



The Abdus Salam
International Centre for Theoretical Physics



SMR 1666 - 7

**SCHOOL ON QUANTUM PHASE TRANSITIONS
AND
NON-EQUILIBRIUM PHENOMENA IN COLD ATOMIC GASES**

11 - 22 July 2005

***Three Tales on Quantum Information
Theory, Quantum Phase Transitions and Cold Atoms***

Presented by:

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Three Tales on Quantum Information

Theory, Quantum Phase Transitions and Cold Atoms

- Lecture I – Introduction to QIT – theory of **entanglement**, entanglement **criteria** and **measures**, **multiparty** entanglement, entanglement detection, **distillability** (literature: bruss.pdf, lewen.pdf, trieste1.ppt)
- Lecture IIa – Entanglement and **quantum phase transitions** - entanglement in simple integrable models at the criticality, **localizable entanglement**, **entanglement** versus **correlations** (trieste2.pps)
- Lecture IIb – **Generation of** entanglement in many body systems, generation via quantum phase transitions, generation in **complex** and **disordered** systems
- Lecture IIIa – Entanglement based **codes**, **matrix product states** (Partially Entangled-Pair States), **renormalization group** on quantum states (armand.pdf)
- Lecture IIIb – Examples – Spin $_XY$ chain in a **random X-oriented** field