SONDERSEMINAR/Special Seminar
MPQ/LMU

am:	**Freitag, 26. Juli 2013**
Uhrzeit:	**10:00 Uhr s.t.**
spricht:	**Dr. Carsten Schuck** **Department of Electrical Engineering** **Research Group Prof. Tang** **Yale University** **15 Prospect St.** **New Haven, CT 06511** **USA**
Thema:	**High Efficiency, Low-Noise Superconducting Nanowire Single-photon Detectors Integrated with Nanophotonic Circuits**
Ort:	**Lehrstuhl Prof. T.W. Hänsch, Diskussionsraum Schellingstr. 4/ III. St., Raum H311,D-80799 München**

gez. Prof. T.W. Hänsch

Abstract

High Efficiency, Low-Noise Superconducting Nanowire Single-photon Detectors Integrated with Nanophotonic Circuits

High detection efficiency, low dark count rate and accurate timing resolution are the most desired features of a single photon detector. For quantum optical information processing it is furthermore highly desirable to integrate detectors and optical circuitry on one common and scalable platform. Here I will present how these requirements can be achieved with NbN and NbTiN nanowire superconducting single-photon detectors (SSPD) embedded in nano-photonic waveguides on a silicon chip for visible and infrared wavelengths. Employing a travelling wave design we realize up to 90% detection efficiency for single-photons in the telecom band. By engineering the detector and waveguide dimensions at the nanoscale we furthermore demonstrate sub-nanosecond electrical output pulses with timing jitter below 50 ps and milli-Hz dark count rates, resulting in a noise equivalent power in the 10^{-19}-10^{-20} W/($Hz^{1/2}$) range. I will present two applications of our integrated nanowire SSPDs:

Firstly, we show how to exploit the detectors' high temporal resolution to resolve individual photon round trips in silicon ring resonators for time-domain multiplexing. Secondly, we perform photon-counting optical time domain reflectometry (OTDR) over 263 km of standard telecom fiber to illustrate the low noise performance of our detector. The integration of such ultrafast, high-efficiency superconducting single-photon detectors with low-loss optical waveguide devices on a single chip is an ideal match for scalable quantum photonic circuitry.