

Scientific report.

The Summer Institute took place over a three weeks' period, with a concentrated PhD course in the middle week. A wide range of topics was covered with emphasis on ultra-cold gas research and on quantum information. Special series of introductory lectures were given to introduce the topics broadly and to give the participants a good chance to appreciate the latest news in the very active research fields.

In the sub-field of Quantum Gas research, in particular the introductory courses by Keith Burnett and Rudi Grimm laid a solid foundation for the advanced research talks by themselves and by Jason Ho and Peter Knight. Several aspects from the Quantum Gas introductions were also relevant in the talks by Ignacio Cirac, Mark Saffman, Michal Raymer, and Klaus Mølmer, on quantum information and quantum optics studies with cold gasses.

I attended the course myself, and I was impressed by all speakers who went through big efforts to be very pedagogical and to give really excellent introductions to the topics. My impression was that all the students benefited very much from the course. In addition to PhD students, marked with X'es in the list of participants, a good number of young post docs also benefited from the school.

The Symposium also attracted the attention of the staff and students at the Niels Bohr Institute, NORDITA and the Hans Christian Oersted Laboratories, and good interaction with other research fields were established this way.

We refer to the symposium homepage <http://quantop.nbi.dk/nbsi2004/index.html> , where further information and pictures from the event are presented.

Please find attached the programme and the list of participants for the Niels Bohr Summer Institute, which was held at the Niels Bohr Institute in August this year.



# Niels Bohr Summer Institute 2004

## Quantum Optics

### Program

\* Invited Talks

\*\* Tutorials

	Monday 9th	Tuesday 10th	Wednesday 11th	Thursday 12th	Friday 13th	Saturday 14th	Sunday 15th
<b>Tutorial 1</b> <i>9:00 - 10:20</i>			Klaus Mølmer <i>Quantum Optics with Gaussian States</i>			Chris Pethick	
<b>Tutorial 2</b> <i>10:50 - 11:30</i>				<i>(10:50 - 12:10)</i> Ignacio Cirac <i>Basics of Quantum Information and Computation</i>	<i>(10:50 - 12:10)</i> Ignacio Cirac <i>Basics of Quantum Information - Recent Developments</i>		
<b>Invited Talks</b> <i>14:00 - 14:45</i>				Eugene Polzik			
<b>Afternoon</b>							<i>City Canal Tour</i> with sandwich/wine/beer (free of charge) Deadline for signing up is July 23rd

	<b>Monday 16th</b>	<b>Tuesday 17th</b>	<b>Wednesda y 18th</b>	<b>Thursday 19th</b>	<b>Friday 20th</b>	<b>Saturday 21th</b>	<b>Sunday 22th</b>
<b>Tutorial 1</b> 9:00 - 10:20	Keith Burnett <i><u>Correlations and Entanglement in Cold Atoms</u></i>	Atac Imamoglu <i><u>Quantum Optics with Semiconductor or Quantum Dots</u></i>	Keith Burnett* <i>Molecules and Condensates</i>  Rudi Grimm <i>Molecular BEC and Crossover to a Fermionic Superfluid</i>	Chris Monroe <i><u>Trapped Ion Quantum Bits and Entanglement Schemes</u></i>	Michael Raymer <i><u>Quantum Optical State Measurement and Ultrafast Statistical Sampling</u></i>	Michael Raymer <i><u>Quantum Optical State Measurement and Ultrafast Statistical Sampling</u></i>	<i>Whole-day boat trip to Veen with sandwich/wine /beer (free of charge)</i> Deadline for signing up is July 23rd
<b>Tutorial 2</b> 10:50 - 12:10	Goran Wendin <i><u>Superconducting Quantum Circuits. Qubits and Computing</u></i>	Rudi Grimm <i>Optical Routes Towards BEC, Feshbach Resonances and Ultracold Molecules</i>	Atac Imamoglu  Goran Wendin* <i><u>Controllable coupling of Josephson junction qubits</u></i>		Chris Monroe <i><u>Scaling the ion trap quantum computer</u></i>	Michael Raymer <i><u>Quantum Optical State Measurement and Ultrafast Statistical Sampling</u></i>	<i>On Veen you can see the ruins of "Uranienborg" and "Stjerneborg" - the museum of Tycho Brahe</i>
<b>Invited Talks</b> 14:00 - 14:45	(14:00 - 15:20) Martin Plenio** <i><u>From Classical Information to Quantum Entanglement</u></i>	Anton Zeilinger <i>Quantum Information beyond Two Qubits</i>	Alex Kuzmich <i>Quantum networking with atomic ensembles</i>	Joerg Schmiedmayer <i>Atom Chips: Micro-manipulation of Neutral Atoms</i>	Peter Knight <i>Bits and Chips: Walking on a Wire</i>	Mark Saffman <i><u>Cross Entanglement of Single and N Atom Qubits for Quantum State Transmission</u></i>	
<b>Invited Talks</b> 15:00 - 15:45	(15:30 - 16:15) Jason Ho*	Martin Plenio <i>Static and Dynamical Entanglement Properties of Interacting Quantum Systems</i>	Luis A. Orozco		Steven Van Enk		
<b>Evening</b>				Conference dinner, "Spiseloppen" in Christiania Deadline for signing up is July 23rd			

	<b>Monday 23rd</b>	<b>Tuesday 24th</b>	<b>Wednesday 25th</b>	<b>Thursday 26th</b>	<b>Friday 27th</b>	<b>Saturday 28th</b>
<b>Tutorial 1</b> <i>9:00 - 10:20</i>	Serge Haroche	Serge Haroche	Serge Haroche			
<b>Tutorial 2</b> <i>10:40 - 12:00</i>						
<b>Invited Talks</b> <i>14:00 - 14:45</i>	Michael Raymer <i>The photon wave function and its measurement</i>					
<b>Invited Talks</b> <i>15:00 - 15:45</i>				Francesco De Martini <i>Realization of Optimal Universal Maps for Quantum Information</i>		

\* **Invited Talks**

\*\* **Tutorials**