Proposed SOHO Joint Observing Program

CROSS-CALIBRATION BASED ON STELLAR OBSERVATIONS

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Progress:

Draft Scheme

Discussion at SPWG

Detailed Plan Minor Revision

Objective: To spatially co-register and to flux calibrate several instruments based on observations of a star.

Scientific Case: It is crucial to monitor instrument sensitivity changes during the SOHO mission. It is also important to place intensity measurements of various instruments on a common scale and to spatially co-register them if we are to combine observations with the different instruments. Both purposes can be served by observing stars. Several UV-bright stars pass close enough to the sun during the course of the year that they can be observed by SUMER, LASCO and UVCS. They should be observed each year during the mission to co-register the instrument pointings, to track sensitivity changes, and to compare with IUE, Voyager and optical intensity calibrations. None of these stars is known to vary, so strict simultaneity may not be necessary, but it is clearly desirable. Unfortunately, none of these stars are likely to be detectable below the Lyman limit, so these calibrations are restricted to the UVCS first order UV ranges and the White Light Channel, the longer wavelength part of the SUMER range, and LASCO. Line ratios must be used to transfer the calibrations to shorter wavelengths.

OBSERVABLES

- UVCS: Intensities over the full wavelength ranges in the UV channels and count rate in the WLC
- SUMER
- LASCO

TARGETS

HD19374 (53 Ari), HD23016 (13 Tau), HD27295 (53 Tau), BD+23 1179, HD42087 (3 Gem), HD43384, HD43818, WD0711+22, Abell 30, HD87901 (α Leo), HD91316 (ρ Leo), HD142096, HD142883, HD144470 (ω^1 Sco), HD163995 (4 Sgr), HD164492, HD171961, and HD210424 (38 Aqr) are available. HD 39767 (B2.5 Ve) may be variable.

PROPOSED OBSERVATIONS

UVCS

UVCS will repeatedly place the UV channel slits and the WLC focal plane aperture to let the star drift across them. For 11" spatial resolution, the star drifts past in 268/sinθ seconds (where θ is the angle between the slit and the apparent path of the star; 66° for the example below). Repeated drifts across the slit will build up the exposure time, and they will also sample different parts of the detector and different internal occulter positions. The detector masks will cover the entire spectral ranges of the UV detectors at full spatial and spectral resolution. In order to meet telemetry limitations with several readouts during the drift across the slit (1-2 minute), only about 19 (TBC) pixels in the spatial direction will be read out. It will be necessary to select different grating positions for the different crossings to cover the full wavelength ranges. The direct O VI and Redundant Ly α contributions fall on top of each other in the O VI channel. This is not a problem for the sparse emission line spectrum of the corona, but it is a problem for a stellar continuum. Different grating positions will place the deep stellar Lyman absorption features at different positions.

Details of the mirror motions and slit width depend upon the target star and the distance from Sun center. As an example, we consider the approach of ω^1 Sco to the east limb on Nov. 26. We conservatively take a dwell time much larger than the crossing time. As we gain experience with the satellite, more efficient choices can be made. A single drift across the aperture should provide about 430 counts per pixel at 1240 Å and 50 counts per pixel at 1040 Å (with about 93 counts per pixel superposed from the Redundant Lyα contribution) when the star is at 2.37 $R_\odot$ (assuming the spectrum to be 2 pixels high). The internal occulter will reduce these values to 155 and 21 counts per pixel, respectively, at 1.5 $R_\odot$. This sequence includes 14 drifts across the slit, one of which crosses the WLC.

UVCS

Initial instantaneous FOV	133"x11"
Initial height	2.37 $R_\odot$
Roll Angle	66°
Pixel	7"x7"
Spectral Resolution	0.14 Å Ly α channel, 0.09 Å O VI channel
Dwell time	1460 seconds
FOV stepped by	0.067 $R_\odot$ down to 1.5 $R_\odot$
Initial grating position	-500
Grating stepped by	250 pixel shift
Total time	5.9 hours

SUMER

LASCO