

QUDEDIS - Science Meeting Final Report (Peter Zoller - 328)

The Obergurgl Meeting 2005 for quantum optics and quantum information has been held in the Universitäts-Sportheim in Obergurgl, Tirol. It emerged from a series of conferences, starting in 1984, initially with the goal to discuss current topics in the field of quantum optics. While the conference has brought together eminent scientists, a particular emphasis was placed on the participation of young scientists. The large amount of young invited speakers and poster presentations has given them the opportunity of meeting leading researchers in their field.

Traditionally, the main focus of the conference was on quantum optics and quantum information, while the major component in recent years has been the field of atomic physics with cold quantum gases. Due to the emerging interest on the overlap with condensed matter physics, particular emphasis has been placed on mesoscopic physics as well as on strongly correlated atomic systems. As a consequence of the collaboration of scientists from the different fields, a rich variety of fruitful interdisciplinary connections has formed.

Among the topics in quantum degenerate dilute systems, one of the subject areas widely covered throughout the conference was on cold atoms in optical lattices. The presentations included reports about recent experiments on fermions in an optical lattice (T. Esslinger, Zürich, G. Modugno, Firenze) and nonlinear effects for Bose-Einstein-Condensates (BECs) in optical lattices (E. Arimondo, Pisa). On the theoretical side, D. Jaksch (Oxford) talked about the modelling and simulation of Bose-Hubbard Hamiltonians and H.P. Büchler (Innsbruck) discussed the implementation of exotic quantum phases in optical lattices. New aspects of the stability of superfluid currents in strongly correlated systems were discussed by E. Demler (Harvard), M. Gunn (Birmingham) elaborated on molecules in optical lattices and C. Williams (NIST) discussed single- and multi-particle spectra of 1D atomic samples in optical lattices.

Another essential part of the conference was devoted to experimental and theoretical developments for the creation and manipulation of BECs. The invited speakers addressed creation of BECs in disordered potentials (M. Inguscio, Trento), on atom chips (J. Schmiedmayer, Heidelberg), in optical traps (R. Grimm, Innsbruck) and the extraction of a single atom using a quantum tweezer (F. Schreck, Innsbruck). A proposal on the creation of ground state molecules was presented by C. Koch (Orsay).

Finally, applications of degenerate Fermi gases represented another major component of the conference. Thorough consideration was given to the study of the crossover from BEC to a Bardeen-Cooper-Schrieffer (BCS). In particular, specialized topics included the study of density correlations (C. Bruder, Basel), the presentation of a semi-classical field model (J. Javanainen, Connecticut) and the experimental realization with ^6Li (F. Chevy, Paris). L. Levitov (MIT) presented theoretical results on many-body dynamics at quantum phase transitions and P. Törmä (Jyväskylä) on spectroscopy of superfluid atomic Fermi gases.

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