**V64**

# Interferometry

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[1]

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## 3.1. Dependence of the contrast on the polarisation angle

At first the dependence of the contrast on the polarisation angle phi is analysed. The measurements listed in Table 1 show the minimum and maximum intensity of the lasers interference for different polarisation angles $\phi$. In order to compute the contrast, **??**

**Table 1:** Measurements for the polarisation angle dependence of the contrast $K$.

| $\phi$ / ° | $I_{\text{min1}}$ / V | $I_{\text{max1}}$ / V | $I_{\text{min2}}$ / V | $I_{\text{max2}}$ / V | $I_{\text{min3}}$ / V | $I_{\text{max3}}$ / V |
|---|---|---|---|---|---|---|
| 0 | 1.60 | 1.75 | 1.57 | 1.77 | 1.63 | 1.78 |
| 15 | 0.97 | 1.57 | 0.94 | 1.49 | 0.95 | 1.54 |
| 30 | 0.51 | 1.28 | 0.52 | 1.27 | 0.53 | 1.30 |
| 45 | 0.39 | 1.31 | 0.40 | 1.34 | 0.40 | 1.36 |
| 60 | 0.53 | 1.74 | 0.54 | 1.78 | 0.53 | 1.76 |
| 75 | 0.96 | 2.23 | 0.97 | 2.13 | 0.98 | 2.21 |
| 90 | 1.87 | 2.05 | 1.97 | 2.41 | 2.01 | 2.24 |
| 105 | 1.81 | 3.10 | 1.78 | 3.22 | 1.84 | 3.53 |
| 120 | 1.31 | 4.30 | 1.35 | 4.23 | 1.41 | 4.47 |
| 135 | 1.15 | 5.06 | 1.23 | 4.78 | 1.21 | 5.05 |
| 150 | 1.39 | 4.44 | 1.44 | 4.32 | 1.47 | 4.54 |
| 165 | 1.65 | 3.16 | 1.69 | 3.19 | 1.73 | 3.33 |
| 180 | 1.66 | 1.87 | 1.64 | 1.82 | 1.80 | 2.01 |

**EQREF HERE** is used to calculate the contrast $K$ for each measuremnt series. After that the average values and the standard deviations of the three measurements are calculated. The corresponding datapoints are shown in Figure 1. The theory law of the angle dependence is given by **?? EQREF HERE**. Here, a function of the form

$$K = 2K_0 \cdot |\sin(\phi - \delta)\cos(\phi - \delta)|$$

is fitted to the data points. The offset $\delta$ is used to compensate for deviations in the experimental setup. The fitparameters follow as

$$K_0 = 0.57 \pm 0.01 \qquad \delta = (3.23 \pm 0.58)°$$

using the *python* extension *scipy* [2] and only include statistical uncertainties. The resulting fit function is also displayed in Figure 1. For the following measurements the polarisation angle is set to 45°.

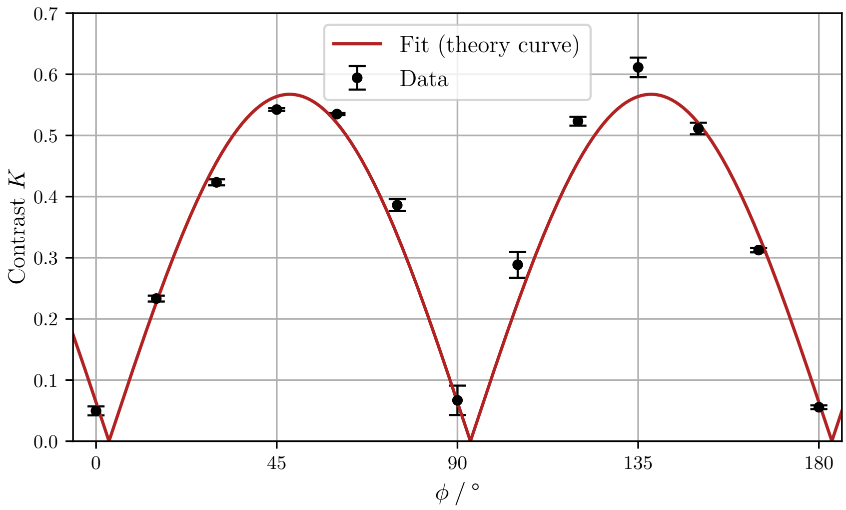


**Figure 1:** Averaged measurements of the contrast $K$ against the polarisation angle $\phi$ and fit using *scipy* [2].

## 3.2. Refraction index of glass

For the determination of the refraction index of glass the double glass holder is placed in the two beams. The two glass panes are already tilted by an angle $\Theta_0 = \pm 10°$. Using **?? EQREF HERE** the number if maxima passing the center of the interference spectrum is given by

$$M = \frac{\Delta\phi_+ + \Delta\phi_-}{2\pi}$$

where $\Delta\phi_\pm$ is the phase shift induced by the glass panes tilted by $\pm 10°$. This expression can be simplified to

$$M = \frac{2T}{\lambda} \cdot \frac{n-1}{n} \cdot \Theta_0 \theta \tag{1}$$

where $\lambda = 632.99\,\mathrm{nm}$ is the wavenlenght of the laser and $T = 1\,\mathrm{mm}$ is the thickness of the glass panes. The number of measured maxima is again averaged over the ten measurement series. The values are shown in Table 2. The experimental value of the

**Table 2:** Measurements of the maxima $M$ passing the center of the interference spectrum and corresponding tilt angle $\theta$.

| $\theta$ | $\overline{M}$ |
|---|---|
| 2 | $6.00 \pm 0.45$ |
| 4 | $12.30 \pm 0.46$ |
| 6 | $19.20 \pm 0.75$ |
| 8 | $25.30 \pm 0.64$ |

refraction index of glass follows from a linear fit to the datapoints. The datapoints and the resulting fit are shown in Figure 2. The resulting value is $n_{\text{glass}} = 1.484 \pm 0.008$.

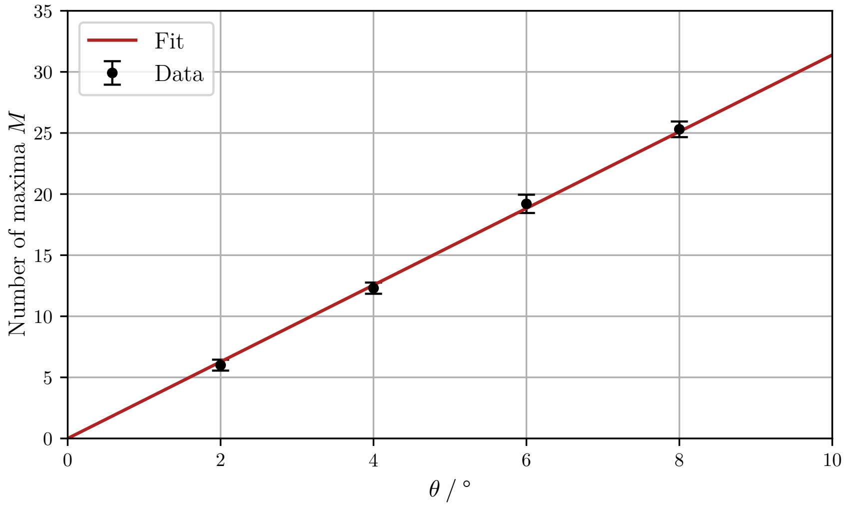


**Figure 2:** Averaged measurements of the number of maxima $\overline{M}$ against the tilt angle $\theta$ and fit using *scipy* [2].

## 3.3. Refraction index of air

To determine the refraction index of air, the measurements listed in Table 3 are used.

**Table 3:** Measurements of the maxima $M$ passing the center of the interference spectrum and pressure $p$ in the air chamber.

| $p$ / mbar | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ |
|---|---|---|---|---|---|
| 8 | 0 | 0 | 0 | 0 | 0 |
| 50 | 2 | 2 | 2 | 2 | 2 |
| 100 | 4 | 4 | 4 | 4 | 4 |
| 150 | 6 | 6 | 6 | 7 | 6 |
| 200 | 8 | 9 | 9 | 9 | 9 |
| 250 | 10 | 11 | 11 | 11 | 11 |
| 300 | 13 | 13 | 13 | 13 | 13 |
| 350 | 15 | 15 | 15 | 15 | 15 |
| 400 | 17 | 17 | 17 | 17 | 17 |
| 450 | 19 | 19 | 19 | 19 | 19 |
| 500 | 21 | 21 | 21 | 21 | 21 |
| 550 | 23 | 23 | 23 | 23 | 23 |
| 600 | 25 | 25 | 25 | 25 | 25 |
| 650 | 27 | 28 | 28 | 27 | 27 |
| 700 | 29 | 30 | 30 | 30 | 30 |
| 750 | 32 | 32 | 32 | 32 | 32 |
| 800 | 34 | 34 | 34 | 34 | 34 |
| 850 | 36 | 36 | 36 | 36 | 36 |
| 900 | 38 | 38 | 38 | 38 | 38 |
| 950 | 40 | 40 | 40 | 40 | 40 |
| 981 | 41 | 41 | 41 | 41 | 41 |

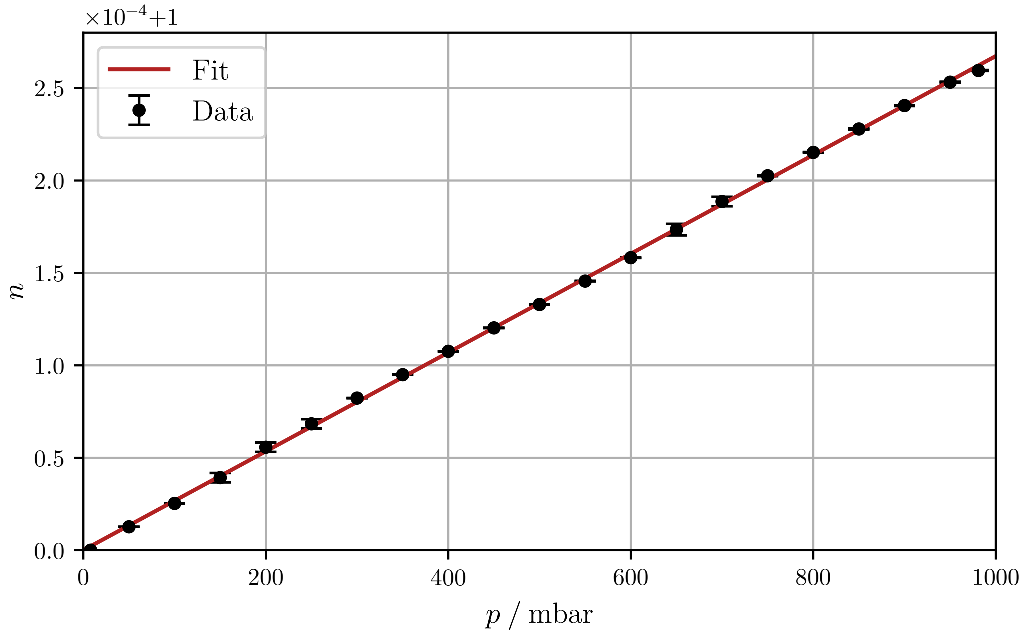


**Figure 3:** Plot.

## 4. Diskussion

## References


[1] *Versuch zum Literaturverzeichnis*. TU Dortmund, Fakultät Physik. 2022.

[2] Pauli Virtanen et al. 'SciPy 1.0: Fundamental Algorithms for Scientific Computing in Python'. In: *Nature Methods* 17 (2020), pp. 261–272. DOI: 10.1038/s41592-019-0686-2.

# A. Anhang

## A.1. Originaldaten