SO/PHI data request form

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

Magnetic flux evolution of sunspots

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Science case (stay on one slide):

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

Sunspot evolution and decay has generally been studied by a change of the total magnetic flux and area evolution (e.g., Martinez Pillet 2002). However, the processes driving sunspot evolution and decay are not understood. Studies of simulated sunspots suggest that the decay process of sunspots starts below the surface, while the area and magnetic flux seen at the surface is constant (Strecker et al. 2021). The evolution of the inner structure of a sunspot, i.e., the umbra-penumbra ratio and the development of light bridges, could be indicators of this hidden initial decay process. During the further evolution sunspot decay must be accompanied by a loss of flux from the sunspot. Therein, moving magnetic features might have a key role. Therefore, the amount of magnetic flux in the surrounding of a sunspot contributed by different types of magnetic features is important to study in greater detail, especially, over a long time period in relation to the flux evolution of the sunspot.

PHI observations at the highest spatial resolution, extending over several days, are necessary to study the flux evolution of an active. The large FOV will show the entire active region, at best a sunspot, the surrounding moat region, and opposite polarity. The combination of continuous observation over several days, a large FOV and high spatial resolution provided by PHI cannot be provided by any other satellite or earth bound telescope. The height extension of magnetic loops connecting different polarities of the active region and their evolution, in interaction with the photospheric evolution, e.g., flux cancellation events, can be studied by making use of support by EUI and SPICE observations.

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: several days of tracking an active region
- Cadence (maximum 1 dataset/min): 30 minutes; 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): Close to perihelion
- Total number of datasets: based on the SOOP "R_SMALL_MRES_MCAD_AR-Long-Term" 186 datasets for a duration of 3days and 21 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, relate structure and dynamics of MMFs and their response to transition region, extend tracking duration of active region/sunspot by making use of Earthbound telescopes, e.g., SST, GREGOR, DKIST or Hinode
- Special requests: