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

Alumnus Talk

by

Sven Ramelow
Humbold Universität Berlin

A Large Effective χ(2) Nonlinearity on a Si_3N_4-Chip

It is believed in nonlinear optics that intrinsic material nonlinearities would be far too weak to allow for efficient nonlinear interactions of single photons. This has been challenged by the coherent photon conversion (CPC) scheme [1]: strongly pumping one of the modes in a four-wave mixing(FWM) process one can generate an effective $\chi^{(2)}$ nonlinearity for the remaining three fields which in principle can be made arbitrarily large by increasing the pump power. This theoretically allows for efficient single photon level $\chi^{(2)}$ nonlinearities [1].

Here, I will present an overview and new results on efforts to implement CPC. I will explain how CPC can realize any effective 2nd order nonlinear process. An important example is when two of the three interacting fields are degenerate. The resulting interaction is then fully analogue to second harmonic generation (SHG), albeit with non-harmonic frequencies. This, we recently demonstrated utilizing an on-chip high-Q Si_3N_4 microring resonator. We generated a strong effective $\chi^{(2)}$ nonlinearity using the CPC scheme by strongly pumping one of its resonances. For weak probe light at another wavelength we then observed effective SHG with a normalized efficiency of 77%/mW. This is an order of magnitude higher than in LN waveguides and demonstrates the perspective of reaching efficient single photon nonlinearities on chip by harnessing the rapid advancement of ultra-high-Q nonlinear microresonator technology

Monday, 6 March 2017,
17:00 get-together with coffee and snacks!

Freihaus Hörsaal 5, Wiedner Hauptstraße 8 – 10, 1040 Vienna

Hosted by: Anton Zeilinger

[1] N. K. Langford, S. Ramelow, R. Prevedel, W. J. Munro, G. J. Milburn, A. Zeilinger, Nature 478, 360, (2011).