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Goal of my PhD

Ultra-violet spectropolarimetry is a useful tool to measure the complete magnetosphere of stars. The goal of my PhD is to design, create and tests polarimeters working from 90 to 400 nm for spectropolarimetric measurements. Three polarimeters were designed for POLLUX, an instrument for the LUVOIR mission. Two types of polarimeters have been developed : one by transmission ($\lambda > 120 \text{ nm}$) and one by reflexion. The FUV and the NUV ones are presented here. The polarimeters are being tested in vacuum chambers to measure their optical performances with UV light in space condition.



Polychromatic temporal modulation polarimetry

Polarisation

Stokes Vector:

$\begin{pmatrix} I \\ Q \\ U \\ V \end{pmatrix}$ Intensity
Linear polarization
Circular polarization



Mueller Matrix:

- Characterises a component
- Defines polarization modification

$$S_{out} = M S_{in}$$

Polarimeters

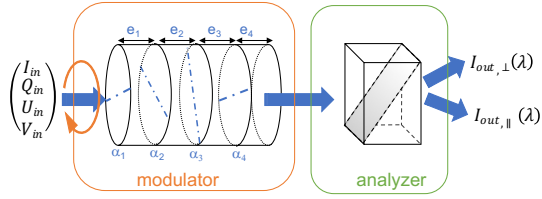
Rotating modulator (discrete positions)

Analyzer : Linear polarizer

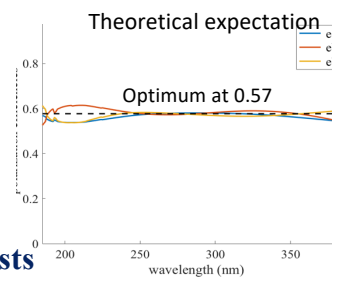


NUV polarimetry : by transmission (200 – 400 nm)

Design NUV

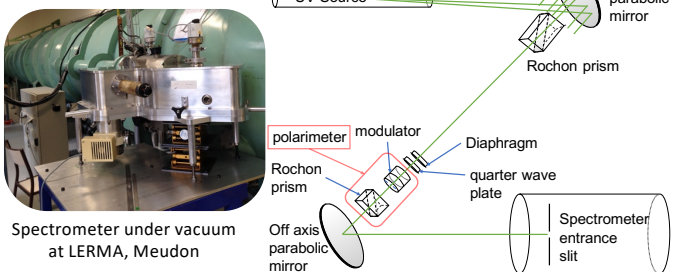


- Modulator : 2 double plates of MgF_2
 - 6 angular positions
- Analyzer : MgF_2 Wollaston prism



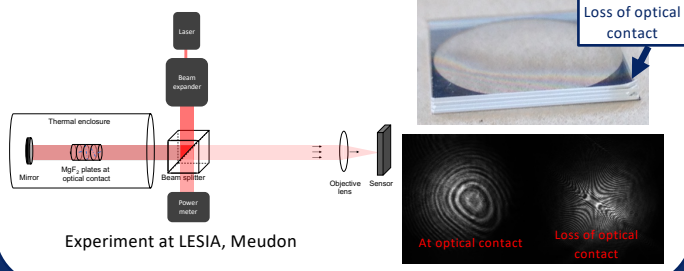
Tests

Test bench for optical performances



Spectrometer under vacuum at LERMA, Meudon

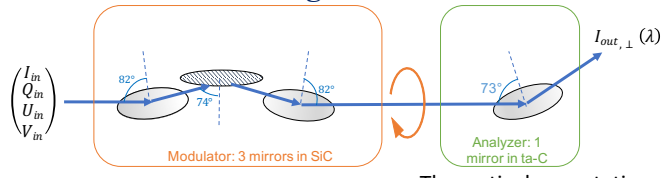
Test bench for thermal resistance of the optical contact



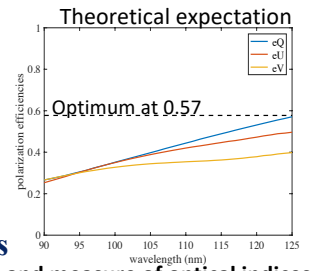
Experiment at LESIA, Meudon

FUV polarimetry : by reflexion (90 – 124.5 nm)

Design FUV

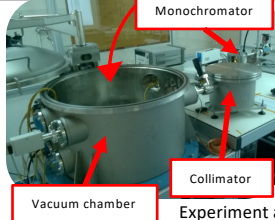
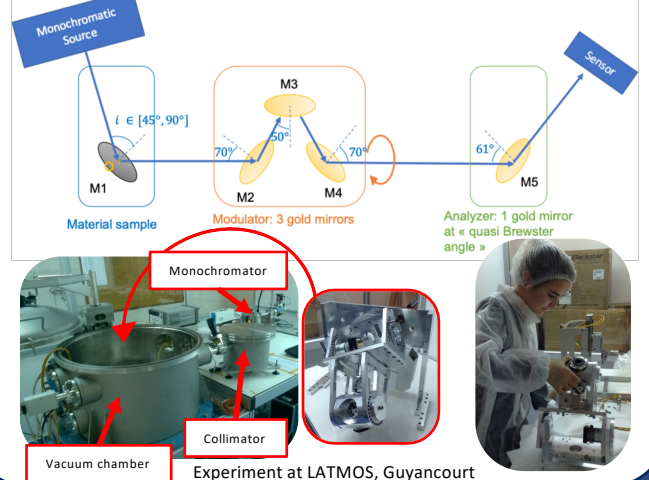


- Modulator : 3 mirrors in SiC
 - 4 angular positions
- Analyzer : 1 mirror in ta-C



Tests

Test bench for optical performances and measure of optical indices



Conclusion and perspectives

- Several polarimeters have been designed for POLLUX and other missions working in UV.
- Theoretical results and simulations are promising.
- 3 experiments are on-going to measure the performances.