# Versuch No. 66

# Fortgeschrittenen Praktikum:

# Surface Plasmons at a Metal-Insulator Interface

Surface plasmons are a collective excitation of the conduction electrons at a metal-insulator interface. Surface plasmon resonances follow from classical electrodynamics i.e. from Maxwell's equations. Thus, the theory of surface plasmons is well understood. Surface plasmons have considerable commercial relevance being exploited for biosensing applications. In addition, surface plasmons attract the attention of contemporary research as an interface between optics and nanoelectronics as well as for Surface-Enhanced Raman Spectroscopy.

In the "Fortgeschrittenen Praktikum" surface plasmons at a metal-insulator interface basic understanding of surface plasmons is achieved by determination of the dispersion relation of a surface plasmon at a noble metal-air interface. To that end, the reflection of a monochromatic light beam on a thin metal layer is measured as a function of the angle of incidence of the light beam. The angle, under which the surface plasmon is excited, reveals the relation between momentum and frequency of the surface plasmon.

## 1. Experimental Steps

- Adjust the optical pathway for optimal signal detection.
- Calibrate the goniometer for correct angle determination.
- Measure the surface plasmon absorption of a metal-air interface for a wide range of optical frequencies.

## 2. Essential Physical Concepts

Optical properties of metals, collective excitation of electrons, light propagation in matter, light-matter coupling, dispersion relation, k-space, Lock-In measurement technique

## 3. Apparatus and Measurement Techniques

White light Xenon arc lamp, monochromator, optical chopper, goniometer, photodiode, I-V converter, Lock-In amplifier, computer and data acquisition card