V11a Polarization differential objective spectroscopy with nulling coronagraph.

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In order to characterize an exo-planet its spectrum should be measured. This is not an easy task since the light from the parent star overwhelms the planet light. The planet signal should be discerned from the speckle noise. Hence a high-contrast method needs to be achieved. The differential polarization method enables to extract the partially polarized planetary signal from unpolarized stellar noise and makes possible to obtain not only a direct image of the exo-planet but also its spectrum.

We report the laboratory demonstration of polarization differential objective spectroscopy using a four-quadrant polarization mask (FQPoM). We carry out a series of experiments with an optical setup for polarization differential spectroscopy. The optical setup consists of a polarization modulator, FQPoM coronagraphic setup, and an objective spectrometer. A liquid crystal variable retarder is used as a polarization modulator. An objective spectrum is obtained by using a grating. We look for a residual of two spectra taken with p- and s- polarization components. This residue allows to get a polarized constituent of incoming light. By analysis of linear polarization degree of the obtained differential spectrum we can separate the planet light from the speckle noise. In our experiments the intensity ratio of the planet light to the starlight was 6.1×10^{-5} and angular distance was 4.4 λ/D. The experimental result shows effectiveness of differential objective spectroscopic technique for detecting very faint planetary spectrum.