

PHOTOMETRIC CONSEQUENCES OF THE MICROPHONIC AVOIDANCE TECHNIQUE

The resident astronomers have completed the minimal testing required to detect any serious photometric errors which might be introduced by the LWR ping avoidance technique (in which the heater warmup time before the read is extended by 4 minutes). The testing consisted of sequences of alternating normal and ping avoidance reads. No significant differences could be found in the net extracted spectra of well exposed images. Flat field images did indicate that the gross flux number is marginally higher in the ping avoidance reads i.e. the target is read out more heavily after the extended heater warmup. Much of this would cancel out in the background subtraction for the net spectra. No careful study of linearity has been made. However, the natural variations along the spectra due to spectral sensitivity and grating blaze, and the high order echelle spectra where the interorder background is high, provide a zero-order verification of linearity. Only a few strong absorption lines have been studied.

We therefore believe that there will be many instances in which the observer can gain the benefits of ping avoidance without significant photometric error. Our test results are described below in some detail since the comparisons of the spectra are of general interest as an illustration of the repeatability and signal/noise of LWR spectra.

A) Studies of flat field images

Based on 3 sequences totalling 7 images in all, we find that the ping avoidance nulls have 97 ± 64 flux numbers (FN) more than the null read normally. Based on only one series of 3 tungsten flood lamp exposures, we found the intermediate level exposures to be about 60 FN brighter when read with the ping avoidance technique. The available data is consistent with the change in FN being insensitive to exposure level.

B) Studies of low dispersion, trailed spectra

A sequence of 4 exposures, each a 31.2 s trail on HD60753, was obtained as follows:

LWR10930	test read	
LWR10931	normal read	here, 'test read' refers to the ping
LWR10932	test read	avoidance read
LWR10933	normal read	

To study differences between the derived net fluxes, we studied ratios of the net flux spectra. The ratio of two normal reads illustrates the expected level of repeatability and signal/noise. Several typical examples are shown on the next page.

C) Studies of low dispersion, point spectra

A sequence of three 24 s exposures of BD+75°325 was obtained, sandwiching a test read between two normal reads. Again, the test spectrum agreed within the expected limits for normally read spectra.

A Technique for Avoiding Microphonics on the LWR Camera

It is possible to reduce the probability of contamination of LWR images by microphonic noise "pings" by extending by 4 minutes the warmup of the cathode heater prior to the read. As seen in the table below, the probability of a ping is reduced from about 80% to about 15%. Furthermore, the pings which do occur tend to fall much higher in the image, averaging 1/7 of the way down from the top. In contrast, the pings in normally read images tend to fall about 1/3 of the way up from the bottom.

The effects of the extended heater warmup on other aspects of the spectral images are yet to be fully explored. However, some testing for photometric changes is described in the attached report. While a slight change in flat field images is detectable, no significant effects were discerned in the net spectra extracted from well exposed images.

At the present, the observatory staff recommends that this technique be used only when as warranted by the benefits of ping avoidance. Observers are urged to evaluate the test results in the context of their particular program. Note that the read will require an extra 4 minutes.

The read procedures have been modified so that the telescope operators can perform the ping avoidance reads routinely when requested on the observing form.

LWR Ping Statistical Data

type of read	No. of images	% with a ping	y*	y range	period
4 ^m extra warmup	114	15	790	615-895	Spring '81
normal warmup	312	85	435	154-727	Spring '81

* y is line number; y=895 at the top and 127 at the bottom of the image.

For the low dispersion spectra,

$$\text{wavelength (A)} = \begin{cases} 5184 - 4.662 * y & \text{large aperture} \\ 5281 - 4.662 * y & \text{small aperture} \end{cases}$$

For the high dispersion spectra,

Mg II λ 2795 is at y \approx 320

Mg II λ 2803 is at y \approx 230 in order 83 and at y \approx 650 in order 82.

D) Studies of high dispersion spectra

Four 26 s exposures of Lambda Leporis, Bl IV, were obtained in the order:

LWR11196 normal read
 LWR11197 test read
 LWR11198 normal read
 LWR11199 test read

Ratios between the test reads and the normal reads were formed for the extracted spectra for orders 81,82,83 and 100. Several typical results are shown on the next page.

Equivalent widths, residual intensities, and radial velocities were checked for the MgII lines and for the sharp interstellar FeII line at 2599 A in order 89. The values for LWR9758 are also given to indicate the dispersion among normally read images widely separated in time.

Image	type	2795 A (order 83)			2803 A (order 82)			both	
		EW (A)	% residual	V_r	EW (A)	% residual	V_r	V_r	V_r
LWR11196	N	0.543±.002	-0.9±0.9	12.1	0.451±.003	8.0±0.0	-10.1	10.4	
LWR11197	T	0.500 .002	-0.8 0.8	15.5	0.455 .003	9.7 0.2	-5.0	14.6	
LWR11198	N	0.499 .007	-0.3 0.1	12.1	0.468 .002	6.9 0.1	0.0	15.4	
LWR11199	T	0.500 .007	-1.3 0.6	15.5	0.436 .003	3.9 0.2	-1.6	16.4	
mean	-	0.511±.022	-0.8±0.4	13.8	0.453±.013	7.1±2.4	-4.2	14.2	
LWR 9758	N	0.525±.010	-0.1±0.2	40.3	0.427±.011	1.8±0.1	66.9	43.0	

Image	type	2599 A (order 89)		
		EW (A)	% residual	V_r
LWR11196	N	0.337±.002	9.5±0.0	11.7
LWR11197	T	0.340 .004	12.2 0.5	11.7
LWR11198	N	0.349 .006	10.8 0.4	11.7
LWR11199	T	0.324 .006	12.0 0.0	11.1
mean	-	0.338±.010	11.1±1.2	11.6±0.3
LWR 9758	N	0.318±.002	13.8±0.1	42.1

Note on velocities: The velocities were corrected for earth and spacecraft motions. The difference of more than 25 km/sec between LWR9758 and the images LWR11196-11199 appears to be a good example of thermal shifts. LWR9758 was taken with THDA = 17.0°C, and was processed with the mean calibrations. LWR11196-11199 were taken at THDA ~ 12.5°C, and were processed with the new processing scheme which includes empirical THDA corrections (Thompson, Turnrose, Bohlin IUE Newsletter 15, p.8). Figure 14 on p. 51 IUE Newsletter No. 15 indicates that the wavelengths reported for LWR9758 would be too large by ~22 km/s, so its velocity should be decreased by this amount.

A.V. Holm

R. J. Panek

September 11, 1981

LOW DISPERSION TRAILED SPECTRA

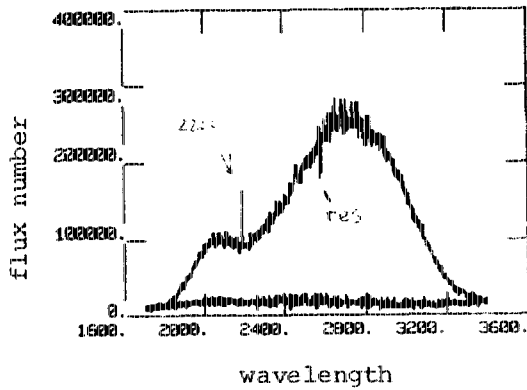


FIG 1: Gross spectrum LWR10930

The hot pixel near 2200 Å and a reseau mark are flagged.

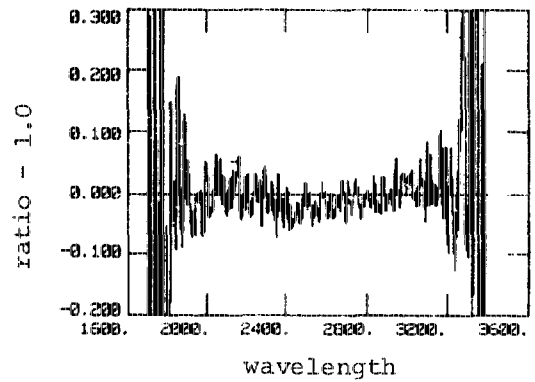


FIG 2: Ratio of test read/normal read
LWR10930/LWR10931 smooth 5 pixels

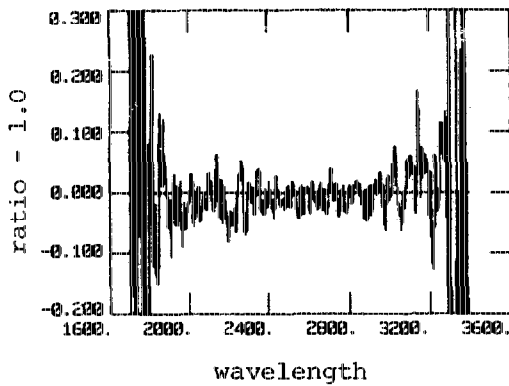


FIG 3: Ratio of test read/normal read
LWR10932/LWR19033 smooth 5 pixels

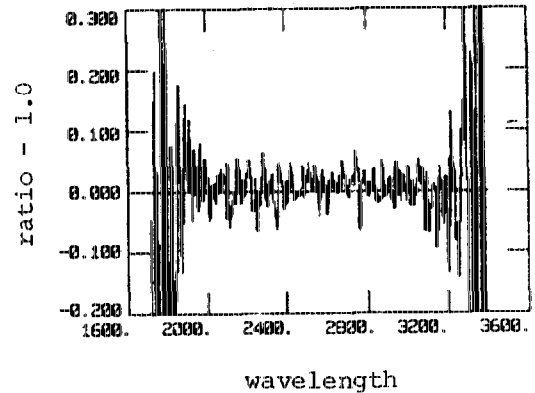


FIG 4: Ratio of normal read/normal read
LWR10933/LWR10931 smooth 5 pixels

Illustrates the expected level of repeatability.

HIGH DISPERSION SPECTRA

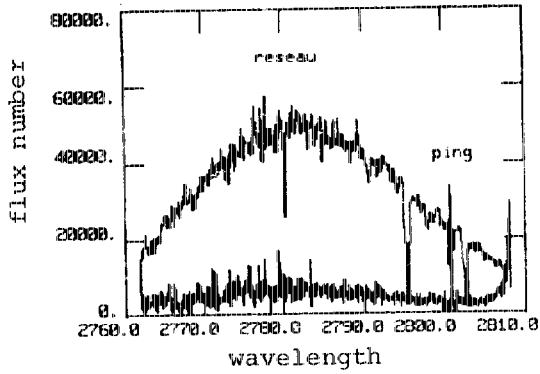


FIG 5: Order 83 Gross spectrum
and background LWR11196

The MgII lines are evident at 2795, 2803 A. A reseau mark and the ping are marked.

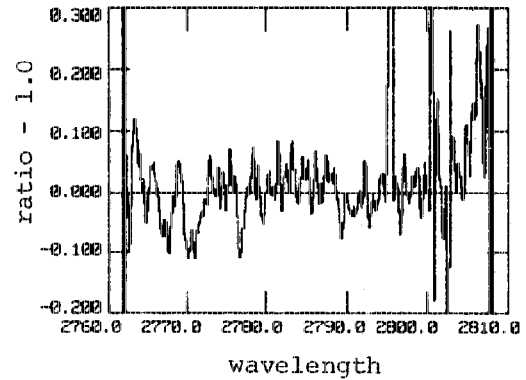


FIG 6: Order 83 Ratio
Test read/normal read
LWR11197/LWR11196

The effect of the ping is seen near 2801 A. The ratio also differs markedly from unity at the MgII lines.

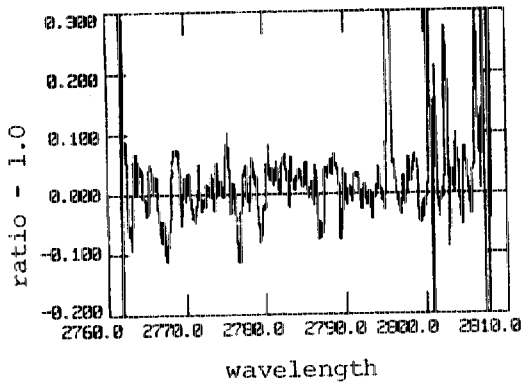


FIG 7: Order 83 Ratio
Normal read/normal read
LWR11198/LWR11196

Again the ping is apparent, and the ratio is extreme at the MgII lines.

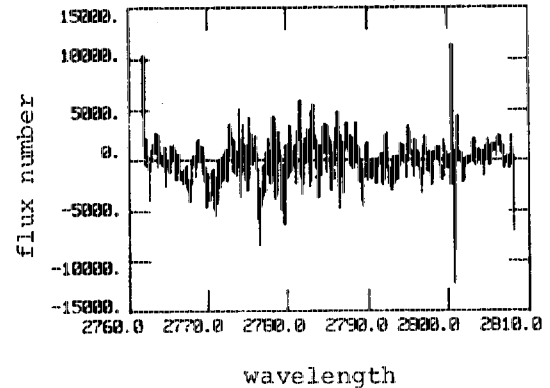


FIG 8: Order 83 Difference
Test read - normal read
LWR11197 - LWR11196

The ping is evident, but the difference is smooth across the MgII lines. This indicates that the anomalous ratio there is due to the noise inherent in very deep lines.