# Phase-sensitive surface plasmon resonance sensor based on interferometric configuration

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# PHASE-SENSITIVE SURFACE PLASMON RESONANCE SENSOR BASED ON INTERFEROMETRIC CONFIGURATION

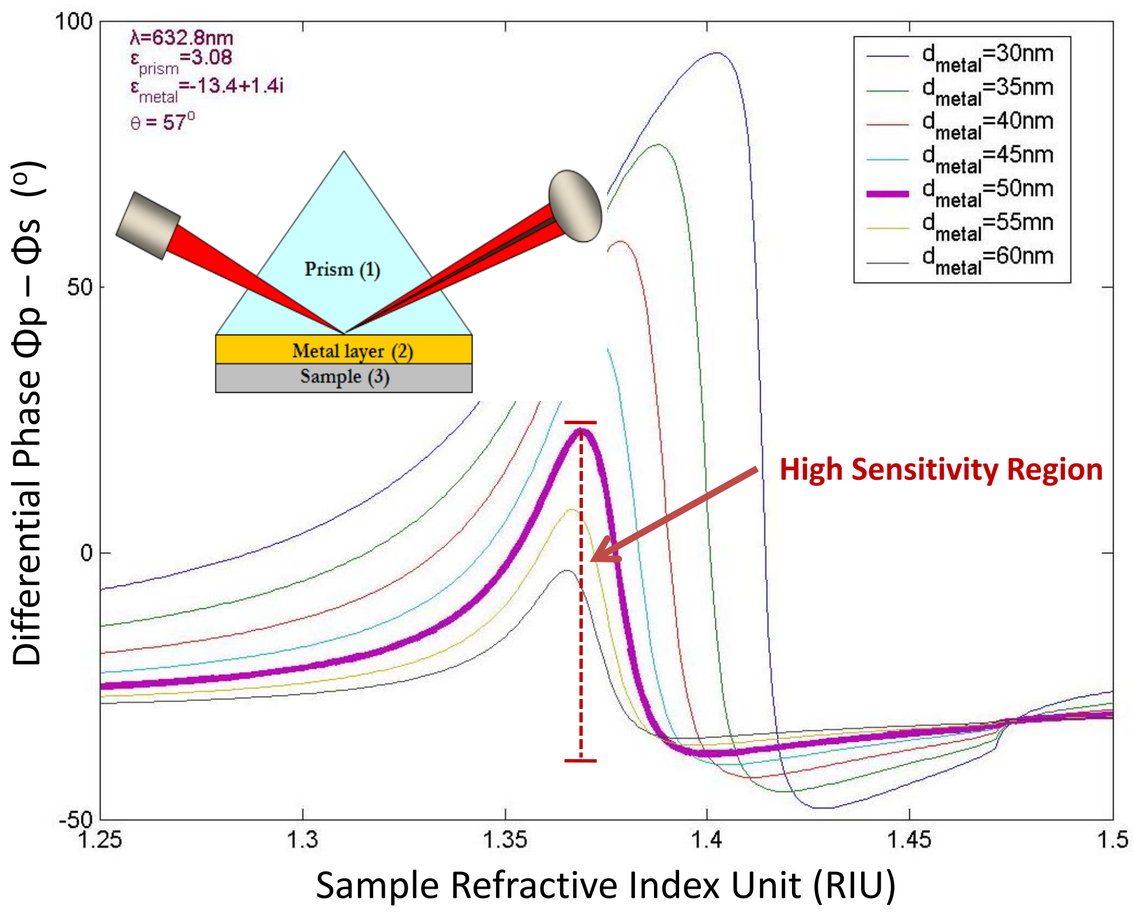
## Background

*Surface plasmon waves* are quantized harmonic oscillatory motion of electrons at the surface. The criteria for excitation of surface plasmon resonance (SPR) are: the incident wave must be matched in *angular frequency and momentum* with that of the surface plasmon.

## Novelties & Applications

- ***Simplified multi-reflection model*** for surface plasmon
- High sensitivity by ***phase detection***
- ***Noise suppression*** using interferometric configuration
- Demonstrated refractive index measurement for ***$CoCl_2$***
- Potential application in real time bio-molecular interactions
- Potentially useful for biosensing and bioimaging

## Simulation Results




## Discussions

- S-polarized light serves as a reference
- Interferometer for phase detection
- Differential phase:

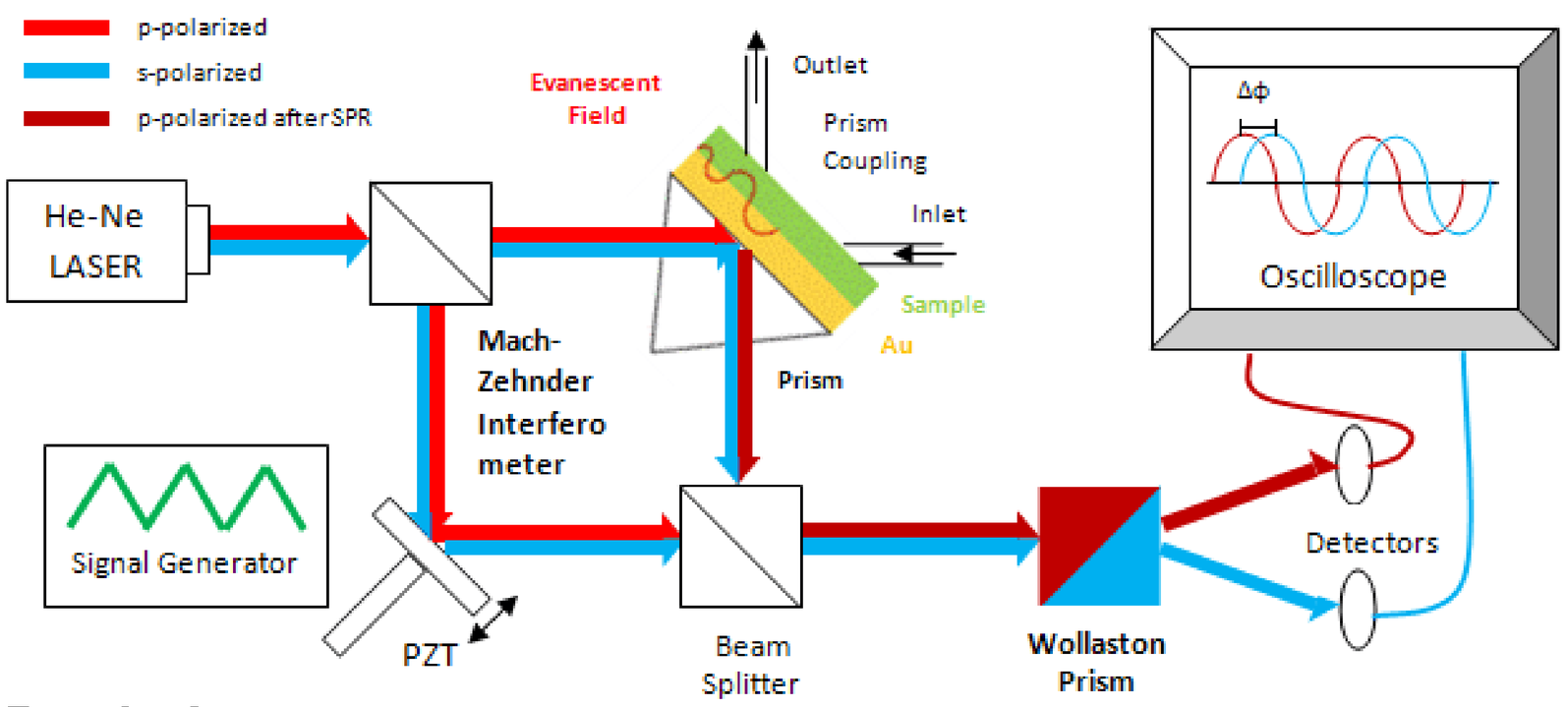
$$r_{p(s)} = \frac{r_{12} + r_{23}\exp(2ik_{z2}d)}{1 + r_{12}r_{23}\exp(2ik_{z2}d)}$$

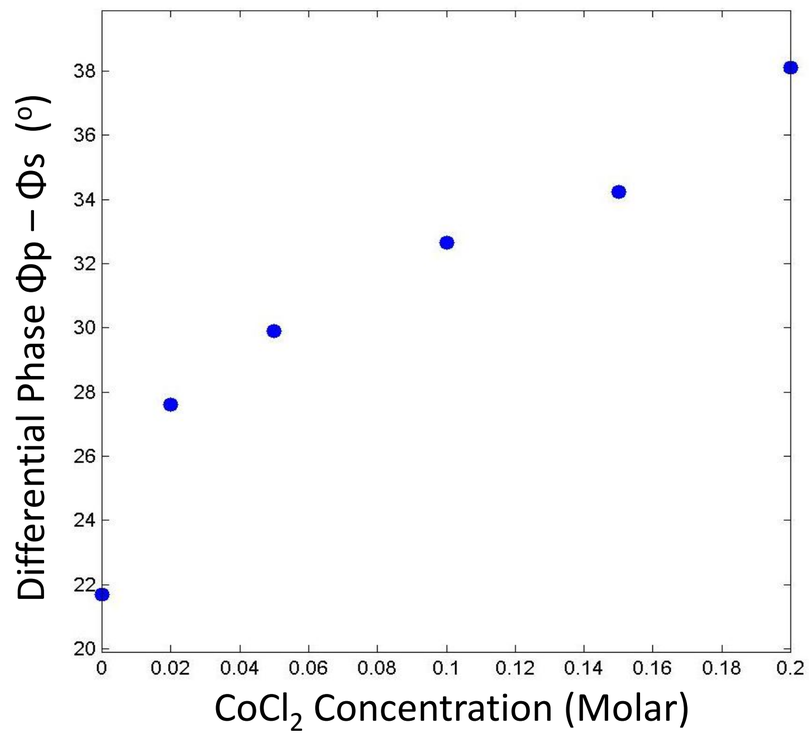
$$\Delta\emptyset = \arg(r_p) - \arg(r_s)$$

$r_{12}$: *reflectivity of prism-metal interface*
$r_{23}$: *reflectivity of metal-sample interface*
$k_{z2}$: *wave number vector of the transmitted light in the metal layer*

- Integration with microfluidics for real time detection
- Simultaneous detection of both polarizations
- Resolution (theoretical): $4.1\times10^{-4}$ RIU/degree
- Resolution (experimental): $3.1\times10^{-2}$ Molar/degree

## Experimental Results




## Conclusions

- High phase detection sensitivity is obtained theoretically and demonstrated in the experiment.
- A linear relationship ($R^2$=0.8994) is observed for differential phase change vs. sample concentrations.

**Project Title: Surface Plasmon Resonance Measurement I**
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