**Abstract:** The development of the numerical pipeline for the automatic calibration of the zero levels images obtained from the solar telescope Magneto Optical Filters at Two Heights (MOTH) is the aim of my research grant at Università degli Studi di Roma Tor Vergata. The MOTH telescope, located at the Mees Observatory (Mau, USA) and operated by IfA - University of Hawai‘i and Georgia State University, consists in a dual channel equipment, each mounting magneto-optical filters (MOP) at 589 nm (Na D2-line) and 707 nm (K I-line), respectively. The aim of the MOTH solar full disk observations is the study of the magnetic evolution and dynamics of the solar low atmosphere by mean of the line-of-sight measure of velocity and magnetic field, at two different levels of the solar atmosphere. The MOTH data can be merged with magnetic and velocity field data from Helioseismic and Magnetic Imaging (HMI) on Solar Dynamic Observatory (SDO), for a detailed study of the solar field, by a three-highest characterizations of the solar magnetic evolution, in order to identify signatures of solar eruptive events, useful for Space Weathering. Within the SOLARNET Programme “Mobility for Young Researchers” I had the opportunity to spend 7 weeks at Harvard-Smithsonian CFA, with Solar and Stellar X-ray group (SSXG) team members: I gained a deeper awareness of solar magnetograms analysis techniques, I practised methods for solar active region analysis and for the identification of Solar eruptive phenomena such as CMEs and flares, also using data from Atmospheric Imaging Assembly (AIA) on SDO.

I worked on variations in the polarity inversion line (PIL) in active regions. It has also been evaluated the possibility of matching magnetograms from MOTH and HMI and images from AIA for a preliminary studies of a flare forecasting model. Moreover, we examined the possibility of incorporating MOTH data, also available in a future SWERTO database in Tor Vergata, into a flux rope model developed in collaboration between Harvard-Smithsonian CIA and MTI Laboratory for Nuclear Science.

**MOTH II - Magneto-Optical filters at Two-Heights**

Observations carried on by the solar telescope MOTH have the main purpose of studying the dynamics and magnetic evolution of the solar photosphere, this allows to characterize in particular solar active regions, by the line-of-sight measure of velocity and magnetic field, at two different levels of the solar atmosphere (between 300 and 700 nm).

The MOTH instrument consists in a dual channel equipment, each mounting magneto-optical filters (MOP) at 589 nm (Na D2-line) and 707 nm (K I-line), respectively. The main elements are a series of polarization analyzers, a MOP, constituted by a cell containing vapis of K (or Na) immersed in a longitudinal magnetic field within two crossed linear polarizers, and a wing selector. This setup separates the light beam in a blue wing and red wing of the K (or Na) line and encodes wavelength information into two circular polarization states (±x and ±y). The final database includes our components R(x), R(y), B(x) and B(y), for which it has been calibrated and data reduction procedure is summarized in the flowchart on the right, with the final purpose of computing magnetograms and dopplergrams at two heights of the solar atmosphere. This allows to evaluate the magnetic gradient along the Line-Of-Sight.

The instrument is usually operated at the Mees Observatory (Mau, USA), but currently (December 2016-February 2017) it is located in Antarctica, where two CfA team members are carrying on observation campaign. MOTH data will soon be available in a database managed by Tor Vergata: SWERTO (Space-Weather at the University of Rome Tor Vergata). The instrument is suitable for a ground based network of MOTH telescopes around the world. Upgrading the instrument for on-satellite flights is also under evaluation.

**Conclusions:** During this experience with the SOLARNET “Mobility for Young Researchers” Programme, the basis for a collaboration between Universita di Roma Tor Vergata and Harvard-Smithsonian Center for Astrophysics for Solar Physics has been settled. It involves the matching of magnetograms from MOTH and HMI for a multi-dimensional study of solar magnetic fields in active regions. Observations carried on by the solar telescope MOTH have the main purpose of studying the dynamics and magnetic evolution of the solar photosphere, this allows to characterize in particular solar active regions, by the line-of-sight measure of velocity and magnetic field, at two different levels of the solar atmosphere.

**References:**


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**Observations carried on by the solar telescope MOTH:**

- The aim of the MOTH solar full disk observations is the study of the magnetic evolution and dynamics of the solar low atmosphere by mean of the line-of-sight measure of velocity and magnetic field, at two different levels of the solar atmosphere.
- The MOTH data can be merged with magnetic and velocity field data from Helioseismic and Magnetic Imaging (HMI) on Solar Dynamic Observatory (SDO), for a detailed study of the solar field, by a three-highest characterizations of the solar magnetic evolution, in order to identify signatures of solar eruptive events, useful for Space Weathering.

**References:**