

# CONFERENCE ON HIGHER DIMENSIONAL QUANTUM HALL EFFECT, CHERN-SIMONS THEORY AND NON-COMMUTATIVE GEOMETRY IN CONDENSED MATTER PHYSICS AND FIELD THEORY

**1 - 4 March 2005**

**(Miramare - Trieste, Italy)**

The Abdus Salam International Centre for Theoretical Physics (ICTP, Trieste, Italy) is organizing a Conference on Higher Dimensional Quantum Hall Effect, Chern-Simons Theory and Non-Commutative Geometry in Condensed Matter Physics and Field Theory, to be held at the ICTP, from 1 to 4 March 2005. The Conference will be directed by Profs. **A.P. Balachandran** (Syracuse University, New York, U.S.A.), **Kumar Gupta** (Saha Institute of Nuclear Physics, Kolkata, India), **V.P. Nair** (City College of the CUNY, New York, U.S.A.) and **Shoucheng Zhang** (Dept. Physics, Stanford University, Stanford, CA, U.S.A.).

Great progress in physics is often made when ideas from seemingly disconnected branches converge. Historically, the interaction between condensed matter physics and field theory has led to great conceptual revolutions such as the renormalization group theory and broken symmetry. Today, as theoretical physics faces unprecedented challenges to unify fundamental forces and solve strongly correlated electron problems such as high  $T_c$  superconductivity, cross fertilization between condensed matter physics and field/string theory could lead to new insights and new ways to attack a large class of similar problems.

A number of recent developments have revealed a common intellectual thread tying together a class of seemingly disparate problems such as the Quantum Hall effect, noncommutative geometry, D-brane physics and the twistor formalism of general relativity, etc. Quantum Hall effect is one of the most interesting correlated states in condensed matter physics. Its low energy limit is fully described by a topological quantum field theory, namely the Chern-Simons theory. The fractional charge and statistics of the quasi-particle serve as a paradigm of how fractional quantum numbers in physics can emerge in the low energy limit. Recently, the Quantum Hall effect has been generalized to higher dimensions. These generalized states not only retained some of the basic features of the two dimensional Quantum Hall effect, but also revealed deep connections to the noncommutative geometry and theory of relativity. There are also connections to D-brane physics, which also have their own independent relationship to noncommutative geometry. Twistors, introduced long ago by Penrose in general relativity, emerge as the natural formalism to discuss Quantum Hall effect in higher dimensions; they also appear in the context of scattering amplitudes in Yang-Mills theory and their recently revealed connection to string theory on supertwistor space. Another interesting new development is the generalization of the two dimensional Quantum Hall effect to the spin Hall effect in three dimensions, which has direct application in a new emerging field called spintronics. It is clear from all this that there is a deep and common substrate of mathematical formalism and inter-linkages of physical ideas in these recent developments. The purpose of this Conference is to bring together active researchers working on these diverse subjects, to share ideas and tools developed separately in different branches of physics. Such a Conference is not only timely but will help to give a more definite structure to a number of issues which are at present rather loosely connected.

The Conference will consist of five to six talks per day. Each talk will be of either 40 minutes or 30 minutes duration, leaving ample time for consultations and discussions among the participants. The duration of the conference will be of 4 days.

## **PARTICIPATION:**

Scientists and students from all countries that are members of the UN, UNESCO or IAEA can attend the activity. Although the main purpose of the Centre is to help researchers from developing countries through a programme of training activities within the framework of international cooperation, a limited number of students, post-doctoral scientists and researchers from developed countries are also welcome to attend. As the Conference will be conducted in English, participants must have an adequate working knowledge of that language.

As a rule, travel and subsistence expenses of the participants are borne by their home institutions. Every effort should be made by candidates to secure support for their fare (or at least half-fare). However, limited funds are available for some participants who are nationals of, and working in, a developing country, and who are not more than 45 years old. Such support is available only to those attending the entire Conference. There is no registration fee to attend this activity.

**The closing date for the receipt of Requests for Participation is: 1 November 2004.**

The **Application Form** is obtainable from the ICTP WWW server: <http://agenda.ictp.trieste.it/smr.php?1646> (which will be constantly up-dated) or from the activity Secretariat ([smr1646@ictp.trieste.it](mailto:smr1646@ictp.trieste.it)). It should be completed, signed and returned before **1 November 2004 to:**

the Abdus Salam International Centre for Theoretical Physics  
Conference in Condensed Matter Physics and Field Theory (smr.1646)  
Strada Costiera 11  
I-34014 Trieste, Italy

Telephone: +39-040-2240305 E-mail: [smr1646@ictp.trieste.it](mailto:smr1646@ictp.trieste.it) Telefax: +39-040-224531

<http://agenda.ictp.trieste.it/smr.php?1646>

## **ORGANIZERS**

**A.P. BALACHANDRAN**  
(Syracuse Univ., New York, U.S.A.)

**Kumar GUPTA**  
(Saha Institute, Kolkata, INDIA)

**V.P. NAIR**  
(CUNY, New York, U.S.A.)

**Shoucheng ZHANG**  
(Stanford University, CA, U.S.A.)

## **LIST OF SPEAKERS:**

**A.P. Balachandran (Organizer)**  
**S. Bellucci**  
**A. Bernevig**  
**Yi-Xin Chen**  
**B. Dolan**  
**T.R. Govindarajan**  
**K. Gupta (Organizer)**  
**K. Hasebe**  
**Pei-Ming HO**  
**Jiang-Ping HU**  
**D. Karabali**  
**Y. Kimura**  
**D. Lee**  
**S. Murakami**  
**V.P. Nair (Organizer)**  
**J. Polchinski**  
**A. Polychronakos**  
**S. Ramgoolam**  
**S. Randjbar Daemi**  
**G. Sparling**  
**L. Susskind**  
**N. Toumbas**  
**G. Volovik**  
**Yong-Shi Wu**  
**Shoucheng Zhang (Organizer)**

**DEADLINE:**  
**1 November 2004**