IUE Camera Sensitivity Variations

A check for sensitivity variations of the IUE cameras has been carried out by analyzing a subset of the repeated observations of low dispersion standard stars. The SWP spectra, discussed below, suggest a sensitivity decrease of 1%/year at 1300Å, 4%/year at 1550Å, and 5%/year at 1850Å. Too few LWR spectra have been analyzed to give values for sensitivity changes but the analysis shows that any changes are small. The apparent changes for both cameras do not correspond to the changes expected from particle radiation damage to the MgF_2 windows (Heath and Sacher 1966).

Large-aperture point-source spectra for three stars were analyzed by comparing them to reference spectra obtained in mid 1978. The reference spectra for BD+28°4211 and for HD 93521 were taken with the same exposure time as the later spectra. For HD 60753 the reference spectrum had an exposure 20% longer than the later spectra. The comparison was accomplished by ratioing each sample by the corresponding sample in the reference spectrum. Then the ratios were plotted as a function of wavelength and they were binned in convenient wavelength bands. (Fig. 1 shows a typical plot for the ratio of SWP 6024 to SWP 2139.) The averaged ratios were corrected for the variation of camera sensitivity with temperature by -0.83% per °C of THDA. The SWP spectra used in this study had been processed with the good ITF (Holm 1979) or corrected by use of the quadratic decomposition algorithm (Holm and Schiffer 1980).

The SWP data used are summarized in Table 1. The column labeled "600 Å Ratio" gives the averaged ratios in the 600Å band centered on 1550Å. The three columns labeled "150Å Ratio" give the averaged ratios in bands whose wavelength limits are given approximately in the heading. The column labeled "R_{THDA}" gives the multiplicative factor used to correct for differences in camera temperature. The reference spectra (SWP 2139 for BD+28°4211, SWP 1955 for HD 93521, and SWP 1752 for HD 60753) are included in the table. The four spectra whose image numbers are followed by a "Q" were corrected by the quadratic decomposition algorithm.

Figure 2 shows the 150Å ratios plotted as a function of time.

The LWR data are summarized in Table 2 and Figure 3. The column labeled "800Å Ratio" represents the averaged ratio in the 800Å band centered on 2600Å. Not much weight can be attached to the observed variations because an earlier study showed that the 1σ deviation for spectra averaged in 100Å bins at 2400Å, 2600Å, and 2900Å was 2% after correction for temperature variations. Nonetheless these data show that there have been no major changes in sensitivity in the bands analyzed. In particular the strong absorption band centered at 2600Å in radiation-damaged MgF_2 (Heath and Sacher 1966) has not begun to develop.

The purpose of this note has been to alert users to evidence for a slight change in the sensitivity of the SWP camera. This change is not known sufficiently accurately nor in sufficient detail to correct derived fluxes. The study of the change will be improved with the inclusion of more corrected spectra as they become available and with improved software for modeling the change.

Albert V. Holm

Francis H. Schiffer III

References

Heath, D. F., and Sacher P.A. 1966, Applied Optics, 5, 937.

Holm, A. V., 1979, NASA IUE Newsletter, No. 7, p. 27.

Holm, A. V., and Schiffer, F. H., 1980, NASA IUE Newsletter, No. 8, p. 45.

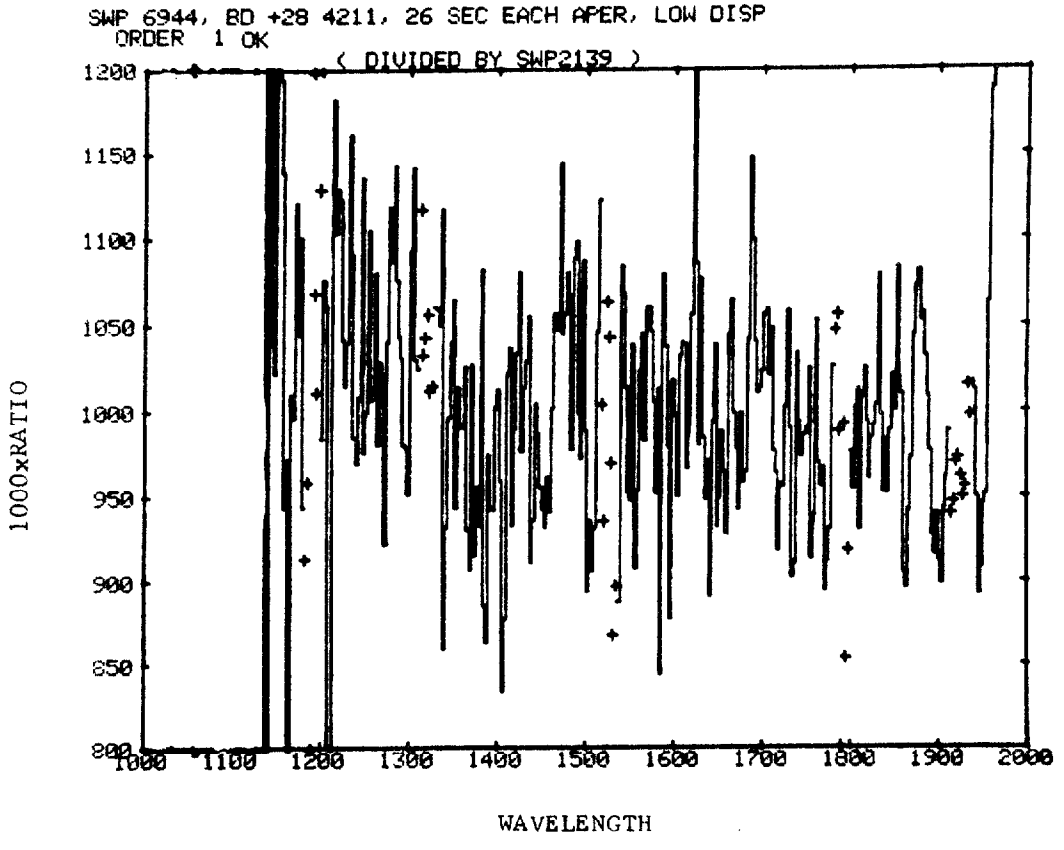

Fig. 1- A sample plot of the ratio of a recent SWP spectrum to the mid 1978 reference spectrum.

TABLE 1

Summary of SWP Sensitivity Variation Data

Target	Image	Date	600Å Ratio	150Å Ratios 1225-1375Å	1475-1625Å	1775-1925Å	R_{THDA}
+28°4211	SWP2059	1978/201	1.008	1.009	1.010	0.993	0.944
	SWP2139	1978/210	1.	1.	1.	1.	1.
	SWP2422.Q	1978/243	0.945	0.957	0.939	0.930	0.910
	SWP2505.Q	1978/249	0.940	0.942	0.937	0.961	0.906
	SWP4875	1979/096	0.924	0.979	0.905	0.905	0.914
	SWP5416	1979/151	0.953	1.003	0.948	0.911	0.925
	SWP5741	1979/188	0.946	0.961	0.946	0.920	0.930
	SWP5906	1979/204	0.948	1.000	0.939	0.922	0.928
	SWP6024	1979/213	0.920	0.946	0.923	0.892	0.926
	SWP6943	1979/295	0.937	0.971	0.929	0.918	0.944
	SWP6944	1979/295	0.943	0.970	0.950	0.925	0.944
	SWP7808	1980/029	0.925	0.966	0.920	0.911	0.934
HD93521	SWP1955	1978/191	1.	1.	1.	1.	1.
	SWP1956	1978/191	1.023	1.006	1.039	1.030	0.978
	SWP3355.Q	1978/319	1.008	1.005	1.009	1.009	0.959
	SWP3356.Q	1978/319	1.029	1.021	1.020	1.047	0.959
	SWP4350	1979/054	1.014	1.022	1.019	0.992	0.973
	SWP5664	1979/179	0.992	1.008	1.003	0.982	0.963
	SWP5743	1979/188	0.966	0.988	0.969	0.954	0.958
	SWP6958	1979/295	0.968	1.004	0.948	0.951	0.979
	SWP7057	1979/305	0.953	0.974	0.945	0.935	0.974
	SWP7058	1979/305	0.965	1.001	0.954	0.952	0.974
	SWP7978	1980/049	0.965	0.999	0.967	0.940	0.981
HD60753	SWP1752	1978/160	1.	1.	1.	1.	1.
	SWP4315	1979/051	0.937	0.954	0.943	0.940	1.014
	SWP5905	1979/204	0.942	0.972	0.952	0.934	1.002
	SWP6703	1979/274	0.940	0.974	0.960	0.917	0.998
	SWP7143	1979/318	0.938	0.963	0.949	0.928	1.006

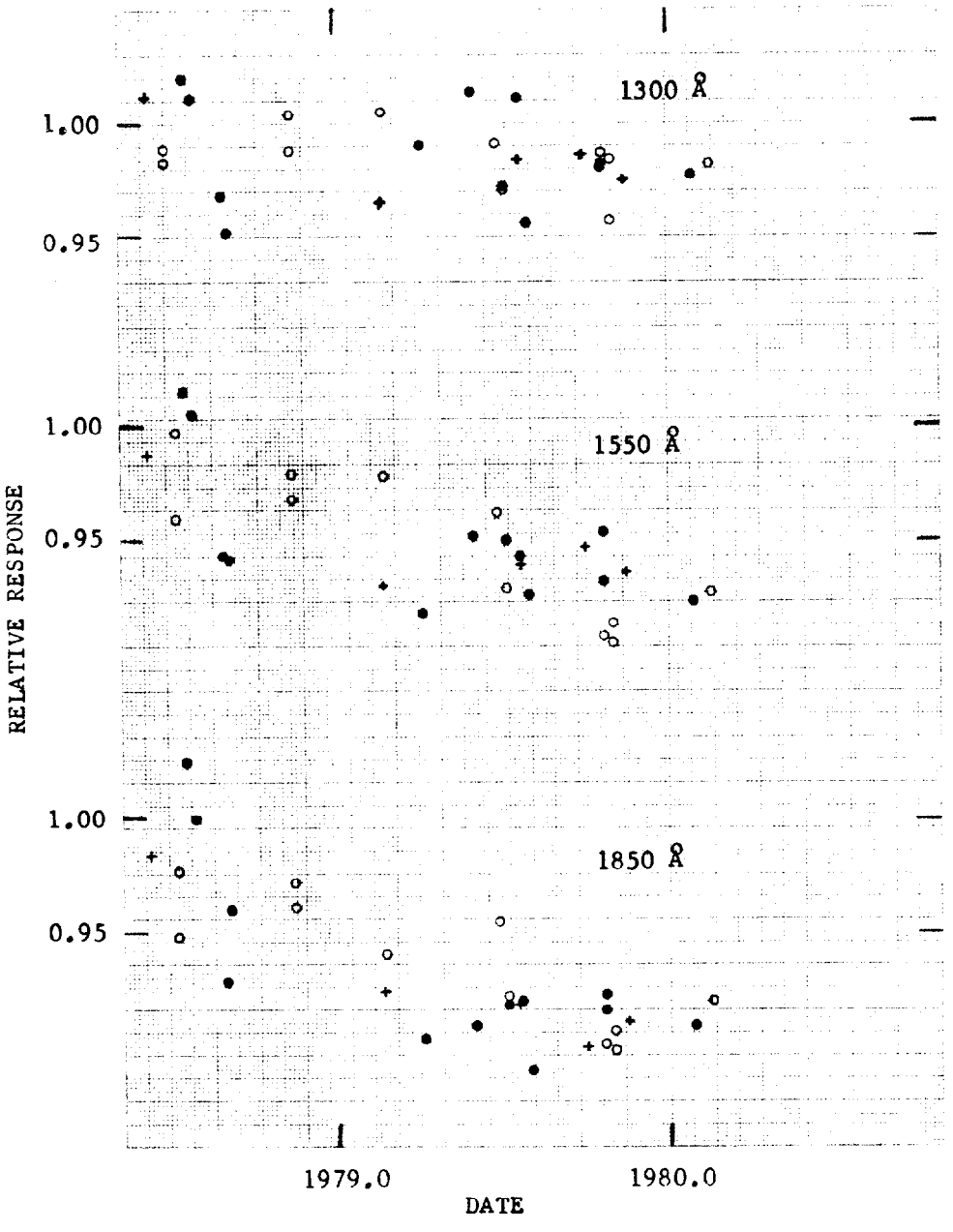

Fig. 2- SWP sensitivity variations for 150 Å bands derived from spectra of BD+28°4211 (•), HD 93521 (o), and HD 60753 (+). In this figure the ratios given in Table 1 have been renormalized to give better dispersions about a linear regression to the data for the three stars.

TABLE 2

Summary of LWR Sensitivity Variation Data

Target	Image	Date	800Å Ratio	100Å Ratios 2390Å	2595Å	2900Å	R_{THDA}
HD93521	LWR1589	1978/152	1.	1.	1.	1.	1.
	LWR1805	1978/191	1.026	0.993	1.016	1.090	0.980
	LWR2942	1978/319	1.035	1.026	1.023	1.074	0.969
	LWR2943	1978/319	1.046	1.032	1.020	1.100	0.972
	LWR5912	1979/295	1.030	0.953	1.029	1.089	0.983
	LWR6950	1980/049	1.003	0.955	1.052	1.031	0.983

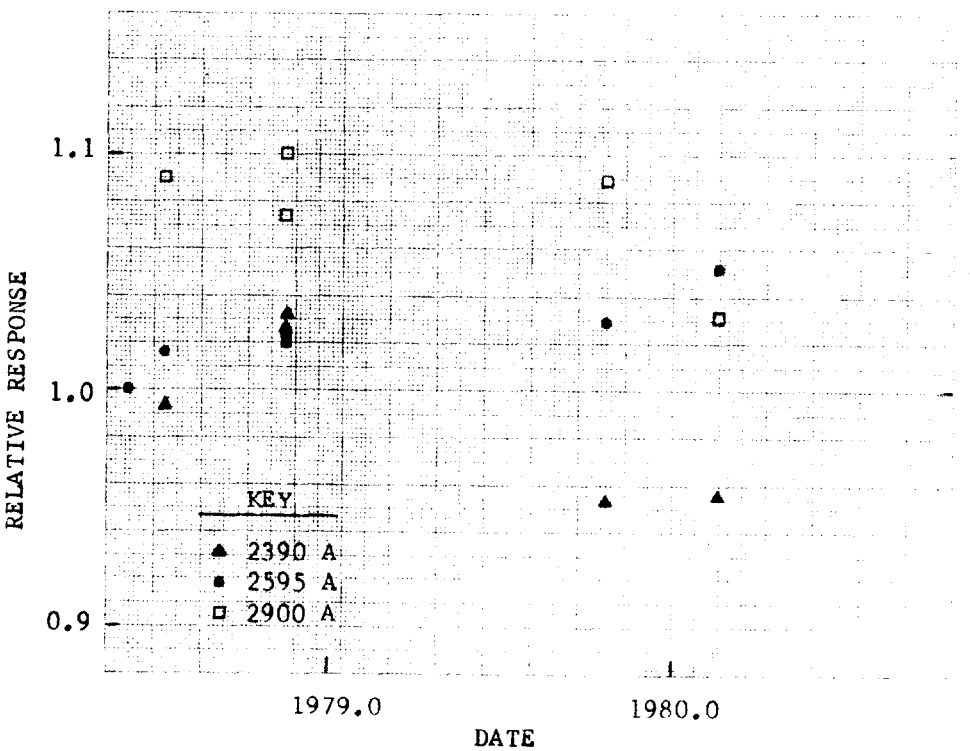

Fig. 3- LWR sensitivity variations for 100 Å bands derived from spectra of HD 93521.