Quiprocone Funding Report
Dr. Almut Beige

Visit of Carsten Marr from the Max-Planck-Institut fuer Quantenoptik in Garching to Imperial College London, January 2003

The main objective of the eight-weeks research visit of Carsten Marr at Imperial College in London was to intensify an already existing collaboration between the Max-Planck-Institut in Garching and the Quantum information and Quantum optics group at Imperial College in London and to conclude ongoing projects.

The visit was very successful and very interesting for both sides. At the end of the eight months period we submitted a publication with the title "Entangled state preparation via dissipation-assisted adiabatic passages'' to Physical Review A. The final manuscript has just been resubmitted and should be in press soon.

One of the main obstacles to coherent control of open quantum systems is dissipation and the inability to precisely control experimental parameters. To overcome these problems one could use adiabatic processes that keep a system continuously inside a decoherence-free subspace. However, these processes are very slow and make a system in general even more sensitive to errors that are not taken care of by the decoherence-free subspace. As a solution Carsten's paper proposes to use "dissipation assisted adiabatic passages''. These are relatively fast processes where the presence of spontaneous decay rates corrects for errors due to non-adiabaticity. The system remains constantly inside a decoherence-free state and behaves as predicted for the corresponding adiabatic process.

As an example we presented a concrete scheme to entangle atoms by moving them slowly in and out of an optical cavity. With respect to the dissipation problem, the proposed state preparation scheme is comparable with other recently proposed atom-cavity schemes. However, the experimental requirements for the realisation of the scheme are significantly reduced and the setup is widely robust against parameter fluctuations. By further improving the underlying ideas we hope that we can, one day, close the current gap between the parameters required in theoretical proposals and possible parameters in current experimental setups like the atom-cavity experiment in Prof. Rempe's group in Garching.

Carsten Marr and I also discussed the possibility to use the considered two-atom cavity setup as an improved single photon source. This project has not been as productive as we hoped for. However, we supervised a successful three-months student project (by Michael Trupke) on this subject and learned many things about the generation of single photons.

During his visit, Carsten gave a seminar talk in the official seminar of the Quantum information and Quantum optics group which was also attended by Ed Hind's group. He participated actively in several group seminars and his work will stimulate further projects within the group at Imperial College that are, hopefully, of interest for the experimental group in Garching and could stimulate further collaborations.

Dr. Almut Beige,
London, 21 July 2003