



The Abdus Salam
International Centre
for Theoretical Physics
www.ictp.it



First ICTP-NCP International College on Plasma Physics 11-15 November 2013



www.ncp.edu.pk

Directors: S. M. Mahajan (USA), Z. Yoshida (Japan), J. Niemela (Italy), H. Saleem (Pakistan)

The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy is organizing its regional activity “First ICTP-NCP International College on Plasma Physics”, 11-15 November, 2013 in collaboration with the National Centre for Physics (NCP), Islamabad, Pakistan.

The ICTP has expanded its scientific activities in many different directions since its inception in 1964; arranging academic activities in different developing countries to promote research and regional cooperation in science and technology is one very welcome addition. Professor Fernando Quevedo, Director ICTP, is supporting and encouraging the scientists working in the developing countries to benefit from this program. Centres, affiliated with ICTP are emerging in different countries so that even a larger number of scientists and students can directly benefit from the limited financial and other resources. This plasma college, the first of its kind to be held in Pakistan, was made possible under this “expanded mandate” of ICTP sponsored regional academic activities.

The National Centre for Physics (NCP), the ICTP partner for this activity, was, itself, established on the lines of ICTP; it organizes several scientific activities including conferences, workshops and lectures of eminent scientists every year. During the last few years the collaboration between NCP and ICTP is being strengthened through joint scientific activities. The NCP also collaborates with many other universities and research organizations including European Organization for Nuclear Research (CERN), Geneva, Switzerland. An example of a very inclusive joint activity (ICTP, NCP and CERN) will be the upcoming

“School on LHC Physics”, directed by H. Hoorani (NCP) and J. Ellis (CERN), August 25- September 9, 2014. The aim of the Plasma College is to promote research in the field of plasma physics in Pakistan, and to provide a forum for developing collaboration among the researchers in the region.

Plasma physics, dealing with charged fluids interacting with long range electromagnetic forces giving rise to instabilities, nonlinearities and turbulence, is a highly complex science. Its domain of applicability is very vast:

- *Dynamics of high density plasmas of white dwarf and neutron stars, made interesting and complicated by quantum effects*
- *The solid state and low density low temperature plasmas for their importance in industry*
- *Plasmas in space, astrophysics (stars galaxies , cosmology),*
- *Thermonuclear fusion, with a promise to create a limitless source of clean nuclear power*

Laboratory pursuit of fusion, the process that powers the stars, is being carried out on many fronts, the two main approaches, magnetic confinement fusion and inertial confinement fusion, though investigated in great detail for more than half a century, are still very active and fundamental scientific disciplines.

A joint venture of several countries namely the International Thermonuclear Experimental Reactor (ITER) is being constructed at Cadarache, France and is one of the largest scientific endeavors for the benefit of future generations. The energy demand of mankind is increasing

tremendously and there is a great need to explore the possibility of developing thermonuclear reactors at commercial level.

Looking at the scope of applications of plasma physics, the First ICTP-NCP International College on Plasma Physics is being held in NCP, Islamabad to promote research of plasma physics

in this part of the world. More than 20 foreign and 100 local Pakistani researchers/students have been invited to participate in the activity. The lectures and discussions during this College will cover many of the above mentioned areas of plasma research.

Scientific Program

Topics to be covered in the college

- *Basic Plasma Physics*
- *Space and Astrophysical Plasmas*
- *Fusion Plasmas*
- *Laser Produced High Energy Density Plasmas*
- *Computational Plasma Physics*

Lectures:

S. M. Mahajan

- Plasma physics- Advanced thinking about elementary ideas
- Plasma physics- Advanced ideas
- Extending the domain of Plasma Physics

A. Fukuyama

- Waves in magnetized plasmas
- RF waves in magnetic confinement plasmas
- Integrated modeling of tokamak plasmas

P. Andreev

- Semi-relativistic hydrodynamics of three-dimensional and low-dimensional quantum plasmas
- Spin waves and spin instabilities in quantum plasmas
- Classic hydrodynamic and kinetic formalism as averaging of delta-functional particle images

H. Saleem

The generation of magnetic fields and flows in galactic and laser plasmas

Du Jiulin

- Characteristics of nonequilibrium plasmas with power-law distributions
- Stochastic dynamical theory of systems with power-law distributions

G. Murtaza

Role of temperature anisotropy in plasma waves

M. A. Baig

Optical emission studies of laser produced plasma

H. A. Shah

Trapping in degenerate plasmas

M. Zakaullah

Plasmas for sterilization of pathogens

A. M. Mirza

Study of ion-temperature-gradient driven drift mode in the presence of nonthermal electron distribution

Video Talks:

Z. Yoshida

Geometrical theory of vortex

B. Eliasson

Electron acceleration by strong Langmuir turbulence and solitons

Working Committees

International Advisory Committee

R. Matsumoto (Japan)
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M. Kikuchi (Japan)
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Local Advisory Committee

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Local Organizers

M. A. Baig (NCP)
R. M. Qureshi (NCP)
I. Rehman (NCP)

Foreign Speakers / Participants

A. E. R. Mohamed (Egypt)
A. M. Cherkos (Ethiopia)
A. P. Misra (India)
A. Tamman (Thailand)
B. Eliasson (Sweden) Video Talk
B. S. Abioye (Nigeria)
Du Jiulin (China)
E. Eslami (Iran)
A. Fukuyama (Japan)
H. Isaac (Uganda)
H. M. A. Sa'adeh (Jordan)
J. Niemela (USA)
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M. Barani (Iran)
M. M. Masud (Bangladesh)
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N. A. M. Hafiz ((Egypt)
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P. Andreev (Russia)
R. Hedwig (Indonesia)
R. Khanal (Nepal)
R. Prajapati (India)
S. Goudarzi (Iran)
S. Kaur (India)
S. M. Mahajan (USA)
Z. Yoshida (Japan) Video Talk

Poster Presentation Awards

Poster presentation awards will be given to encourage young researchers.

Certificates of Participation

Certificates will be awarded to the selected participants who will attend all the general and specific sessions of the event.

Activity Secretariat: Email: plasma2013@ncp.edu.pk

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Course web page: <http://agenda.ictp.it/smr.php?2565>

ICTP home page: <http://www.ictp.it>

(smr # 2565)

Message from Directors of First ICTP-NCP Plasma College 2013

S. M. Mahajan (*USA*), **Z. Yoshida** (*Japan*), **J. Niemela** (*Italy*), **H. Saleem** (*Pakistan*)

Science and technology are the dominant actors of our era; their arrival, growth and accomplishments have fundamentally transformed both our intellectual and social structures. The notions of time-space unity, energy-mass unity and probabilistic nature of the universe at microscopic level have made a great impact on the human thinking. The new researches in the field of biology and genetics are shaking the common ideas about the origin of life. The development of technologies based on fundamental principles of science has given a new shape to the day to day affairs of human life and even to the moral values and ethics.

The science and technology have made great contributions in all spheres of human life including agriculture, health and medicines, industry, education, politics, transportation and economy.

However, the fruits of the advancement of science and technology have not reached equally to the poor and weaker classes in all countries, particularly, in developing countries. The science and technology, being a common heritage of mankind, should be above all prejudices of race, nationality and religion. The scientists work not only for the satisfaction of their curiosity to understand the universe, but they also want to search new principles and invent new technologies for the benefit of mankind.

We all are working together to promote plasma physics research in Pakistan and also in this region with the support of ICTP and NCP. We hope that this College will be very fruitful for the enthusiastic young researchers and students of developing countries taking part in this activity. The collaboration among scientists, surely important for the promotion of research and economic development, also plays a pivotal role in developing cultural relations between different nations. The language of science is universal; the culture of science is universal, let them combine to bring peace and prosperity to all.

A panoramic view of National Centre for Physics

