



The Abdus Salam
**International Centre
for Theoretical Physics**



Advanced School and Conference on Quantum Matter

Description:

This school and conference will feature pedagogical school lectures and conference style talks on Quantum Spin Liquids in an intertwined manner over two weeks. Our aim is to communicate the exciting developments to students and young researchers as well as present state of the art in the field.

MORE INFORMATION:

We are currently witnessing rapid developments concerning the realization of quantum spin liquids in programmable quantum simulators and via Floquet engineering. Similarly, the realization of exotic fractonic phenomena in quantum spin liquids described by higher-rank gauge theories has now become possible in spin models with pursuits for their search in quantum materials. Over the past few years, we have achieved a deepened understanding of the problem of symmetry classification of quantum spin liquids relying on ideas and methods from category theory, and advanced notions in group theory. Substantial progress has also been made to understand the stability of gapless quantum spin liquids. Simultaneously, many-body numerical approaches based on neural network constructions, tensor network methods, and machine-learning approaches have allowed one to shed light on exploring quantum state preparation and its evolution.

TOPICS:

- General Introduction to Quantum Spin Liquids - Fractionalization and Topological Order, and types of Phases
- Partons and Gauge Theory - Symmetry Classification schemes
- Fusion rules, Categories and QSL classification
- Fractons and Higher-Rank Gauge Theories
- Microscopic Models and Materials
- Theoretical and Numerical Approaches - Machine learning methods, neural network constructions
- Quantum State Preparation

SCHOOL LECTURERS:

L. Balents, Kavli Institute for Theoretical Physics, Santa Barbara, USA
F. Becca, University of Trieste, Italy
S. Gazit, The Hebrew University of Jerusalem, Israel
M. Hermele, University of Colorado Boulder, USA

H.-Y. Kee, University of Toronto, Canada
Y.-M. Lu, The Ohio State University, USA
R. Samajdar, Princeton University, USA
S. Trebst, University of Cologne, Germany
J. Vidal, Sorbonne University Paris, France

CONFERENCE SPEAKERS:

C. Batista*, University of Tennessee Knoxville, USA
E. Berg, Weizmann Institute of Science, Israel
P. Bonetti, Harvard University, USA
S. Capponi, University of Toulouse, France
G. Chen, Peking University Beijing, China
G. Young Cho, Korea Advanced Institute of Science & Technology, South Korea
A. Chubukov, University of Minnesota, USA
B. Douçot, Sorbonne University Paris, France
Y.-C. He, Stony Brook University, USA
Y.-B. Kim, University of Toronto, Canada
J. Knolle, Technische Universität München, Germany
A. Läuchli, EPFL and PSI, Switzerland
S.-B. Lee, KAIST, South Korea
Z. Yang Meng, The University of Hong Kong, Hong Kong
L. Messio, Sorbonne University Paris, France
R. Moessner, MPIPKS Dresden, Germany
E.-G. Moon, Korea Advanced Institute of Science & Technology, South Korea
J. Moore, University of California Berkeley, USA

Y. Motome, University of Tokyo, Japan
M. Oshikawa, University of Tokyo, Japan
K. Penc, HUN-REN Wigner Research Centre for Physics Budapest, Hungary
H. Pichler, University of Innsbruck, Austria
F. Pollmann, Technische Universität München, Germany
Y. Ran, Boston College, USA
A. Sandvik, Boston University, USA
N. Shannon, Okinawa Institute of Science and Technology, Japan
I. Sodemann, University of Leipzig, Germany
V. Tripathi, Tata Institute of Fundamental Research Mumbai, India
C. Wang, Perimeter Institute for Theoretical Physics, Canada
A. Wietek, MPIPKS Dresden, Germany
Y. Zhou, Chinese Academy of Sciences, China
L. Zou, National University of Singapore, Singapore
*To be confirmed



1 - 12 December 2025



Trieste, Italy



Application and Deadlines:

For applicants requesting financial and/or visa support:
1 August 2025

For all other applicants:
1 October 2025

DIRECTORS:

S. Bhattacharjee
International Centre for Theoretical Sciences, India
Y. Iqbal
Indian Institute of Technology Madras, India
S. Sachdev
Harvard University, USA

LOCAL ORGANISER:

M. Kiselev, ICTP, Italy

FURTHER INFORMATION:

E-mail: smr4114@ictp.it

Web: <http://indico.ictp.it/event/10879/>

Female scientists are encouraged to apply.



GRANTS:

A limited number of grants are available to support the attendance of selected participants, with priority given to participants from developing countries. There is no registration fee.

