SONDERSEMINAR/Special Seminar
MPQ/LMU

am:	**Mittwoch, 8. Mai 2013**
Uhrzeit:	**16:00 Uhr s.t.**
spricht:	**Dr. Rockson Chang** **Department of Physics** **and the Institute of Optics** **University of Toronto** **Canada**
Thema:	**Exploring Matter Wave Dynamics** **with a Bose-Einstein Condensate**
Ort:	**Lehrstuhl Prof. T.W. Hänsch, Diskussionsraum** **Schellingstr. 4/ III. St., Raum H311,D-80799 München**

gez. Prof. T.W. Hänsch

Exploring Matter Wave Dynamics with a Bose-Einstein Condensate

Bose-Einstein condensates provide a rich and versatile platform to study both single-particle and many-body quantum phenomena. In this talk I describe several experiments using a Bose-Einstein condensate of ^{87}Rb as a model system to study novel matter-wave effects that traditionally arise in vastly different systems, yet are difficult to access.
We study the scattering of a particle from a repulsive potential barrier in the non-asymptotic regime, for which the collision dynamics are on-going. Using a Bose-Einstein condensate interacting with a sharp repulsive potential, two distinct transient scattering effects are observed: one due to the momentary deceleration of particles atop the barrier, and one due to the abrupt discontinuity in phase written on the wavepacket in position-space, akin to quantum reflection. Both effects lead to a redistribution of momenta, resulting in a rich interference pattern that may be used to reconstruct the single-particle wavefunction. In a second experiment, we study the response of a particle in a periodic potential to an applied force. By abruptly applying an external force to a Bose-Einstein condensate in a one-dimensional optical lattice, we show that the initial response of a particle in a periodic potential is in fact characterized by the bare mass, and only over timescales long compared to that of interband dynamics is the usual effective mass an appropriate description. This breakdown of the effective mass description on fast timescales is diffcult to observe in traditional solid state systems due to their large bandgaps and fast timescale of interband dynamics. These experiments make use of the condensate's long coherence length, and the ability to shape and modulate the external potential on timescales fast compared to the particle dynamics, allowing for observation of novel matter-wave effects. Time permitting, I will also discuss our work studying the ultrafast dynamics of exciton-polariton condensates in a GaAs microcavity through the interference of two distinct, resonantly injected condensates.