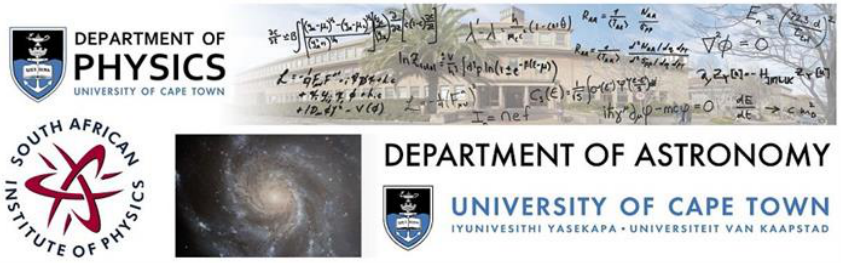

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Single-photon probing of plasmonic waveguides

Wednesday, 6 July 2016 14:40 (20 minutes)

Abstract content
   (Max 300 words)
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Plasmonics is the study of the interaction of light and conduction electrons at metal-dielectric interfaces. Here, surface plasmon polaritons (SPPs) are hybrid photon-electron excitations that can be confined to subdiffraction scales. This feature affords enhanced coupling of emitter systems (e.g. quantum dots) to SPPs, making them suitable candidates for a wide range of on-chip quantum photonic components – most notably single-photon sources. This potential use of SPPs, along with the nonlinearity provided by emitter systems, opens up quantum plasmonics as a potential realisation of quantum information processing. In this setting, the excitation of single SPPs on waveguides via single photons and the confirmation of single-photon states upon output is an important goal. In our work we experimentally probe plasmonic waveguides consisting of gold stripes with surface-relief diffraction gratings at either end (input and output). Single photons generated via parametric down-conversion were coupled into SPP modes by focusing them onto the input grating using a diffraction-limited microscope. A Hanbury-Brown and Twiss setup is then used with single-photon detectors and counting modules to determine a second order correlation coefficient of g⁽²⁾(0)=0.30 ±0.15 from the output grating signal. A value less than 0.5 is indicative of single-excitation states. Our study serves as a first step in developing the capacity to explore further the quantum properties of single SPPs and their application to quantum information processing.

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