Surface Plasmon Coupled Emission: a new super sensitive technique

L. Ceresa[1], J. L. Chavez[1], E. Kitchner[1], J. Kimball[1], I. Gryczynski[2], and Z. Gryczynski[1,2]

[1] Department of Physics and Astronomy, Texas Christian University, 2800 S University Drive, Fort Worth, TX, 76129, USA

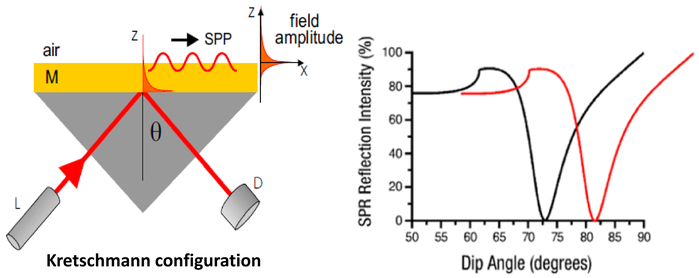
[2] Department of Molecular Immunology and Genetics, University of North Texas Health Science Center, Fort Worth, TX, 76107, USA

Background

Typical concentrations of physiological markers, such as cancer markers or cardiac markers can be very low (i.e. nano-molar range or below). Detecting a low concentration of biomolecules in the presence of an overwhelming background of natural constituents like blood components, becomes a very difficult task to achieve.

Fluorescence detection potentially offers the highest detection sensitivity. However, this is very much limited by **unwanted background signal** of naturally occurring physiological components. SPCE can be a powerful tool to detect low concentrations of biomolecules as well as molecular binding with **superior sensitivity**. The two crucial characteristics of SPCE are **surface confinement** for **fluorescence coupling** and **directional emission**.

Surface Plasmon Resonance: Surface charge density oscillation

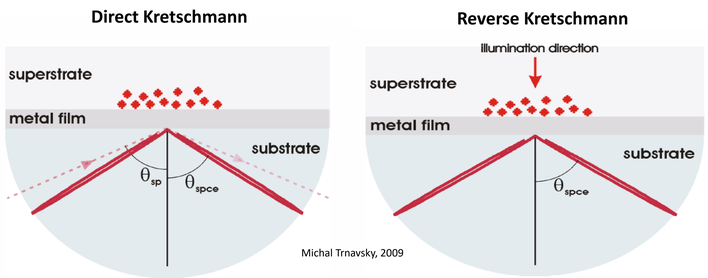


Kretschmann configuration

Novotny and Hecht, 2006

SPR merely detects a change in refractive index. It does not distinguish non specific binding.

Surface Plasmon Coupled Emission: Opposite of SPR



Excitation via SPR

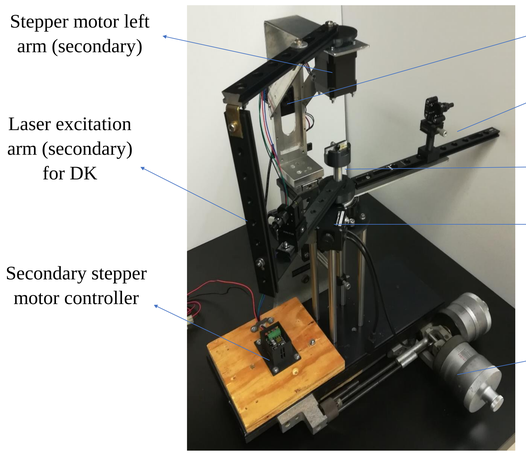
Smaller detection volume
More experimentally difficult

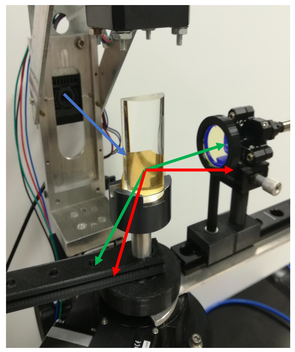
Excitation via external source

Experimentally easier
Not as "precise"

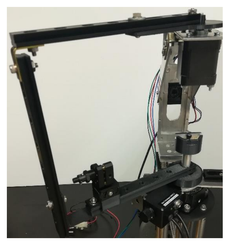
Experimental setup

SPCE testing unit

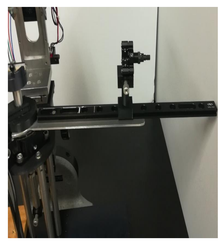




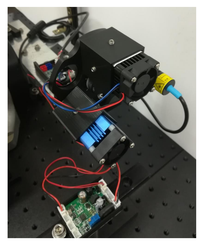
- Precise rotational motion around the sample
- Versatility for direct and reverse Kretschmann configuration
- Multi-laser excitation
- Easy control of sample position



Secondary arm (left)
Excitation arm for DK

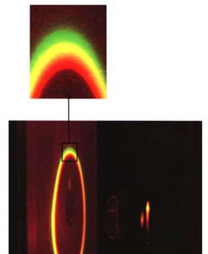


Primary arm (right)
Detection arm for RK and DK

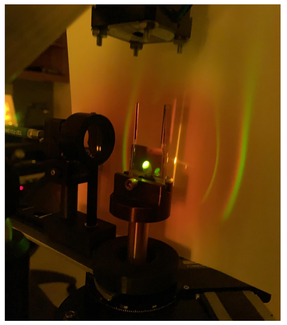


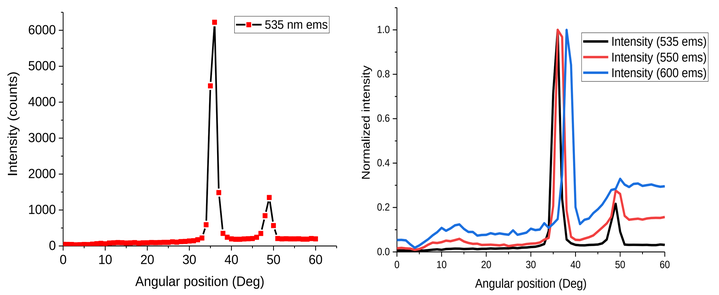
Multi-laser excitation wheel

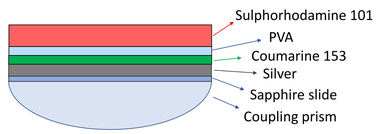
Results



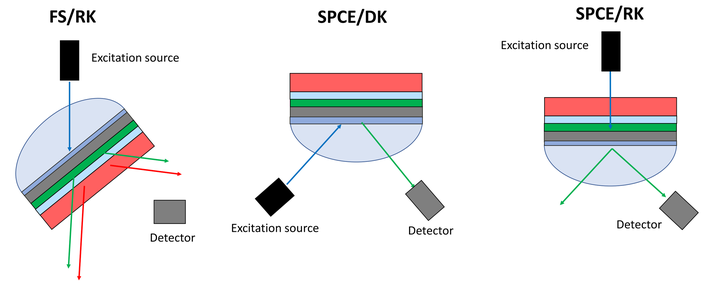
Gryczynski *et al.* 2003







- Test sensitivity and intensity of DK and RK
- Confirm role of distance dependent coupling



COLLEGE OF SCIENCE & ENGINEERING

DEPARTMENT OF Physics & Astronomy