Application Note
Measurement of the four Stokes parameters

This Application note describes how the Stepper Motor Controller SMC4242 can be used together with the Rotation Stage M101 to measure an arbitrary polarisation state.

The polarisation state of electromagnetic radiation can be expressed by the Stokes parameters (S_0, S_1, S_2 and S_3). To measure the four Stokes parameters of polarized light a setup like the one shown in figure 1 can be used. The Stokes parameters can be obtained by performing the measurements listed in table 1.
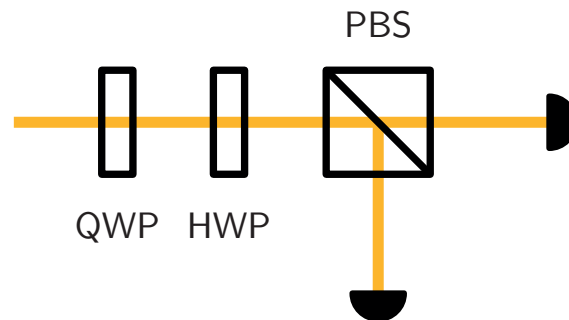

Figure 1: Setup for measurement of the four Stokes parameters. It consists of a quarter waveplate (QWP), a half waveplate (HWP), a polarizing beam splitter (PBS) and two detectors.

Stokes parameter	QWP	HWP	detector signals
S_0	0° (0)	0° (0)	add
S_1	0° (0)	0° (0)	subtract
S_2	45° ($\frac{\pi}{4}$)	22.5° ($\frac{\pi}{8}$)	subtract
S_3	45° ($\frac{\pi}{4}$)	45° ($\frac{\pi}{4}$)	subtract

Table 1: Measurement of the four Stokes parameters (S_0, S_1, S_2 and S_3) using the setup shown in figure 1. The waveplates need to be set to the given angles with respect to the vertical axis and the electrical sum or difference of the detector signals needs to be taken.

In order to facilitate the implementation we provide a sample program
sample_measureStokesParameter.py
on our website www.lk-instruments.com. In this sample program it is assumed, that the quarter waveplate (QWP) is mounted on the Rotation Stage attached to channel 0 of the Stepper Motor Controller and that the Rotation Stage carrying the half waveplate (HWP) is connected to channel 1. In addition it is assumed, that the 0° position corresponds to a situation where the fast axis of a waveplate is vertical.