WP4: New techniques for 2D solar spectro-polarimetry

Description

Work package number	WP4	Lead beneficiary	1 - IAC
Work package title	New techniques for 2D solar spectro-polarimetry		
Start month	1	End month	36

Objectives

- Design of multi-slit integral field unit
- Design of a microlens-fed spectrograph adapted to polarimetry

Description of work and role of partners

WP4 - New techniques for 2D solar spectro-polarimetry [Months: 1-36] (IAC, MPG)

Long-slit spectrographs suffer from the drawback that spatial scanning perpendicular to the slit orientation is required to measure all the points of a 2D FoV. As spatial resolution increases, the steps are smaller and the time required for the scan gets larger, which reduces the possibility to study the connectivity and relation between nearby points in the direction perpendicular to the slit. Thus, highresolution observations with a spectrograph demand alternative configurations of these instruments.

Under this project, two possibilities will be studied, one based on image slicers and the other on the use of microlenses to separate all points of the 2D FoV, divided in two natural sWPs, distributed between the partners according to their expertise. This is the natural division given that the first steps of these tasks are presently in progress under SOLARNET: Single-slit IFU (IAC) and microlens-fed spectrograph (MPG).

Sub-WP 4.1 Multi-slit integral field unit design (IAC)

During the last years, image slicers have been incorporated to advanced night-time instruments as a new technology applied to Astronomy to achieve integral field spectroscopy. Image slicers are composed by a number of reflecting elements that cut a two dimensional field of view and reorganize it as a long slit to feed a standard spectrograph. This allows the simultaneous observation of different points of the field of view to give a data cube where the spectrum of each element is obtained. A design of an eight-slit integral field unit (MuSICa) has been proposed as a future state-of-the-art instrument for EST (Calcines et al, 2013). A single-slit unit prototype is presently under development in the framework of SOLARNET as a first demonstrator that this technology can be applied to high resolution solar observations. An intermediate step with the design of an image slicer that produces three or four output slits will be addressed in this project. The feasibility demonstration of this option, minimising aberrations and following the experience obtained with the construction of the single-slit IFU, will represent a big step for the application of this technique to the eight-slit proposal for EST.

Sub-WP 4.2 Spectro-polarimetry using a microlens-fed spectrograph (MPG)

The feasibility of a microlens-fed spectrograph has already been demonstrated ¡. The microlens concept needs, however, to be adapted and optimized for polarimetric measurements. At present, static polarimeters typically employ only 2 beams, the so-called dual beam polarimeter setup. This configuration is very effective at suppressing the crosstalk from Stokes I to the other Stokes parameters, but does not suppress the crosstalk from any of the other Stokes parameters to each other. Static modulation can be accomplished in a different way from that in a typical polarimeter in a microlens based imaging spectrograph, because the individual image pixels are accessible after the image has been sampled. One therefore does not need to care about introducing static aberrations in the beam, sub-pixel alignment, etc., problems that usually limit the crosstalk suppression of a traditional multi-beam polarimeter. In this case, however, strict co-spatiality is guaranteed by construction, although the spectral and polarimetric properties after the splitting are not perfectly identical and need to be well calibrated and stable over time. In this task, it is proposed to split the individual pixels of a microlens imaging spectrograph at the pixel level, and modulate each of the sub-pixels differently, in order to suppress seeing induced cross-talk from the Earth's atmosphere, as well as changes induced by the time evolution of the solar atmosphere.

Documentation

At the footer of this page you can find next documentation of this workpackage:

- OT EST IAC.pdf: "Multi-slit IFU based in image slicer concept" Technical brochure.

Files

OT EST IAC.pdf	404 KB	2018-01-09	GREST EST