Low-Dispersion Quick-Look Sensitivity Monitoring

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Introduction

The low-dispersion sensitivity degradation analysis has been updated to June 1994 for the primary cameras and January 1994 for the LWR. Although the Final Archive processing has begun, it is important to continue this study in order to monitor possible changes in camera sensitivity and provide an up-to-date THDA (Camera Head Amplifier Temperature) coefficient, which is used to correct for variations in camera sensitivity as a function of temperature. In addition, there is concern that the FES scattered light anomaly may adversely affect IUE data (*e.g.*, if the thermal blanket has come loose and is partially obstructing the apertures).

Analysis

The database consists of several hundred observations of the five standard stars. The flux data are ratioed to a reference spectrum for each star (Table 1) and separated into several wavelength bins, each 150Å wide (300Å for the LWR). The binned flux ratios are then fit with a multiple linear regression to find the time rate of change (%/yr.) in each wavelength region and the overall temperature dependence (%/°C) of the camera. The temperature coefficient is assumed to be time independent and is fit to the THDA. The temperature and time dependent coefficients for the three cameras are listed in Table 4. The data are normalized to 1978 and corrected for THDA dependence before being plotted in Figures 1–4.

Table 1: Reference stars used for normalization

STAR	LWP	date	LWR	date	SWP	date
BD+28°4211	3688	1984.5	1712	1978.5	2139	1978.6
HD 93521	3535	1984.4	1589	1978.4	1955	1978.5
HD 60753	3689	1984.5	1642	1978.4	1752	1978.3
BD+33°2642	3610	1984.5	2137	1978.6	4003	1979.1
BD+75°325	3537	1984.4	2748	1978.8	4237	1979.1

Results

The LWP degradation remains quite linear since the 1984–1985 epoch when it became the primary camera. The apparent increase in the rate of degradation, most evident in the short wavelength end of the camera, is due to the 1984.5 jump in sensitivity. The LWR camera continues to show a slowing in the degradation rates after its decomissioning. The rate of SWP degradation, as is the case with the post-1984.5 LWP degradation, has remained relatively stable over the past several years. The sensitivity results, as shown in Tables 2 and 3, are derived using a starting date of 1984.5, which corresponds to the approximate time the LWP became the primary camera. These values indicate an increase in the sensitivity degradation rate for the LWP in all bandpasses when compared with the trends using all the data. The opposite effect can be seen when one uses 1984.5 as the starting/ending point for the LWR regression analysis.

Table 2: Comparison of LWP degradation rates (%/yr.)

Wavelength Region (Å)	1980.4 1984.5	1984.5 1994.3	1980.4 1994.3
2075–2225	+0.58±0.01	−1.33±0.03	−0.91±0.02
2225–2375	−0.76±0.01	−1.68±0.03	−1.40±0.02
2375–2525	−0.44±0.01	−1.59±0.03	−1.31±0.02
2525–2675	−0.30±0.01	−1.53±0.03	−1.29±0.02
2675–2825	−0.41±0.01	−1.34±0.03	−1.16±0.02
2825–2975	−0.06±0.01	−1.14±0.03	−0.96±0.02

Table 3: Comparison of LWR degradation rates (%/yr.)

Wavelength Region (Å)	1978.4 1984.5	1984.5 1994.0	1978.4 1994.0
2250–2550	−2.51±0.08	−1.08±0.06	−1.73±0.03
2550–2650	−1.47±0.08	−1.11±0.06	−1.43±0.03
2750–3050	−1.49±0.08	−0.94±0.06	−1.27±0.03

The THDAs for each observation are plotted in Figure 5. The statistical increase in camera temperatures is less than 1%/yr. when the least-squares analysis of the data is restricted to dates after 1981 (1983 for the LWP).

Table 4: Results of low dispersion sensitivity analysis

LWP Camera
Temperature dependence = -0.23 ± 0.02 (%/°C)
677 data points used in regression

Time Dependence (%/yr.)

Wavelength Region (Å)	1994.3	1990.3	1980.4 to 1988.4	1986.4	1984.8
2075–2225	−0.91±0.02	−0.63±0.04	+0.01±0.07	+0.56±0.12	+0.78±0.19
2225–2375	−1.40±0.02	−1.25±0.04	−0.87±0.07	−0.52±0.12	−0.47±0.19
2375–2525	−1.31±0.02	−1.16±0.04	−0.74±0.07	−0.43±0.12	−0.13±0.19
2525–2675	−1.29±0.02	−1.18±0.04	−0.87±0.07	−0.45±0.12	−0.04±0.19
2675–2825	−1.16±0.02	−1.08±0.04	−0.83±0.07	−0.50±0.12	−0.22±0.19
2825–2975	−0.96±0.02	−0.88±0.04	−0.57±0.07	−0.27±0.12	+0.06±0.19

LWR Camera
Temperature dependence = -0.89 ± 0.04 (%/°C)
416 data points used in regression

Time dependence (%/yr.)

Wavelength Region (Å)	1994.0	1990.3	1978.4 to 1988.1	1986.4	1984.8
2250–2550	−1.73±0.03	−1.90±0.04	−2.06±0.04	−2.49±0.08	−2.38±0.11
2550–2650	−1.43±0.03	−1.47±0.04	−1.51±0.04	−1.73±0.08	−1.77±0.11
2750–3050	−1.27±0.03	−1.34±0.04	−1.34±0.04	−1.73±0.08	−1.87±0.11

SWP Camera
Temperature dependence = -0.46 ± 0.02 (%/°C)
772 data points used in regression

Time dependence (%/yr.)

Wavelength Region (Å)	1994.3	1990.3	1979.5 to 1988.7	1986.3	1984.8
1225–1375	−0.90±0.02	−0.83±0.03	−0.75±0.04	−0.66±0.06	−0.73±0.09
1475–1625	−0.53±0.02	−0.53±0.03	−0.47±0.04	−0.22±0.06	−0.20±0.09
1775–1925	−0.76±0.02	−0.80±0.03	−0.79±0.04	−0.69±0.06	−0.68±0.09

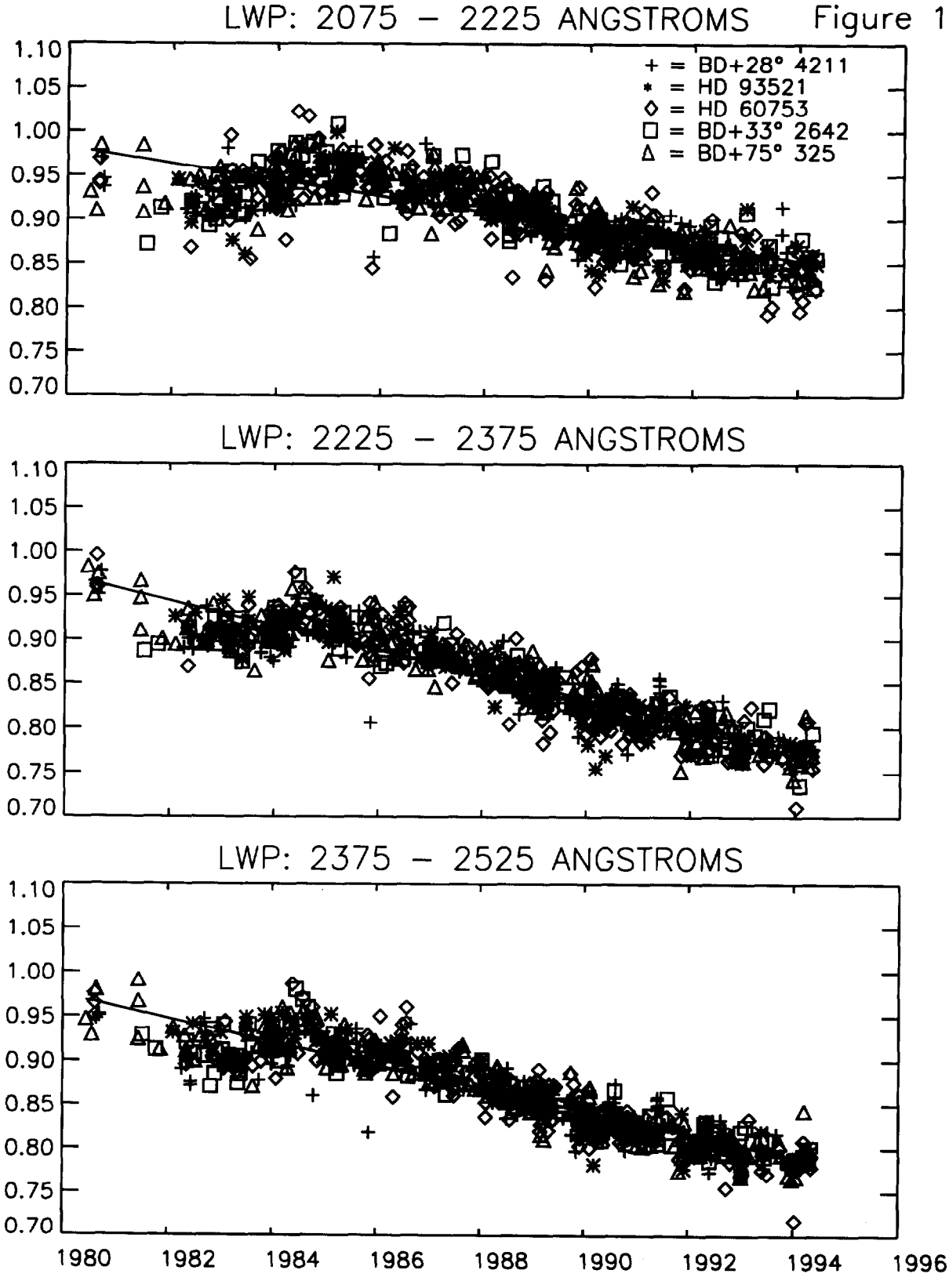

LWP: 2075 – 2225 ANGSTROMS
Figure 1
+ = BD+28° 4211
* = HD 93521
◇ = HD 60753
□ = BD+33° 2642
△ = BD+75° 325
LWP: 2225 – 2375 ANGSTROMS
LWP: 2375 – 2525 ANGSTROMS
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
1980
1982
1984
1986
1988
1990
1992
1994
1996

Figure 2

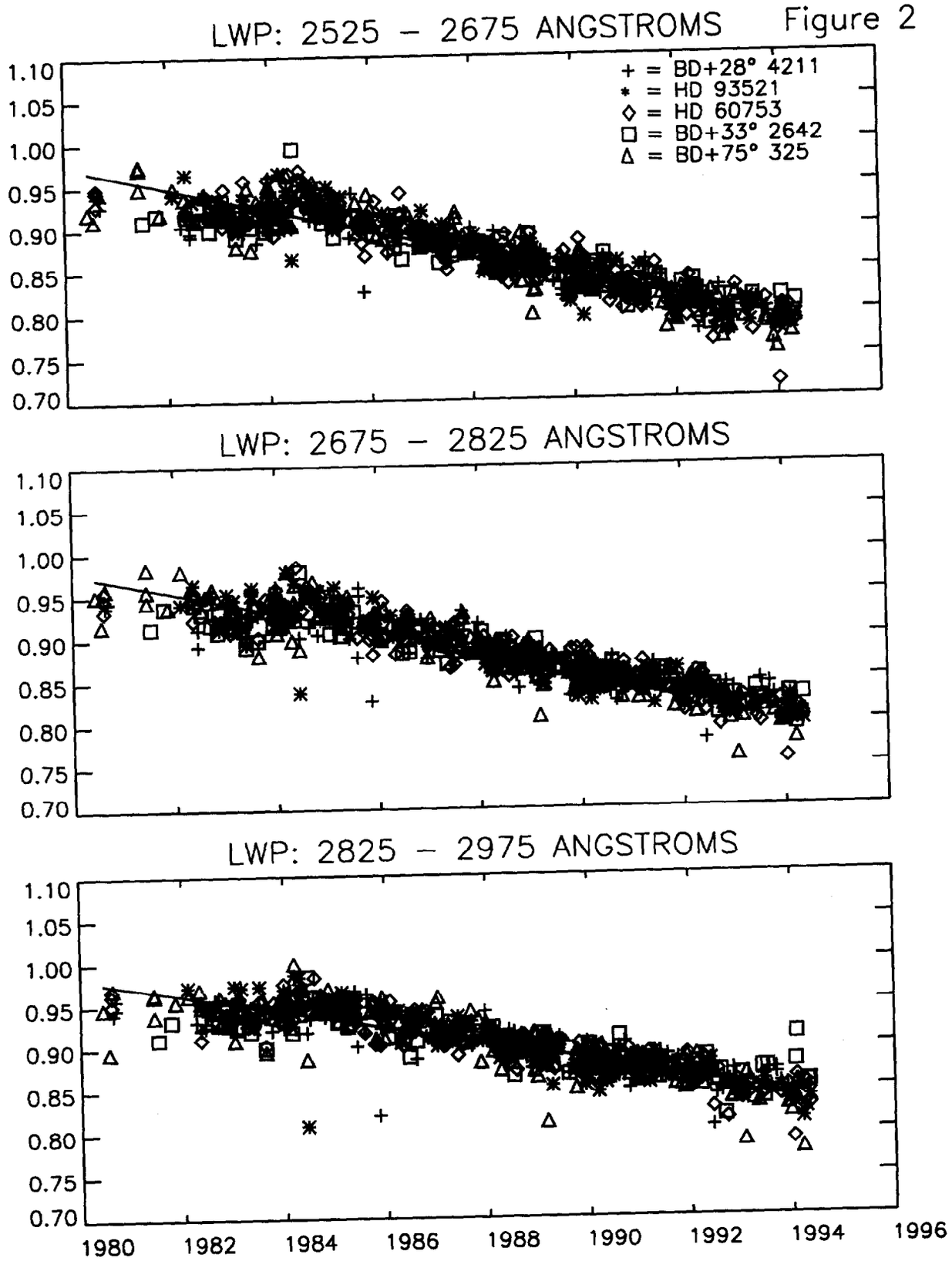

LWP: 2525 – 2675 ANGSTROMS
+ = BD+28° 4211
* = HD 93521
◇ = HD 60753
□ = BD+33° 2642
△ = BD+75° 325
LWP: 2675 – 2825 ANGSTROMS
LWP: 2825 – 2975 ANGSTROMS
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
1980
1982
1984
1986
1988
1990
1992
1994
1996

Figure 3

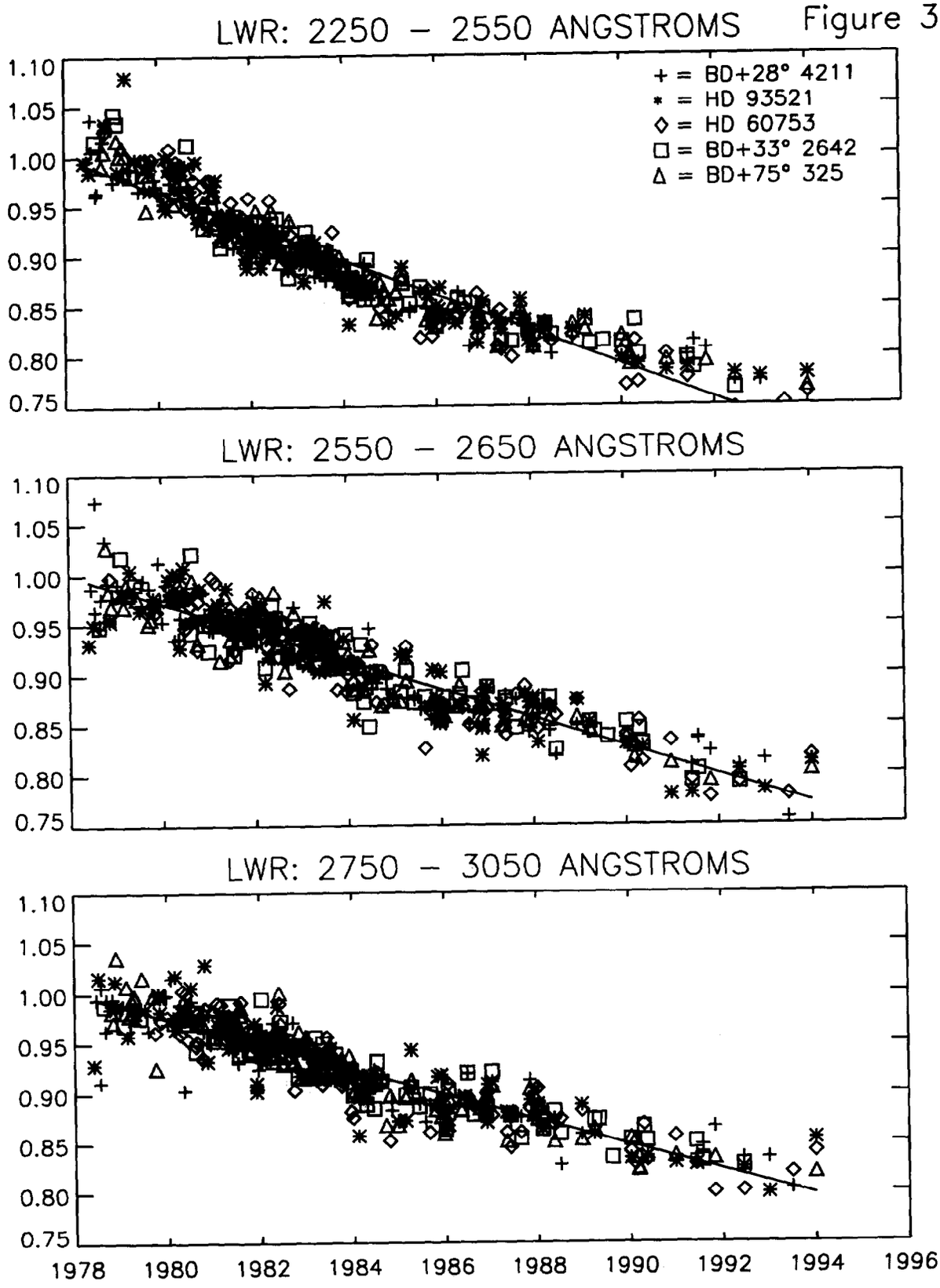
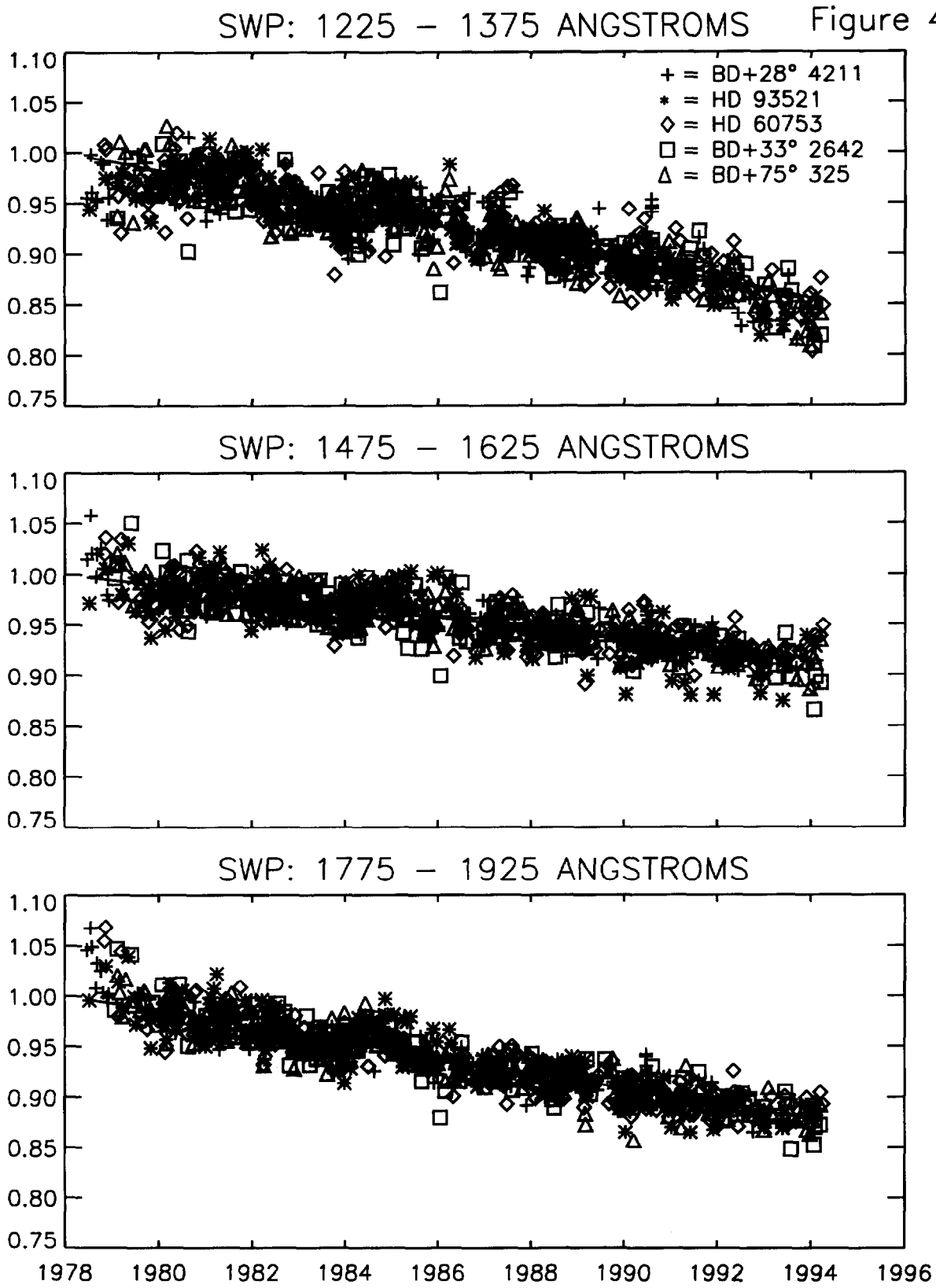

LWR: 2250 – 2550 ANGSTROMS
+ = BD+28° 4211
* = HD 93521
◇ = HD 60753
□ = BD+33° 2642
Δ = BD+75° 325
LWR: 2550 – 2650 ANGSTROMS
LWR: 2750 – 3050 ANGSTROMS
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996

Figure 4


SWP: 1225 – 1375 ANGSTROMS
+ = BD+28° 4211
* = HD 93521
◇ = HD 60753
□ = BD+33° 2642
Δ = BD+75° 325
SWP: 1475 – 1625 ANGSTROMS
SWP: 1775 – 1925 ANGSTROMS
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996

HEAD AMPLIFIER TEMPERATURES (°C) Figure 5