SO/PHI data request form

(Cruise phase + first science orbit; SO/PHI-Team internal version)

Moving magnetic features, their structure and connection to sunspots

Hanna Strecker, David Orozco Suarez

Instituto de Astrofísica de Andalucía

Science case (stay on one slide):

Please also state, why is PHI needed; why is the science unique?

Moving magnetic features (MMFs), small magnetic patches in the moat region around sunspots, have been proposed to be responsible for the removal of magnetic flux from sunspots. However, this has never been confirmed due to contradictory results in the ratio of the flux loss from the spot and the flux transfer from the MMFs (e.g., Martínez Pillet 2002, Kubo et al. 2007). The contribution of MMFs to the flux loss from a sunspot is assumed to depend on the physical mechanisms to which they are associated. However, their classification into different classes could be restricted by the temporal and spatial resolution of the observation. MMFs are associated with the magnetic canopy (Zuccarello et al. 2009, Rempel 2015) and with brightenings and jet-like events in the transition region (Tiwari et al 2018). Flux cancellation processes between MMFs could affect both, the structure of the sunspot canopy and, adjunctly, the stability of the sunspot.

PHI's HRT provides observations of a large FOV, covering an entire sunspot, the surrounding moat region, and attached network, at highest spatial and temporal resolution. Combined with the high magnetic sensitivity, these attributes are ideal to study the topology of MMFs, their field strength and magnetic flux and how they evolve in time, over the entire region from within the sunspot to the network. The performance of PHI, combined with the stability of the measurements over the entire duration of the observation, can not be achieved with any other telescope. Furthermore, in combination with EUI and SPICE, the relation of flux cancellation events of MMFs to the transition region can be studied. This will provide a better understanding of the configuration of MMFs and their connection to the sunspot over multiple heights in the solar atmosphere.

Requirements/data (use additional slide if needed)

Besides best guess requirements, you may also list minimum requirements on the data

- Type of solar feature: Active region, sunspot (if not available a pore would also be fine)
- HRT or FDT: HRT
- Physical parameters needed (available: B_LOS, vector B, v_LOS, I_c, raw data): vector B, v_LOS, I_C
- Total length of observation: 3 hours at least to track MMFs, 5 hours would be better
- Cadence (maximum 1 dataset/min): 5 min (minimum), higher is preferred
- Pointing needs (disc centre, limb, active region location, particular μ): active region location
- Orbit needs (spatial resolution/co-rotation/angle to Earth/angle to other spacecraft): Highest possible spatial resolution to study MMFs, close to perihelion
- Total number of datasets: Depends on total length of observation and cadence: minimum 36 datasets (5 min cadence, 3 hours), 150 datasets (2 minute cadence, 5 hours)
- Full frame 2k x 2k or partial frame 1kx1k, 0.5kx0.5: Full frame
- Full resolution or 2x2, 4x4 binned data: Full resolution
- noise level (default 10^{-3}): Default
- Co-observations with other instruments: EUI and SPICE, to relate structure and dynamics of MMFs and their response to transition region
- Special requests: