IUE DATA REDUCTION

The purpose of this memo is to document charges in the IUE data reduction procedures in a way that will allow the astronomer to evaluage the quality of previously reduced spectra, and to date those changes so that the method of reduction can be traced.

I. High Dispersion Data Extraction 5/22/78

Several runs were recently made for the purpose of comparing different schemes of data extraction on IUE high dispersion images. The one most significant improvement in the result of shifting the dispersion constants rather than shifting the image. (Part of this gain in quality might be achieved by using the new version of OSCRIBE, in which a bug that caused the overlay to be shifted by +1 pixel in the sample direction is fixed. It is, however, more efficient in computer time, as well as more precise, to re-calculate the dispersion constants).

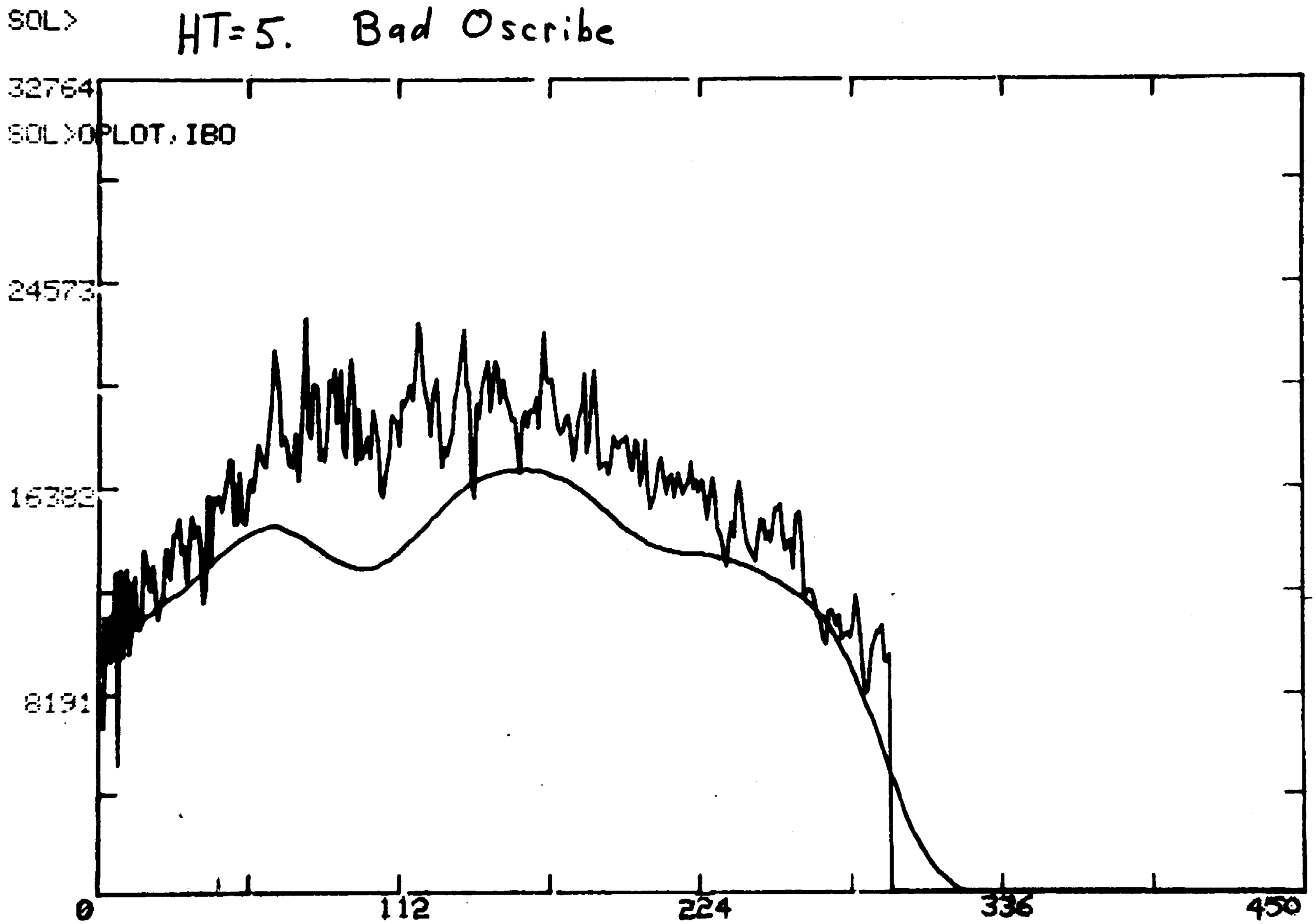
Figure 1 shows order 113 for LWR 1171, a large aperture observation of ηUMa, as processed when the image was shifted. The gross spectrum and the smoothed background are shown.

Figure 2 shows the same data as extracted with re-derived dispersion coefficients, with a pseudoslit height of 5 pixels. (Program CUTMERGE has been run on the Figure 1 data, but not on Figure 2).

The plots in Figure 3 are the differences between the gross and the background in the previous examples, as well as with HT=7. The net spectra extracted with slit heights of 5 and 7 are almost coincident, just touching the zero line at the reseau at about point 345. Since the reseau does not obscure the entire signal at that point, we are reminded that the background shown in Figure 2 is still too large. The net spectrum from the shifted image goes below zero, even in the center of the order; and spurious dips are introduced by the off-center background.

The equality of the NET spectra for HT=5 and HT=7 is somewhat surprising for two reasons. First, the larger slit did not sample significant additional amounts of the adjacent orders near 113 at the short wavelengths. Thus, even for this large aperture spectrum, HT=5 seems to seperate the orders well down to 2000Å on the LWR camera. The second surprise is that at the longer wavelengths in Figure 4 for order 83, the NETS of HT=5 and 7 are again nearly equal. Since little additional signal is picked up with HT=7, we infer that the "wiggles" in the order are not of prime importance in loss of signal. Instead, the broad and noisy dip near point 210 seems to be caused by pseudo-periodic noise in the image. This noise is being investigated further.

R. Bohlin



SOL>
HT=5. Bad Oscribe
32764
SOL>OPLOT,IBO
24573
16382
8191
0
112
224
336
450

Figure 1

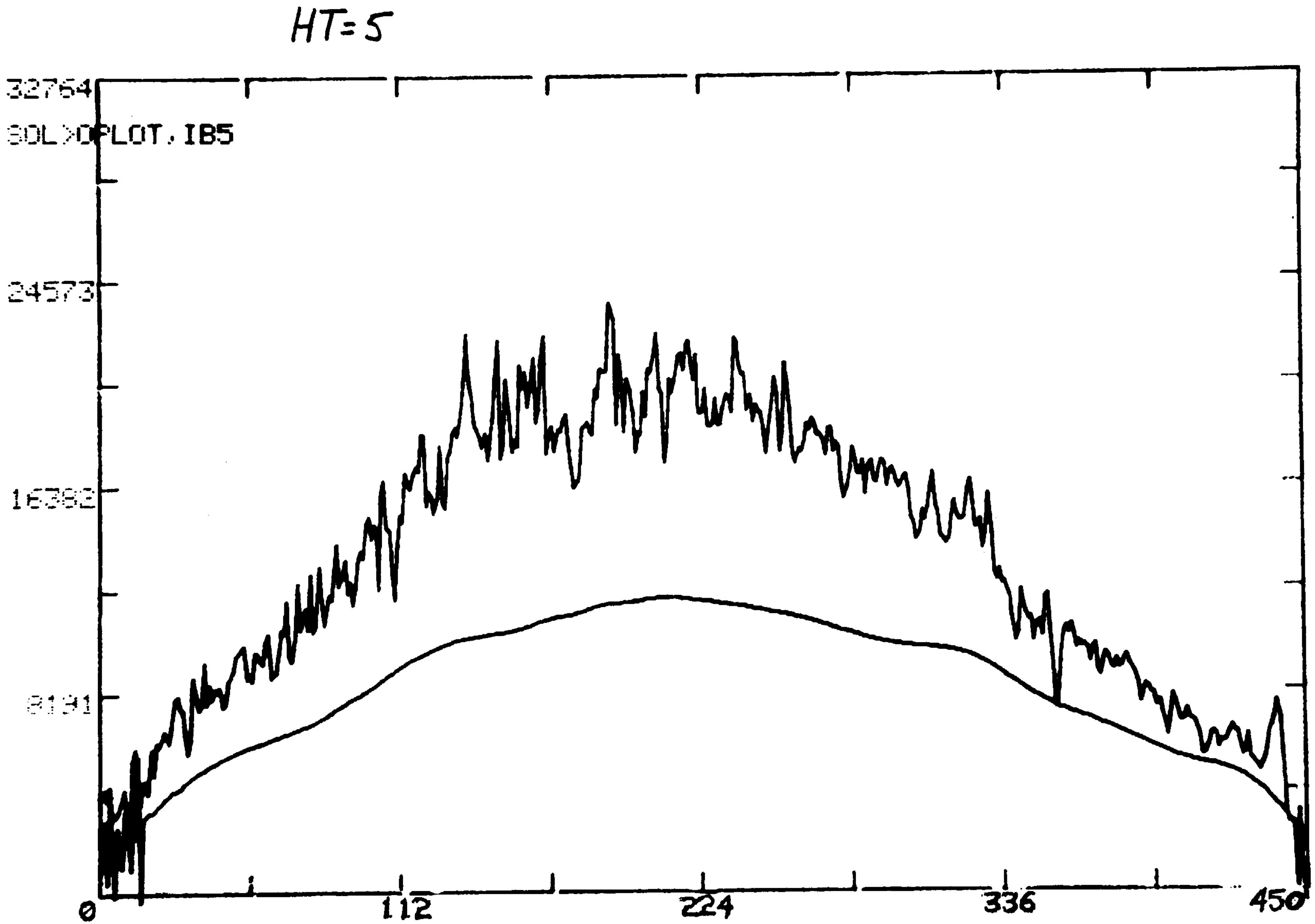


Figure 2

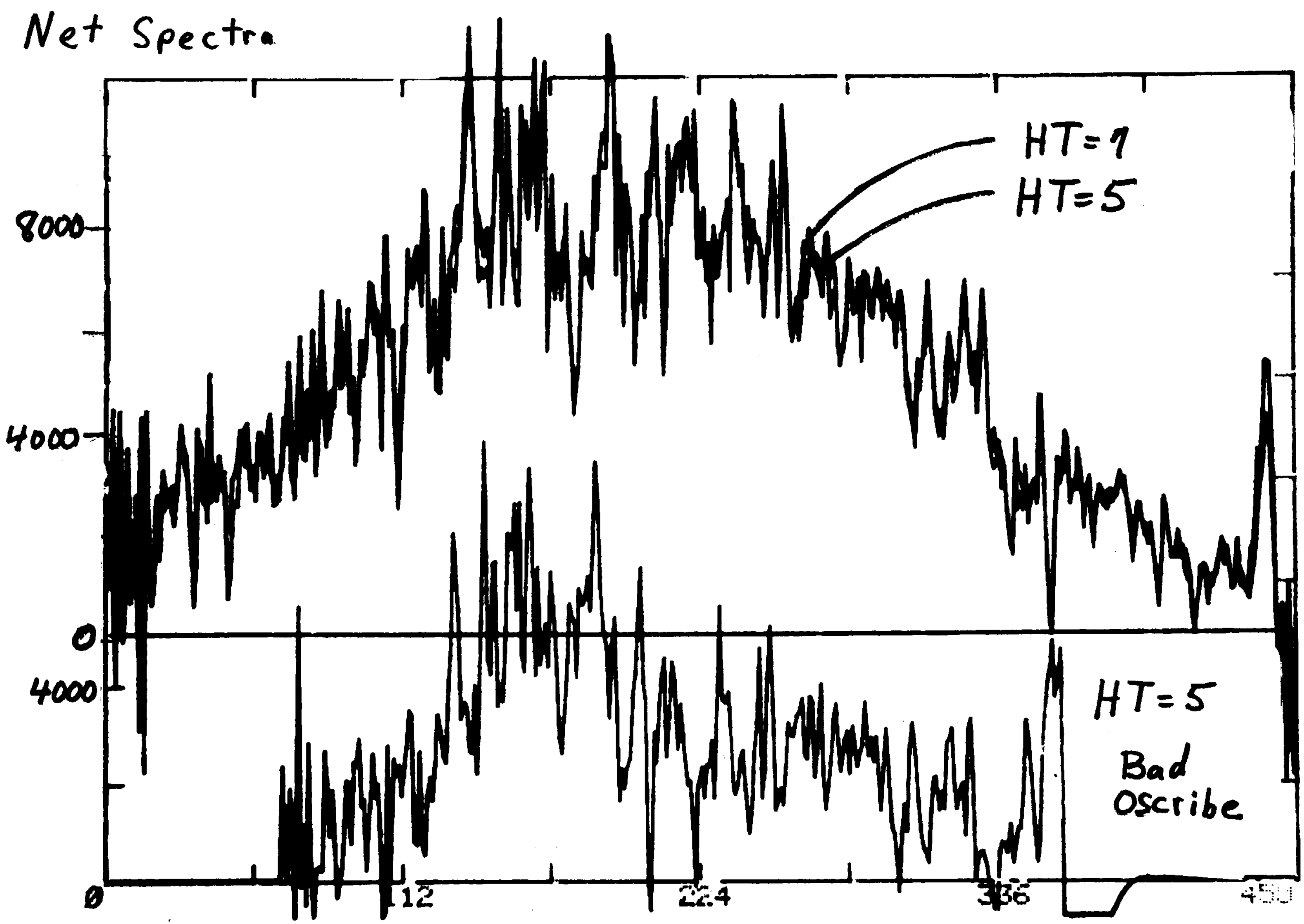

Net Spectra
8000
4000
0
4000
0
112
224
336
450
HT=1
HT=5
HT=5
Bad
Oscribe

Figure 3

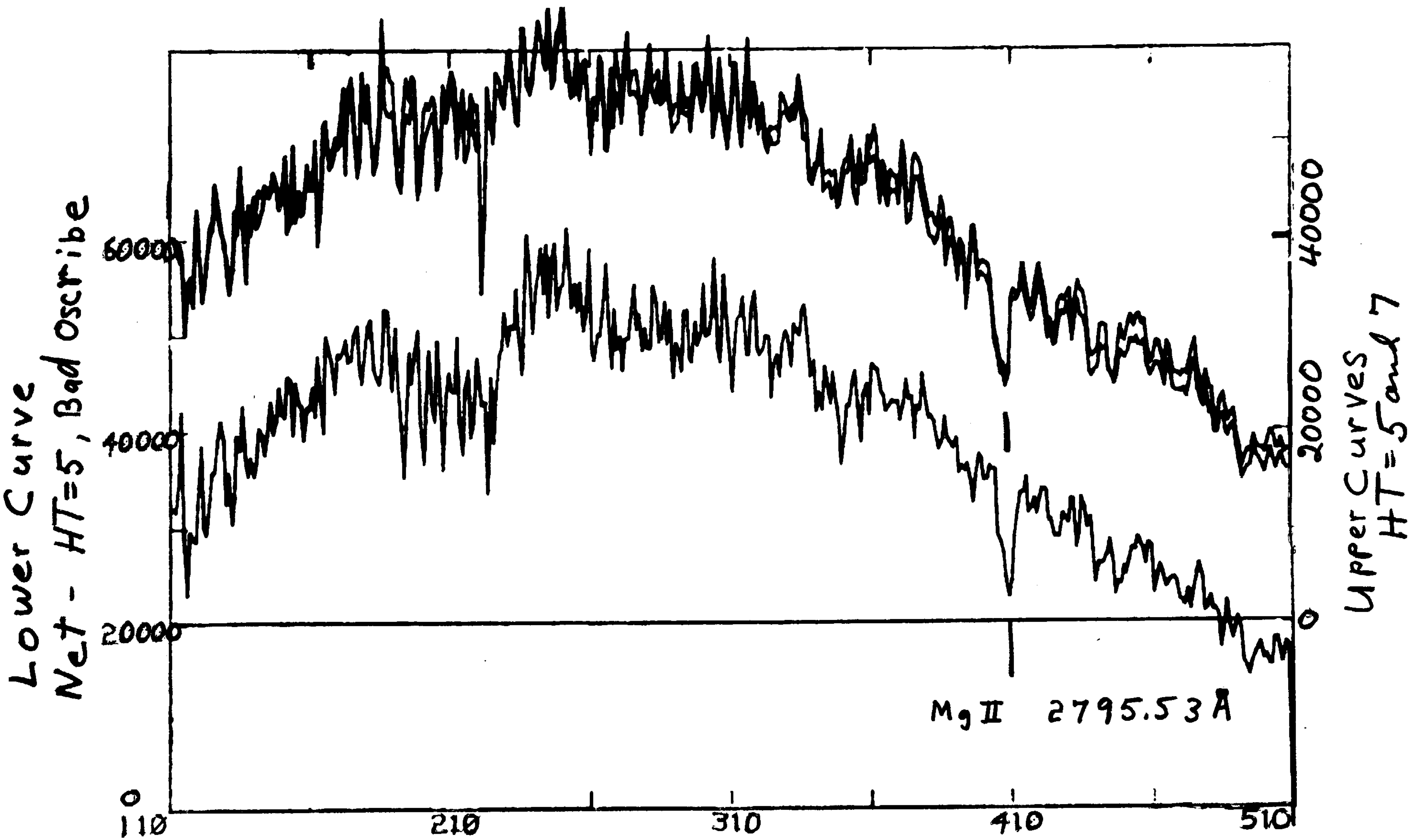

Lower Curve
Net - HT=5, Bad Oscribe
60000
40000
20000
0
110
210
310
410
510
40000
20000
0
Upper Curves
HT=5 and 7
Mg II 2795.53 Å

Figure 4

9-14-78

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II. Radial Velocities in High Dispersion using the Small Apertures.

Heliocentric radial velocities of interstellar lines in the high dispersion spectrum of η UMa were measured in repeated exposures. The measurement accuracy is ± 2 km s^{-1} for SWP and ± 1 km s^{-1} for LWR. The positions of lines within one image agree to this accuracy, testifying to the internal consistency of the wavelength assignments. There does seem to be a small zero point shift from one image to the next for times Δt on the order of a few hours from the last WAVECAL image. The total spread in mean velocities V of the 4 images is 7.5 km s^{-1}, and the spread is 7.1 km s^{-1} after correcting for the satellite orbital velocity V_{sat} to get the true heliocentric velocities $V_{\odot}$. Since the satellite orbital velocity is ± 4 km s^{-1}, that correction should be made to the wavelength to get the best estimates of absolute velocities.

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Heliocentric Radial Velocities of Interstellar Lines in η UMa

IMAGE	Δt (hours)	ION	λ (Å)		V (km s^{-1})	Vsat	V⊙
SWP1185	-2.1	OI	1302.169		-4.4		
		C II	1334.532		-3.8		
			Mean	=	-4.1	-.2	-4.3
SWP1186	-1.0	OI			-2.1		
		C II			+1.8		
			Mean	=	-.2	+.5	+.3
LWR1173	+4.6	Mg II	2795.528		+4.0		
		Mg II	2802.704		+2.8		
			Mean	=	+3.4	-1.6	2.8
LWR1174	+6.0	Mg II	2795		+1.3		
		Mg II	2802		+1.2		
			Mean	=	1.2	-1.0	+0.2