Plasmon based photoacoustics

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Optical sensing has gained a lot of importance in the last years, which can mainly be attributed to its wide range of applications. Some of the systems in use today already use surface-bound electromagnetic waves that saw an up-rise in popularity among the scientific community in the last decades.
The goal of this work is to use interactions of structured and unstructured matter with light in order to exploit localized as well as propagating plasmons for sensing applications in the field of biomedicine. This can be done by using different approaches, including but not limited to utilizing the capabilities of metallic thin films. These films support the excitation of surface plasmon resonances (SPRs) that can be used in different sensing schemes.
This can mainly be attributed to the high sensitivity of such SPRs with regard to changes in the refractive index of the surrounding material. While some of the more commonly known techniques invoke such changes in the surrounding material by changing the chemical composition of it, our work focuses on pressure changes that are induced by sound waves. Those acoustic waves can in turn be excited by using light with high intensities, a method used in photoacoustics, to gain an understanding of biomedical samples. This method benefits from the high contrast gained by the optical excitation and the high resolution in deep regions of the specimen due to the physical properties of ultrasound waves. By combining the general working principle of photacoustics with structured matter, a fully optical measurement scheme can be devised. This technique can improve on the sensitivity and reduce the complexity of more well-known detection methods in photoacoustics.
This talk will first focus on the general idea behind photoacoustics and plasmons as well as the benefits gained by combining the two. Afterwards, an experimental setup will be presented and some early results discussed. This setup is based on the Kretschmann configuration, which can be seen in Figure 1. Finally, an outlook into using surface lattice resonances for the same purpose will be given.

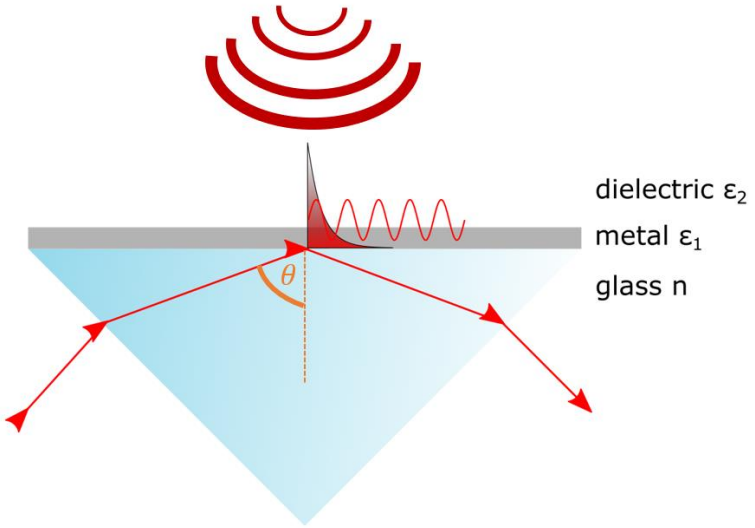

Figure 1: Schematic depiction of sound hitting a Kretschmann sensor configuration.