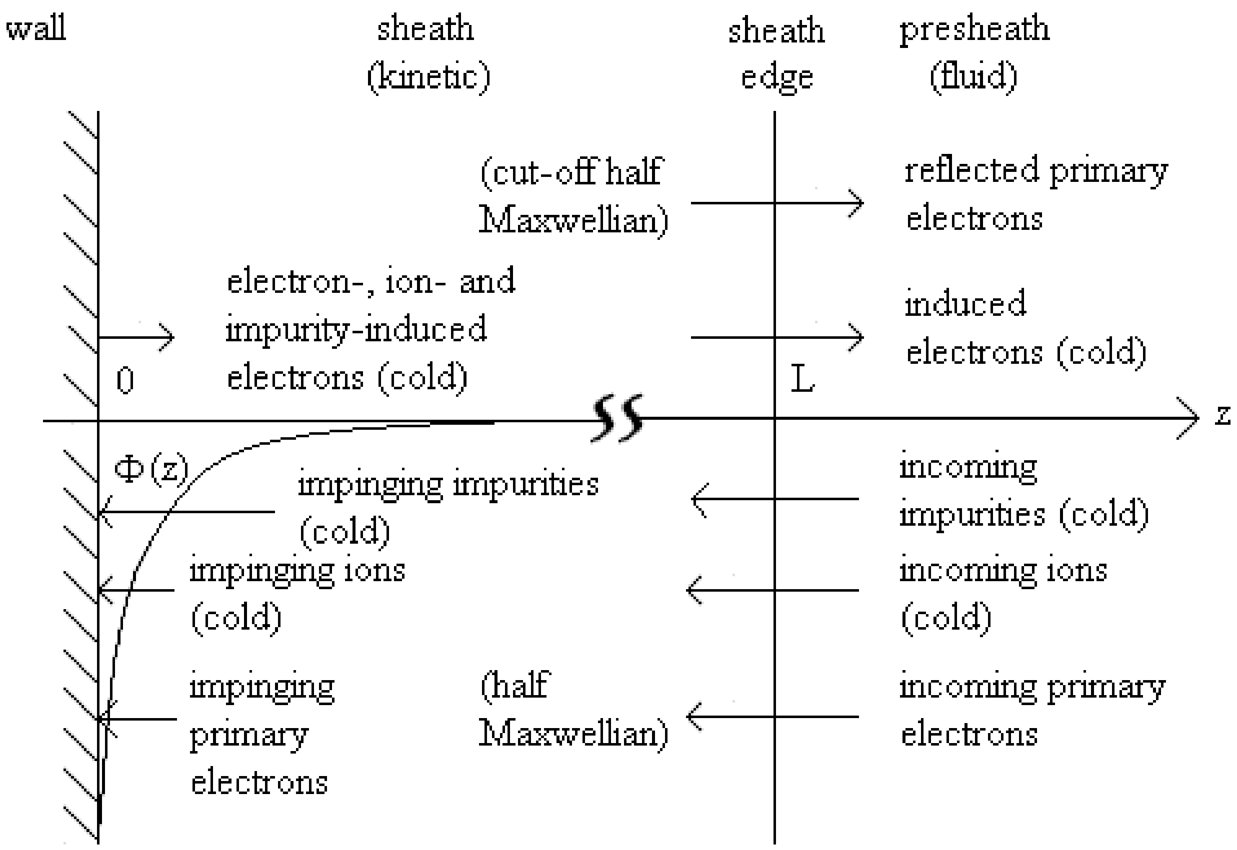
The Plasma-Wall transition model

Preheath – Sheath coupling

Our presheath-sheath transition equations then have 4 free parameters. Hence, we need to choose any 4 parameters (in a consistent manner, though).

If the necessary four parameters are chosen from the presheath / sheath side, the corresponding sheath / presheath parameters are obtained by solving those equations.

Particle-induced electron emission (PIEE)



INSTITUTE OF PHYSICS PUBLISHING PLASMA PHYSICS AND CONTROLLED FUSION

Plasma Phys. Control. Fusion **48** (2006) 1093–1103 doi:10.1088/0741-3335/48/8/004

Effect of particle-induced electron emission (PIEE) on the plasma sheath voltage

N Schupfer[1], D D Tskhakaya sr[1], R Khanal[1], S Kuhn[1], F Aumayr[2], S Figueira da Silva[2] and H P Winter[2]

Normalized floating potential comparison with theoretical values

γ^{ei}	$n_{ps} \times 10^{18} m^{-3}$ (Presheath ion density)	$\phi_W (V)$	$\tilde{\phi}_0$ (Normalized potential[5], as of Ref. 5)	$\tilde{\phi}_0$ (Theoretical result [5])
0.00	1.0000	-29.2747	-2.7485	-2.9275
0.02	1.0084	-29.3476	-2.7566	-2.9348
0.04	1.0168	-29.4199	-2.7646	-2.9420
0.06	1.0251	-29.4909	-2.7724	-2.9491
0.08	1.0335	-29.5621	-2.7803	-2.9562
0.10	1.0419	-29.6328	-2.7881	-2.9633
0.11	1.0461	-29.6679	-2.7920	-2.9668
0.12	1.0503	-29.7029	-2.7958	-2.9703
0.13	1.0545	-29.7378	-2.7997	-2.9738
0.14	1.0587	-29.7726	-2.8035	-2.9773
0.15	1.0629	-29.8072	-2.8073	-2.9807
0.20	1.0838	-29.9776	-2.8261	-2.9978
0.25	1.1048	-30.1458	-2.8447	-3.0146
0.30	1.1257	-30.3102	-2.8628	-3.0310
0.50	1.2096	-30.9426	-2.9323	-3.0943
0.80	1.3353	-31.8170	-3.0283	-3.1817

Sharma & Khanal (2008); [5]Schupfer et al (2006)

We have extended our model to include *simplified* magnetic cases.

IOP PUBLISHING PLASMA PHYSICS AND CONTROLLED FUSION

Plasma Phys. Control. Fusion **54** (2012) 095006 (5pp) doi:10.1088/0741-3335/54/9/095006

A kinetic trajectory simulation model for magnetized plasma sheath

R Chalise and R Khanal

Central Department of Physics, Tribhuvan University, Kirtipur, Kathmandu, Nepal

E-mail: plasma.roshan@gmail.com

Received 1 March 2012, in final form 5 June 2012
Published 27 July 2012
Online at stacks.iop.org/PPCF/54/095006

AIP | Physics of Plasmas
#1 JOURNAL IN 2014 GOOGLE SCHOLAR METRICS FOR THE PLASMA & FUSION CATEGORY

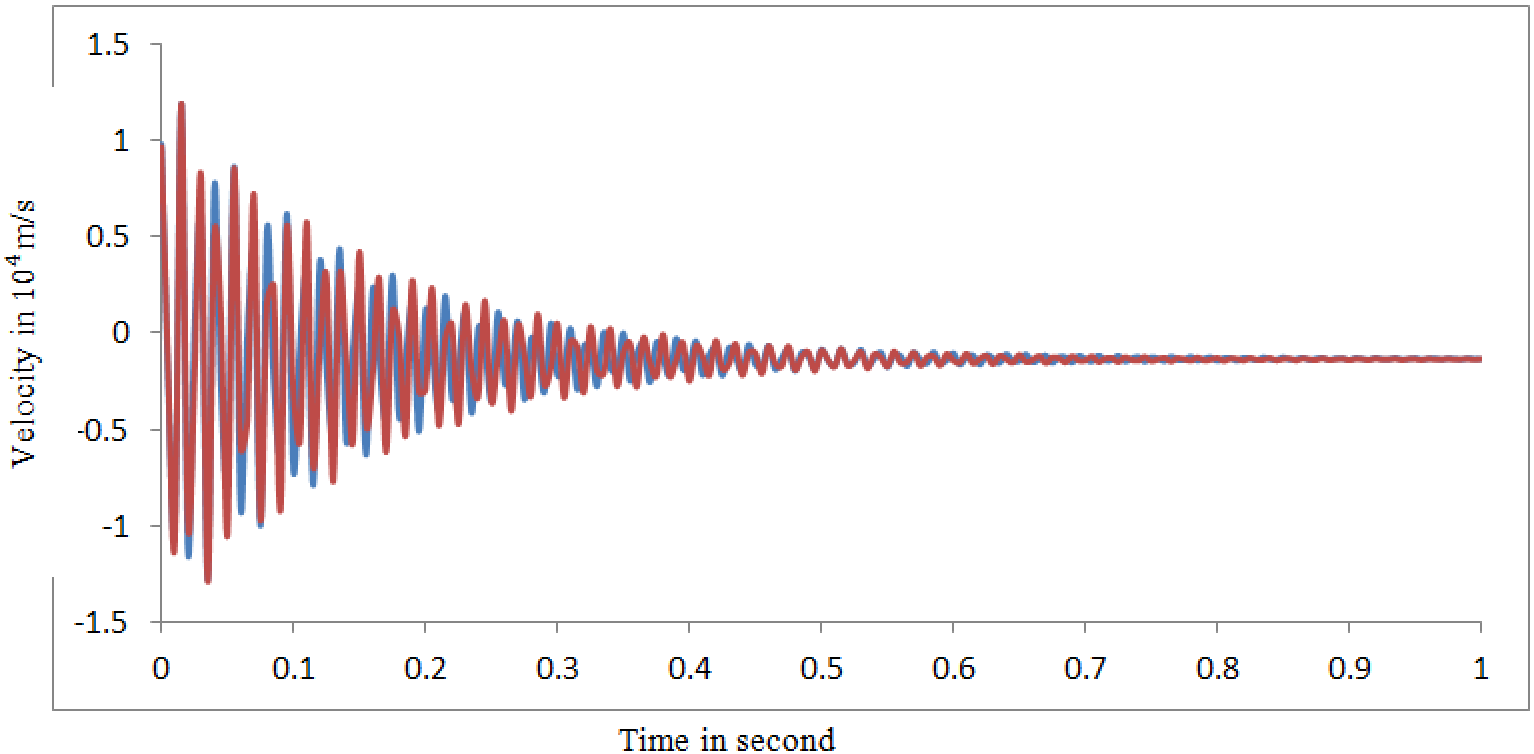
Self-consistent one dimension in space and three dimension in velocity kinetic trajectory simulation model of magnetized plasma-wall transition

Roshan Chalise and Raju Khanal

Temporal dependence of components of velocity of ions in a magnetized plasma sheath for different obliqueness of the magnetic field

--- Fitted $(V_z)_{est} = 1362 + 14600 * \exp(-6.4 * t) * sin\pi(2 * 74 * t + 0.2722)$

--- Calculated



1

Fig. 4: Damping of z-component of velocity with time at magnetic field 2.5 mT, electric field 0.1 v/m and angle 30°.

Table: The observed data of mean value, amplitude, Damping constant, Frequency of oscillation and Phase angle at magnetic field 2.5 mT

Theta	Mean Value			Amplitude			Damping constant			Frequency			Phase Angle		
	V_{xm}	V_{ym}	V_{zm}	V_{xa}	V_{ya}	V_{xa}	V_x	V_y	V_z	V_x	V_y	V_z	V_x	V_y	V_z
30°	26	8052	1362	14910	2287	14600	6.922	6.665	6.4	74.627	74.667	74	0.773π	0.724π	0.272π
45°	0	11435	7137	9794	4815	8200	5.6973	5.734	5.83	72	72	72	0.5π	-0.11π	0.9π
60°	0	3855	11695	10711	10720	3460	5.9655	6.196	5.99	72.94	72.9166	73	0.633π	0.813π	-0.183π

We envisage to extended our model to include magnetized-sheath stability and include more realistic physics and boundary conditions and higher-dimensional geometries.

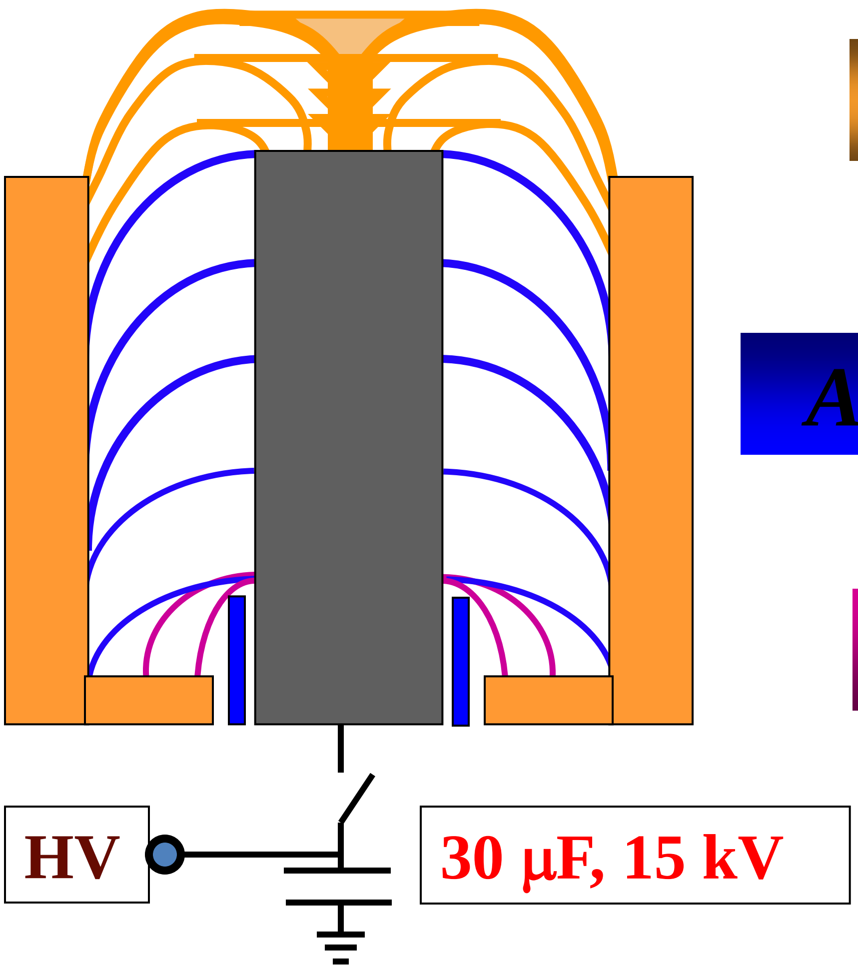
Integrated (partial) Tokamak Modeling

Plasma Focus

- A dense plasma focus (DPF) is a machine that produces, a short-lived hot and dense plasma and can cause nuclear fusion and emit x-rays.

- **The PF is divided into two sections.**
- **Pre-pinch (axial) section.**
- **Radial Section where pinch starts & occurs.**

The Plasma Dynamics in Focus

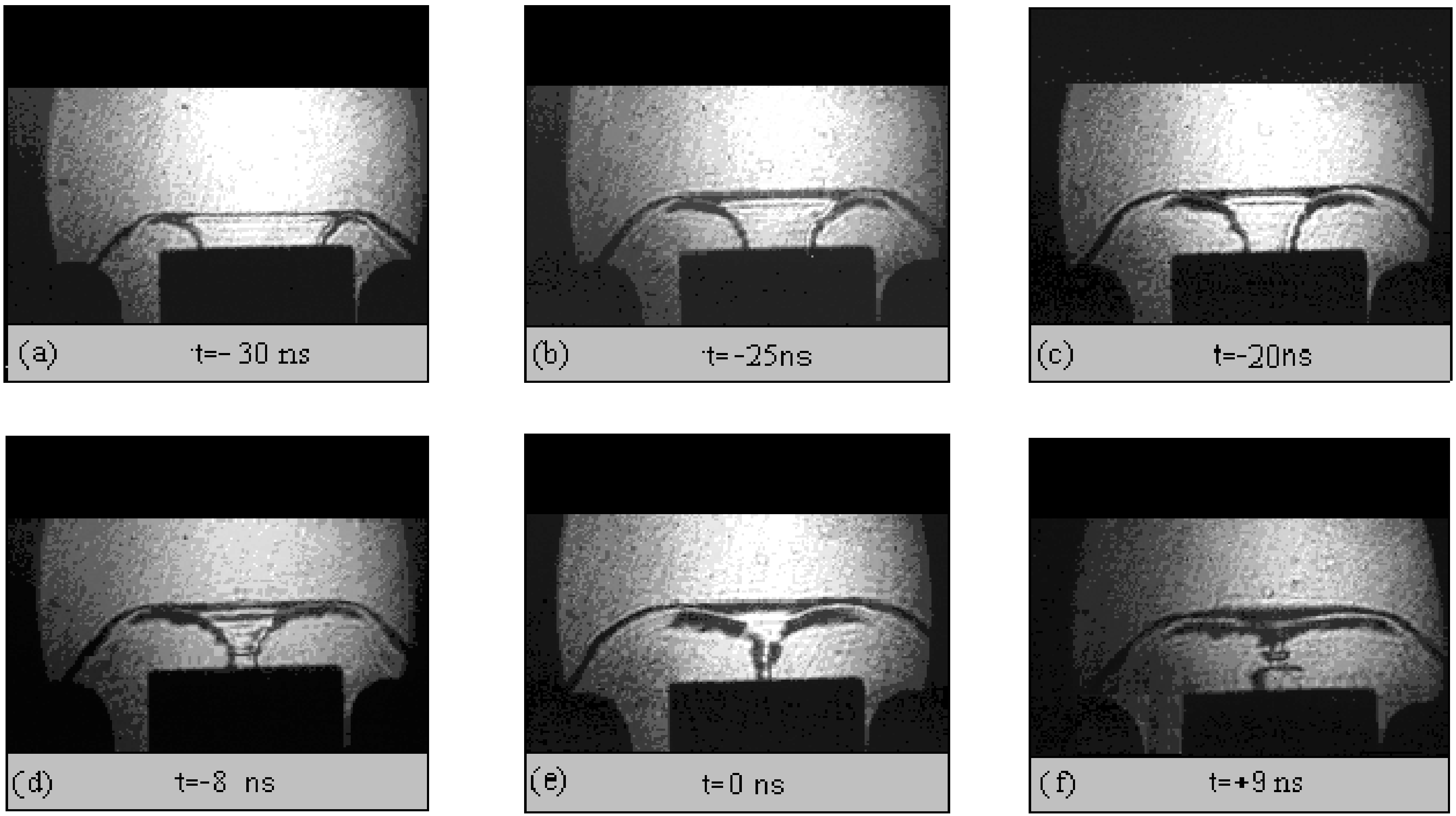


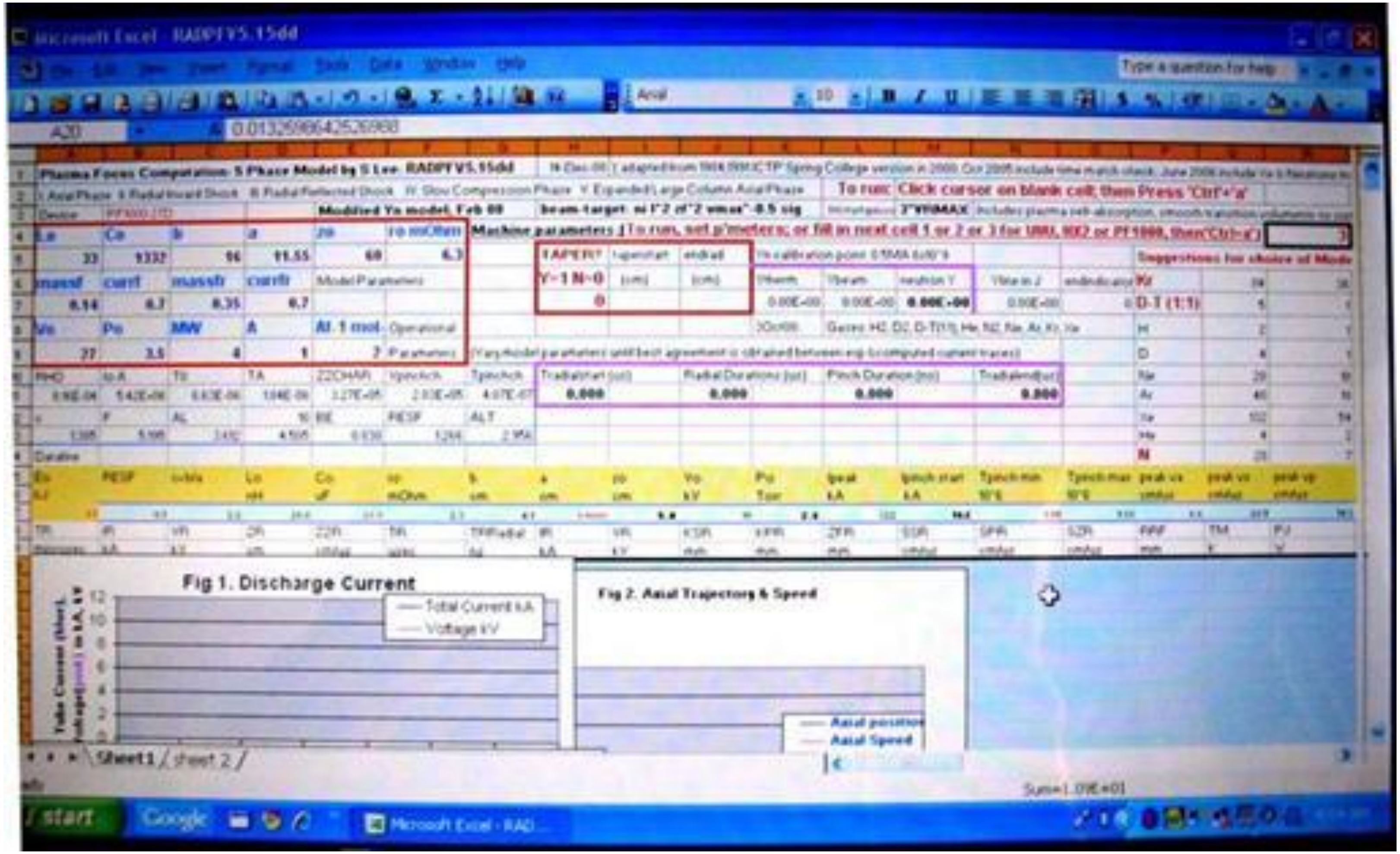
Radial Phase

Axial Accelaration Phase

Inverse Pinch Phase

Radial Compression (Pinch) Phase of the Plasma Focus




Microsoft Excel - RADPFV5.15dd
Plasma Focus Computation: 5 Phase Model by S Lee: RADPFV5.15dd
To run: Click cursor on blank cell; then Press 'Ctrl'+'a'
Modified Yn model. Feb 08
TAPER?
Fig 1. Discharge Current
Total Current kA
Voltage kV
Fig 2. Axial Trajectory & Speed
Axial position
Axial Speed
Sheet1
sheet 2

J Fusion Energ (2015) 34:686–693
DOI 10.1007/s10894-015-9872-0

ORIGINAL RESEARCH

Measurement of Model Parameters versus Gas Pressure in High Performance Plasma Focus NX1 and NX2 Operated in Neon

Prakash Gautam, Raju Khanal, Sor Heoh Saw and Sing Lee

for FMPF-3, NX2 and
Computed Results Usi

S. H. Saw · P. Lee · R. S. Rawat · R
D. Subedi · R. Khanal · P. Gautam
R. Shrestha · A. Singh · S. Lee

Published online: 13 December 2014

Numerical Experiments on PF1000 Neutron Yield

S. H. Saw · D. Subedi · R. Khanal ·
R. Shrestha · S. Dugu · S. Lee

Measurement of Model Parameters Versus Gas Pressure in High-Performance Plasma Focus NX1 and NX2 Operated in Neon

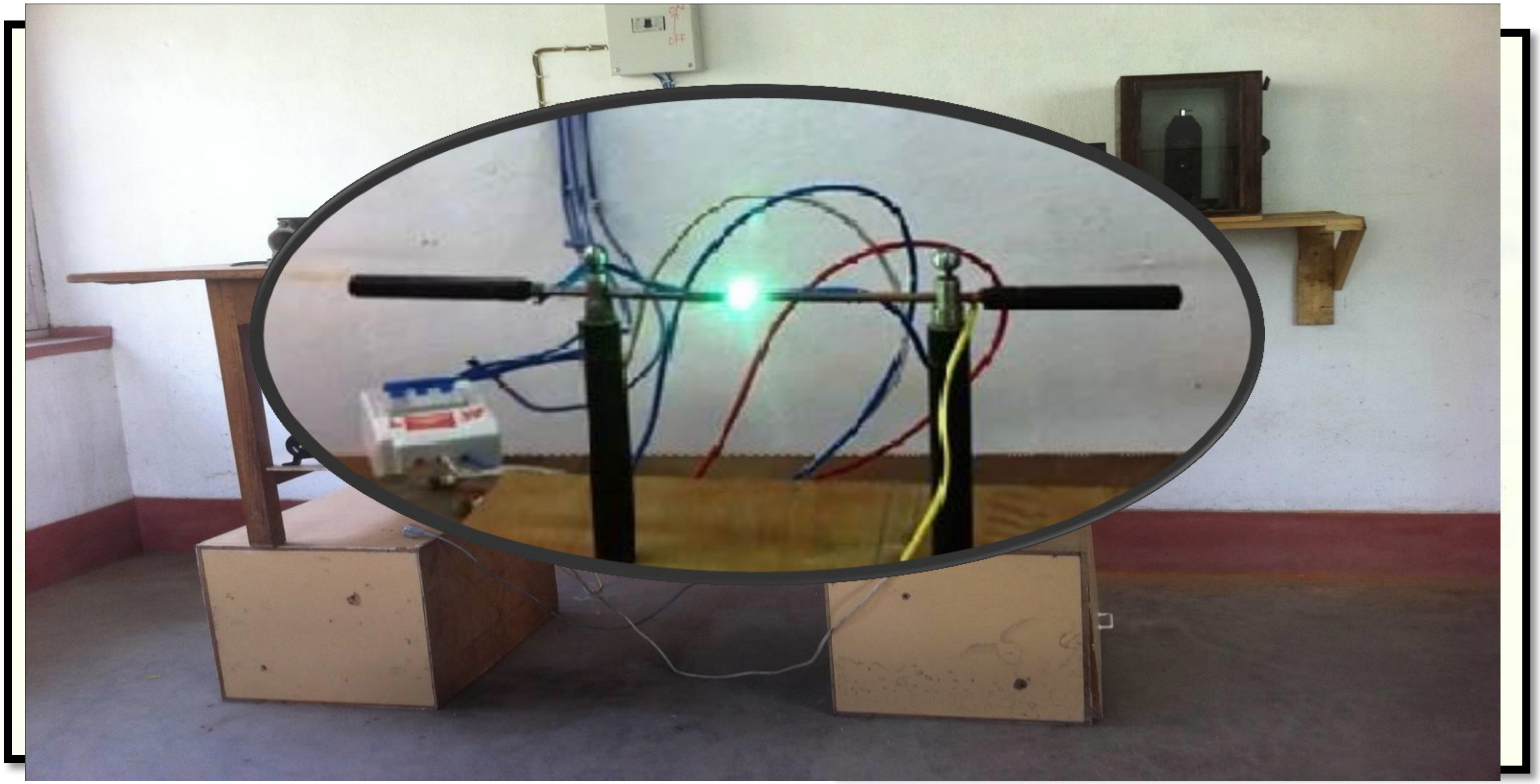
Prakash Gautam, Raju Khanal, Sor Heoh Saw, and Sing Lee

Abstract—**Measured current waveforms at different neon pressures from two different plasma focus (PF) devices, namely,**

code, a reflected shock phase and a slow-compression radiative phase are added to the earlier model to simulate the

accepted by IEEE 20170618

Production and Characterization of Seeded-Arc Plasma for Different Materials of the Electrodes



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Electron Impact Single Ionization of Kr and Xe

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Online published on 7 December, 2015.

We are collaborating in national as well as international level.

Broad collaboration in establishing 'advanced' computational facilities would be an appropriate and big step forward!

Thank You.