

RESPONSE TIME OF THE IUE CAMERAS
AT THE UVC SETTING OF -5.0 KV

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Abstract

The response times of the IUE cameras at the UVC setting of -5.0 kV are redetermined, and found to be consistent with previous determinations. The response times are 114 (± 6) msec for the LWP camera, 114 (± 7) msec for the LWR camera, and 125 (± 8) msec for the SWP camera.

Introduction

The actual exposure time for an IUE spectrum is, in general, not exactly equal to the exposure time requested by an observer on the script. One reason for this difference is that the exposure time performed by the on-board computer is an integer multiple of 0.4096 seconds (one "OBC tic"). The requested exposure time is always rounded down to an integral number of OBC tics.

Another reason for the difference in requested and actual exposure times arises from the fact that a significant amount of time is required to bring the UVC and SEC voltages up for the exposure and to bring the voltages back down again. Thus, there is a net response time for each camera. The actual exposure time is just the requested exposure time rounded down to the next lowest multiple of 0.4096 seconds, minus the response time. For example, a requested exposure time of 1.0 sec is rounded down to 0.819 sec (2 OBC tics) and, assuming a response time of 0.120 sec, results in an actual exposure time of approximately 0.699 sec.

At present, three cameras are available to guest observers for obtaining IUE spectra: the LWP and SWP cameras at a UVC setting of -5.0 kV, and the LWR camera at a reduced UVC setting of -4.5 kV (Imhoff 1985). A recent determination was made of the response time of the LWR camera at the UVC setting of -4.5 kV (Crenshaw 1986). Since response times were determined for the three operational cameras at a UVC setting of -5.0 kV a number of years ago, it was decided to redetermine these values with new data.

The procedure used is essentially identical to that used by Crenshaw (1986). A single exposure of duration N OBC tics is taken and compared to a multiple exposure obtained with M exposures of duration one OBC tic, where N and M are chosen to produce spectra of about the same DN level. The ratio of the flux numbers at a given wavelength for the two spectra is then:

$$R = \frac{FN(M)}{FN(1)} = \frac{M * (0.4096 - T_r)}{(N * 0.4096) - T_r},$$

where FN(1) is the flux (in flux numbers) for the single exposure, FN(M) is the flux for the multiple exposure, and T_r is the response time. The equation can be solved for T_r :

$$T_r = 0.4096 * \frac{M - (R * N)}{M - R} .$$

Results

Low dispersion spectra of HD 93521 (spectral type 09 V) were obtained; the observations are listed in Table 1. For each camera, a single optimum exposure was taken before and after the spectra obtained with multiple exposures. The number of multiple exposures was chosen so that the flux levels would be similar to those for the single exposures, in order to avoid errors that arise from nonlinearities in the Intensity Transfer Function (Holm et al. 1982).

Fluxes in 100 A bins were determined for portions of the spectra with flux numbers greater than 10,000, and ratios of the binned fluxes were calculated. The fluxes for the single exposure spectra are in good agreement: the average ratio is 0.982 (± 0.020) for LWP 9860/LWP 9863, 0.996 (± 0.015) for LWR 17992/LWR 17996, and 0.993 (± 0.014) for SWP 29610/SWP 29613. The two single exposure spectra for each camera were averaged to produce a reference spectrum.

The ratio of flux numbers for the multiple exposure spectra to those for the reference spectra for each 100 A bin is given in Tables 2, 3, and 4. The average ratio "R" is also given, as well as the standard deviation for this value. Substitution of this value into the equation for the response time " T_r " results in the values given in the tables. For each camera, an average response time is calculated, and a maximum uncertainty in the response time is estimated from the standard deviations of ratios for different bins and for different multiple exposure spectra. Thus, the response times are 114 (± 6) msec for the LWP camera, 114 (± 7) msec for the LWR camera, and 125 (± 8) msec for the SWP camera.

Given the uncertainties, the values of the response time agree well with those obtained previously. Imhoff (1984) determines the response time of the LWP to be 126 (± 16) msec, and Schiffer (1980) determines the response time for the LWR and SWP cameras to be 120 (± 15) msec. Since there is no evidence that the response time has changed, the IUE staff will continue to use a value of 120 msec for the calibration of all three cameras.

References

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- Holm, A., Bohlin, R. S., Cassatella, A., Ponz, D. P. and Schiffer, F. H., III 1982, Astron. Astrophys., 112, 341.
- Imhoff, C. L. 1984, NASA IUE Newsletter, No. 24, 24.
- Imhoff, C. L. 1985, NASA IUE Newsletter, No. 28, 7.
- Schiffer, F. H., III 1980, NASA IUE Newsletter, No. 11, 33.

Table 1
Observations

LWP spectra (1987 Jan. 4)	LWR spectra (1986 Nov. 21)	SWP spectra (1986 Nov. 6)
LWP 9861 - 7 tics	LWR 17992 - 7 tics	SWP 29610 - 7 tics
LWP 9862 - 9 x 1 tic	LWR 17993 - 9 x 1 tic	SWP 29611 - 9 x 1 tic
LWP 9863 - 10 x 1 tic	LWR 17994 - 10 x 1 tic	SWP 29612 - 10 x 1 tic
LWP 9864 - 7 tics	LWR 17995 - 8 x 1 tic	SWP 29613 - 7 tics
	LWR 17996 - 7 tics	

Table 2
Flux Ratios for LWP Spectra

Wavelength (A)	Ratio of FN (LWP 9861/Reference)	Ratio of FN (LWR 9862/Reference)
2000	0.985	1.070
2100	1.009	1.099
2200	0.979	1.056
2300	0.963	1.059
2400	0.945	1.080
2500	0.948	1.076
2600	0.961	1.080
2700	0.960	1.091
2800	0.957	1.084
2900	0.960	1.068
3000	0.960	1.070
Mean	0.966	1.076
St. Dev.	0.018	0.013
Response time	114 (\pm 6) msec	113 (\pm 4) msec

Table 3
Flux Ratios for LWR Spectra

Wavelength (A)	Ratio of FN (LWR 17993/Ref.)	Ratio of FN (LWR 17994/Ref.)	Ratio of FN (LWR 17995/Ref.)
2000	0.968	1.110	0.884
2100	0.952	1.094	0.859
2200	0.962	1.081	0.843
2300	0.970	1.069	0.880
2400	0.954	1.075	0.861
2500	0.963	1.072	0.869
2600	0.985	1.072	0.839
2700	0.975	1.079	0.850
2800	0.969	1.085	0.846
2900	0.971	1.060	0.844
3000	0.949	1.049	0.825
Mean	0.965	1.077	0.855
St. Dev.	0.011	0.016	0.018
Response Time	114 (\pm 3) msec	113 (\pm 5) msec	116 (\pm 7) msec

Table 4
Flux Ratios for SWP Spectra

Wavelength (A)	Ratio of FN (SWP 29611/Reference)	Ratio of FN (SWP 29612/Reference)
1300	0.953	1.029
1400	0.955	1.036
1500	0.948	1.036
1600	0.944	1.006
1700	0.959	1.028
1800	0.944	1.013
1900	0.955	1.004
Mean	0.951	1.022
St. Dev.	0.006	0.014
Response Time	119 (\pm 2) msec	130 (\pm 4) msec