

The Scattering of a Scalar Beam from Two-Dimensional Hemi-Spheroid Surfaces

By Harald Wilhelmsen
Supervisor: Prof. Ingve Simonsen

"A study of the intensity of the scattering of scalar waves from non-planar surfaces."

Main assumptions:

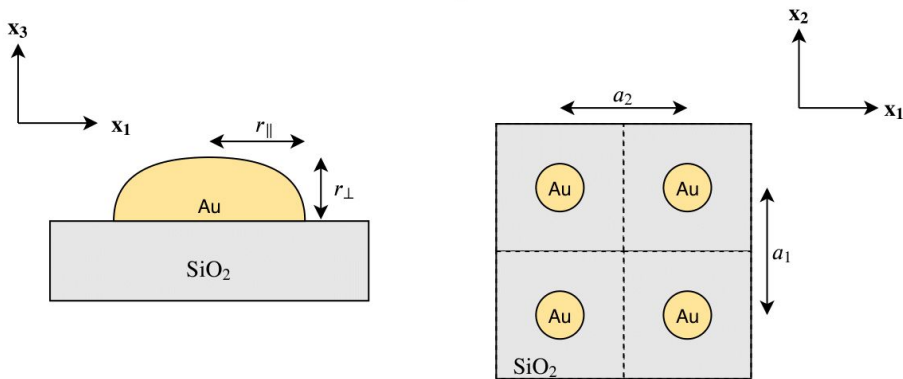
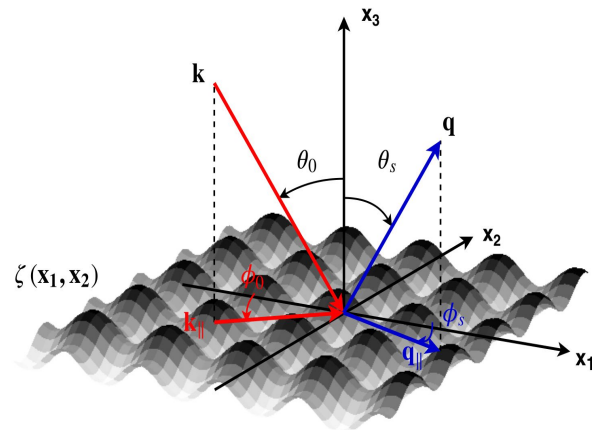
- Incoming plane waves
- A periodic surface
- The Rayleigh hypothesis

The rayleigh hypothesis (in short):

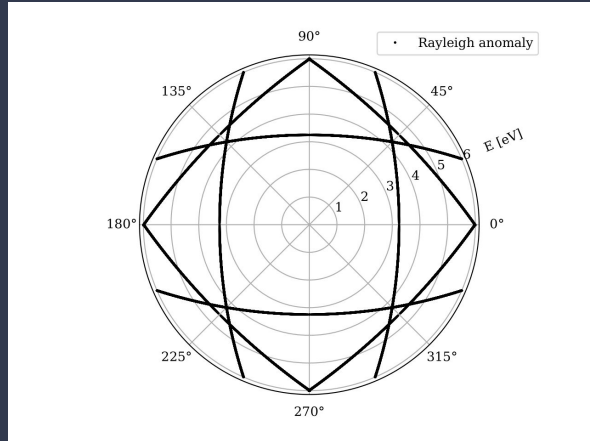
"The plane wave solutions of the incident and reflected wave will hold all the way down to the surface."
(Disregarding any downwards propagating reflected waves)

The reduced Rayleigh equation:

$$\sum_t \hat{I} \left(-\alpha_0 \left(K'_{\parallel} \right) \left| K_{\parallel} - K'_{\parallel} \right| M^+ \left(K_{\parallel} \left| K'_{\parallel} \right| \right) r \left(K_{\parallel} \left| k_{\parallel} \right| \right) = -\hat{I} \left(\alpha_0 \left(k'_{\parallel} \right) \left| K_{\parallel} - k_{\parallel} \right| M^- \left(K_{\parallel} \left| k_{\parallel} \right| \right) \right)$$

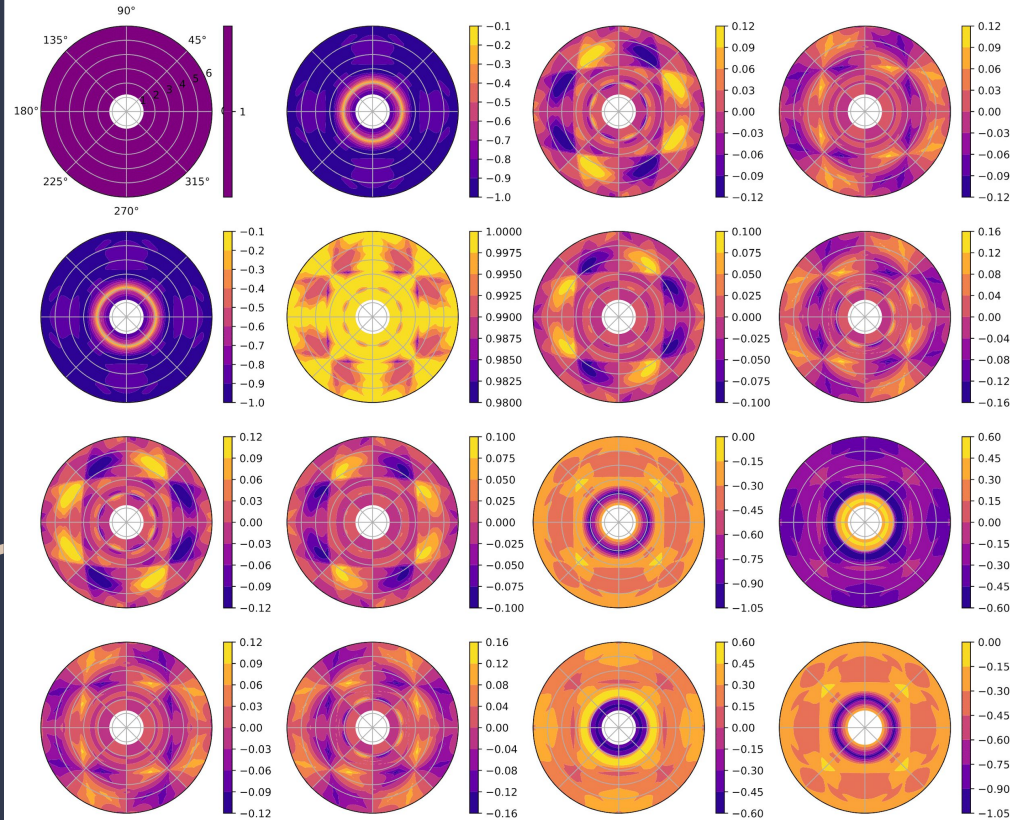


Results



When a diffractive order goes from propagating to evanescent, or visa versa, a so called *Rayleigh anomaly* exist

The Rayleigh anomalies can clearly be observed in the results



Further Work

The scattering amplitudes for a single hemi-spheroid (“half-spheres”) matches well the known theory of Rayleigh anomalies.

Further investigations will look into similar systems, consisting of more hemi-spheroids.

Hopefully, this will provide more insight into the optical response of the surfaces investigated.