The Vienna Doctoral Programme on Complex Quantum Systems
invites you to a

Seminar Talk

by

Aephraim Steinberg
Dept of Physics and Centre for Quantum Information & Quantum Control
University of Toronto

Counting photons as they fly and timing atoms as they tunnel

How much can one photon affect another? How long does a particle spend in the forbidden region of a tunnel barrier? These longstanding questions are of both fundamental and potentially practical importance. I will present two experiments in which we used ultracold atoms to address them.

In the first, we used an atomic coherence effect to generate such strong photon-photon interactions that we could measure the nonlinear optical phase imprinted on a probe beam by a separate, single-photon-level, pulse. We also found that when the right post-selection is performed on this latter photon, it can "act like" many more than 1 photon, writing a larger phase shift, in accordance with the surprising predictions of the "weak measurement" formalism of Yakir Aharonov *et al.* Most recently, we have started to use Rydberg atoms to generate even larger interactions. I will say a few words about the philosophical implications of this "weak value amplification" result.

In the second, we are measuring the traversal time for ultracold (~900 pK) atoms traversing an isolated tunnel barrier, and preliminary results confirm our predictions that particles traverse a barrier *faster* when they have to tunnel through it than when they have enough energy to travel over it. I will place this in the context of the century-old debate over how long tunneling takes.

Monday, 8 October 2018,
16:30h get-together with coffee and snacks!

Lise Meitner Hörsaal, Strudlhofgasse 4, 1st floor, Vienna

The seminar talk will be preceded by a CoQuS Student talk at 17:00h
by

Lorenzo Magrini
University of Vienna
"Nanophotonic near-field levitated optomechanics"

Hosted by: Markus Aspelmeyer