The Diffuse UV Background

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Definitions

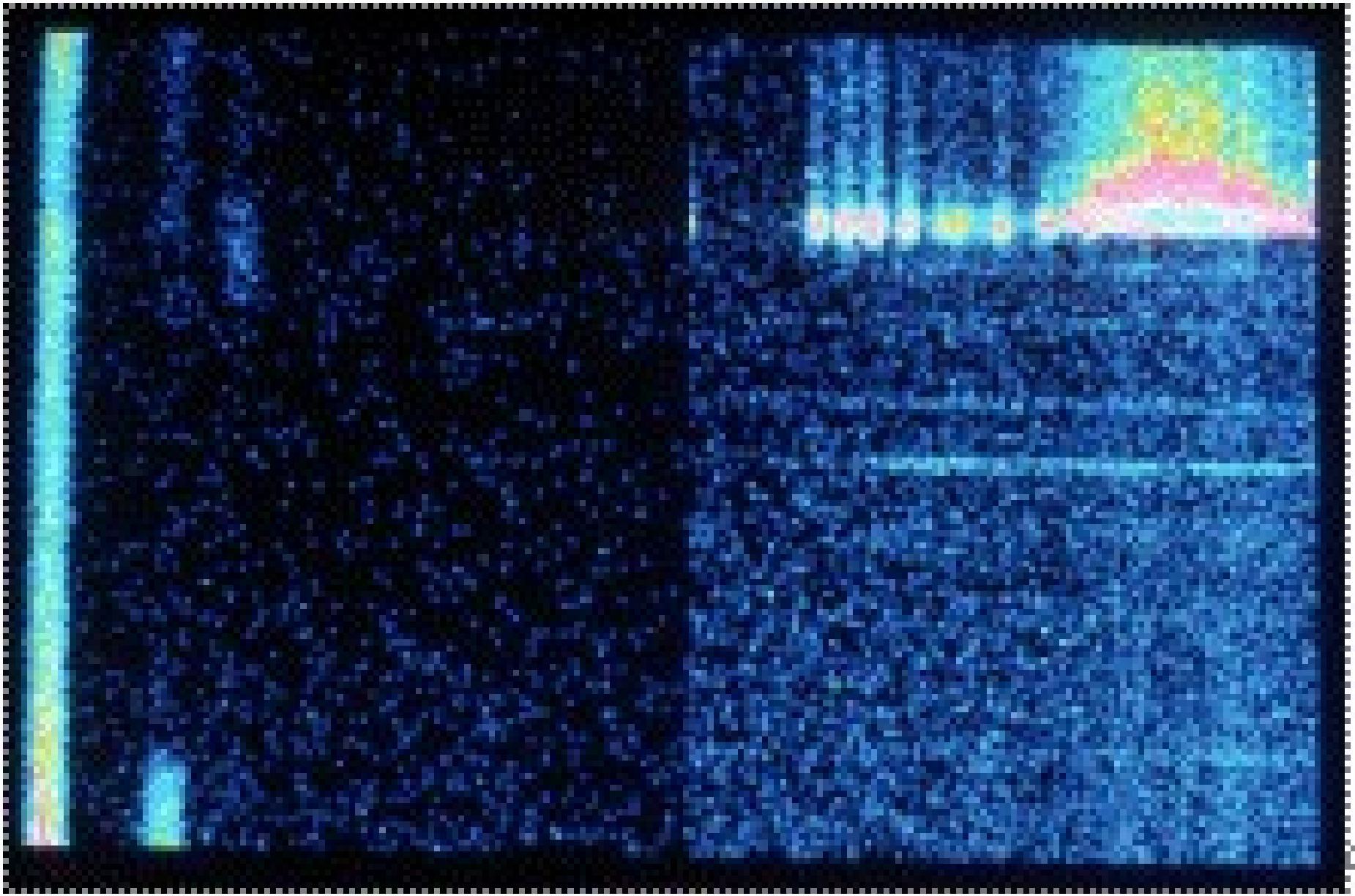
- Diffuse: Not stars.
- UV: 912 – 3200 Å.
  - Lower end is the Lyman limit.
  - Long wavelength side is limited by increasing numbers of stars.
  - Zodiacal light.
- Units: photons cm^{-2} s^{-1} sr^{-1} $Å^{-1}$.
  - 1.33×10^{-11} ergs cm^{-2} s^{-1} sr^{-1} $Å^{-1}$ at 1500 Å.

Sources

- Instrumental Background.
- Airglow.
- Zodiacal Light.
- Unresolved stars.
- Diffuse Galactic Light.
  - Dust.
  - Emission lines.
- Extragalactic Light.

The 1997 reference of diffuse night sky brightness
Leinert et al. 1998 A&A Supplement Series 127, 1

UVX Data



Spectra

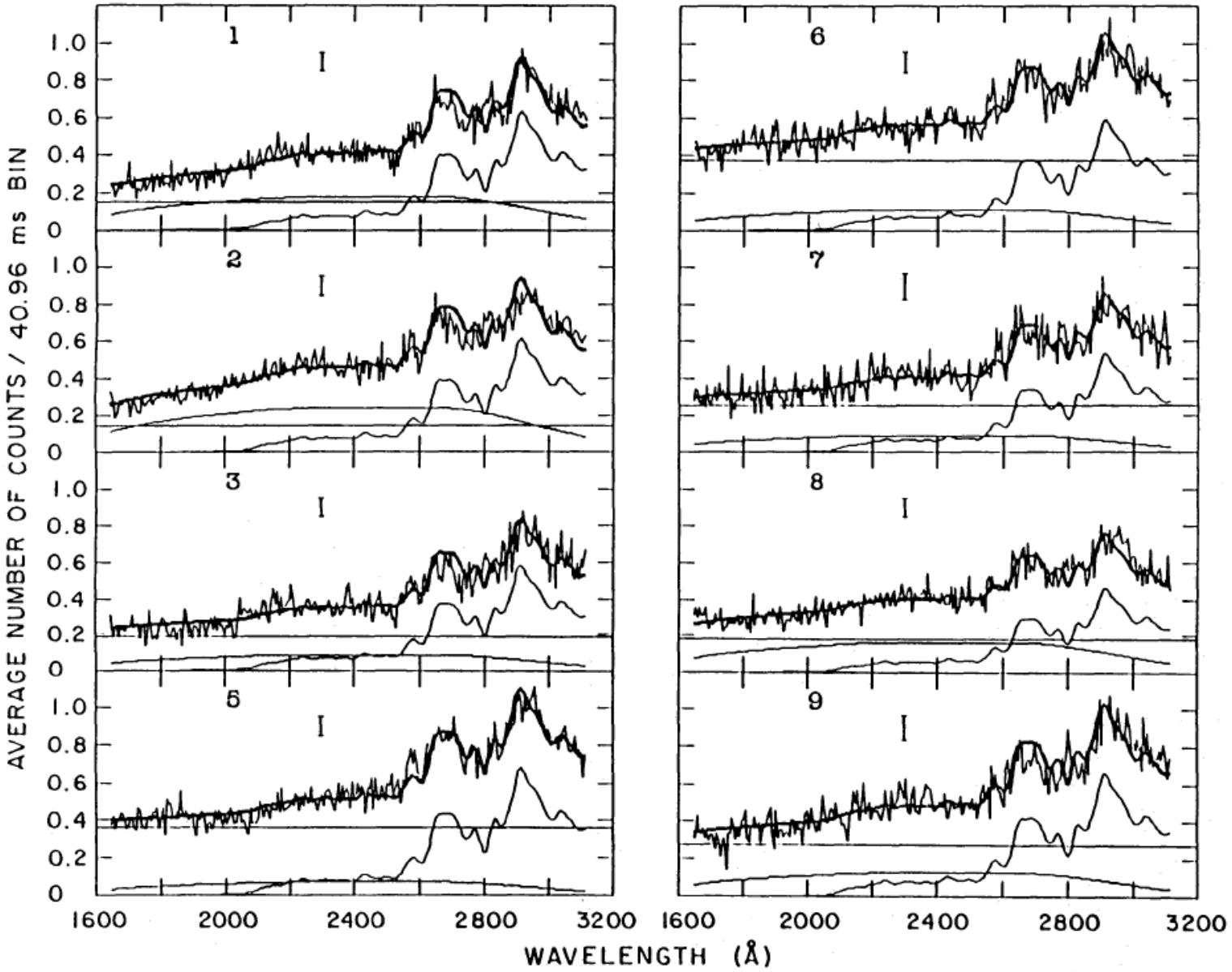


Fig. 2. The reduced spectrum of ea
eight targets is shown. The data h
summed over time and also binned
the dispersion direction, for a bin
6 Å. The dark line is the model fit
made up of the dark current (the
line) plus the diffuse cosmic backgr
smooth curved line) plus the zodia
Sample error bars are shown for e
trum. The O I 2972 Å line may b
some of the spectra, notably that o

otherstuff

1990A&A...231..187M

Zodiacal Light

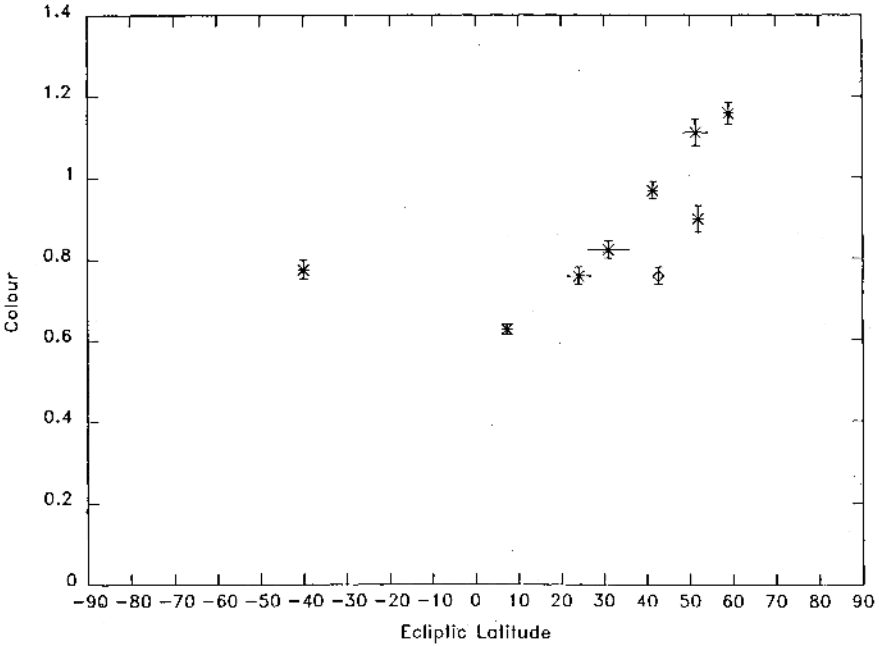


Fig. 5. The colors of the zodiacal light are plotted as a function of ecliptic latitude, with the diamond also showing the position of the one target below the ecliptic after a reflection about the plane of symmetry ($i = 1.4°$). A strong correlation of color with distance from the ecliptic plane can be seen. The horizontal lines show the range in ecliptic latitudes for each target

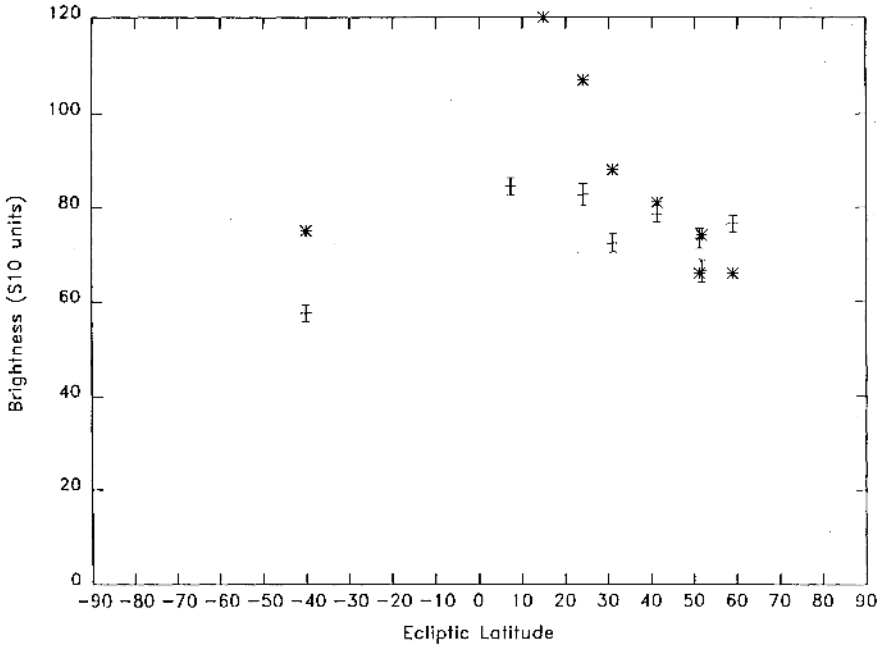


Fig. 6. The brightnesses in S10 units of the zodiacal light in each of our targets are plotted as a function of ecliptic latitude (plus signs). Also plotted are the visible brightnesses in the same directions (asterisks) as obtained by Levasseur-Regourd and Dumont (1980). The UV brightnesses fall off much less sharply with ecliptic latitude indicating a broader distribution for the small particles responsible for the UV scattering

Early Observations

- Rocket Observations.
  - Hayakawa, Yamashita, & Yoshioka (1969).
  - Lillie & Witt (1969).
- OAO-2 (Witt & Lillie 1973)
  - Small field of view (intended for stellar work).
  - Variable dark count.
- Rocket flights from JHU and UCB.
- Review papers: Bowyer (1991); Henry (1991)

DGL Sources

- Unresolved stars (Henry 1977).
- Emission from gas.
  - Plasma emission (Jakobsen & Paresce 1981).
  - 2 photon emission (Deharveng et al. 1992).
  - H_2 fluorescence (Sternberg 1989).
- Dust Scattering (Jura 1978).
  - Reflection nebulae.
  - Scattering of the ISRF by interstellar dust.

Extragalactic Contributors

- Massive neutrinos (Kimble et al. 1981).
- Integrated light of galaxies (Paresce & Jakobsen 1980).
  - Martin & Bowyer (1989) claimed correlation.
- AGN (Bechtold et al. 1987).
- IGM (Jakobsen 1980).

Table 3 Components of the diffuse cosmic far ultraviolet background with approximate intensities[a]

Total intensity	300–1500
Galactic components	
Scattering by dust	200–1500
HII two-photon emission	50
H_2 fluorescence	100 (in molecular clouds)
Components of the "uniform" high-latitude background	
Dust (?)	200
Summed from all galaxies	50
HII two-photon emission	50
Hot gas line emission	10
QSOs/AGNs	<10
Intergalactic medium	<10
Unexplained	none to <200

[a] Intensities dependent upon view direction. Intensities of processes producing discrete features are averaged over the 1400–1850 Å band. Units are photon cm^{-2} s^{-1} $ster^{-1}$ $Å^{-1}$.

Bowyer 1991

Observations

- Murthy & Henry 1995

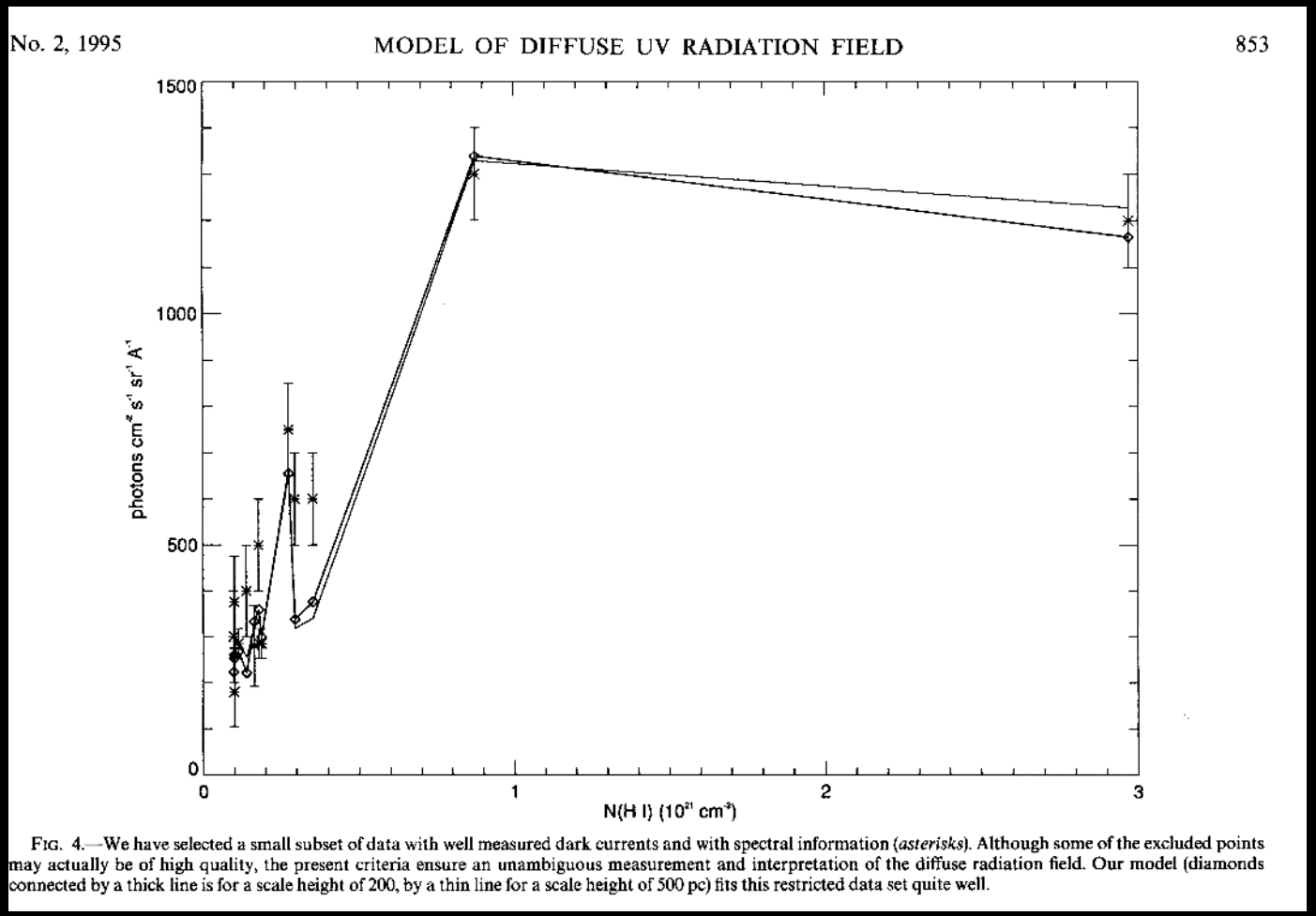
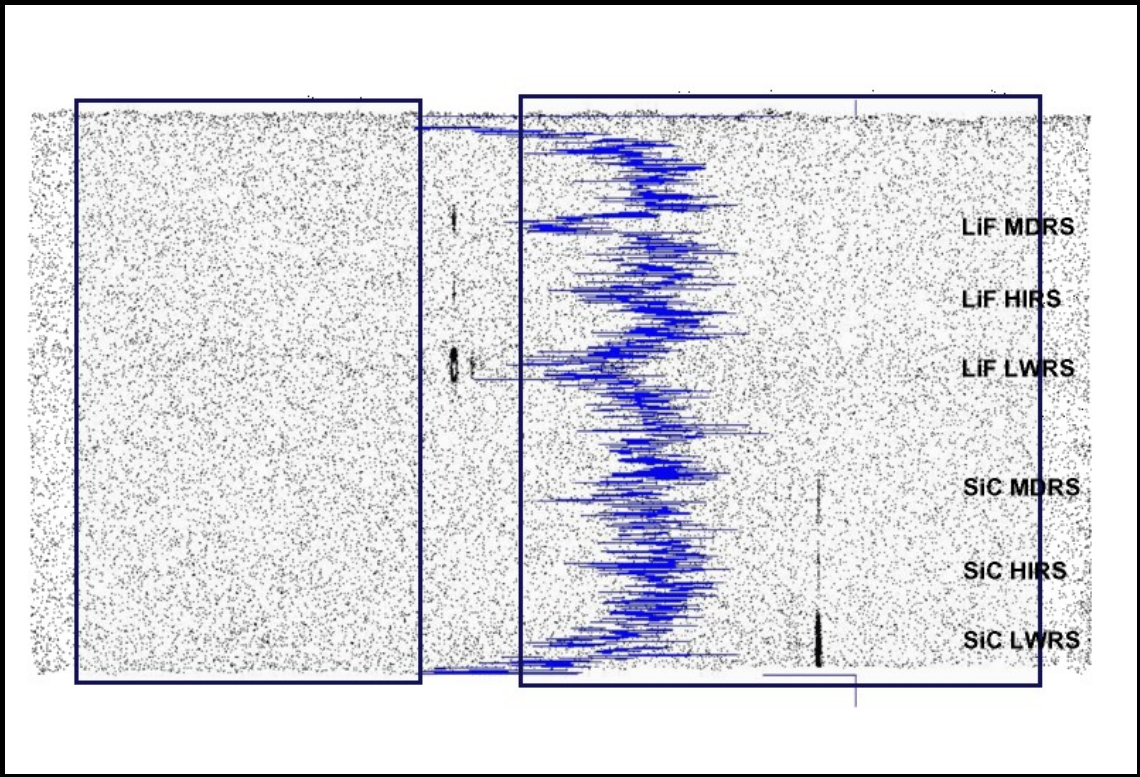
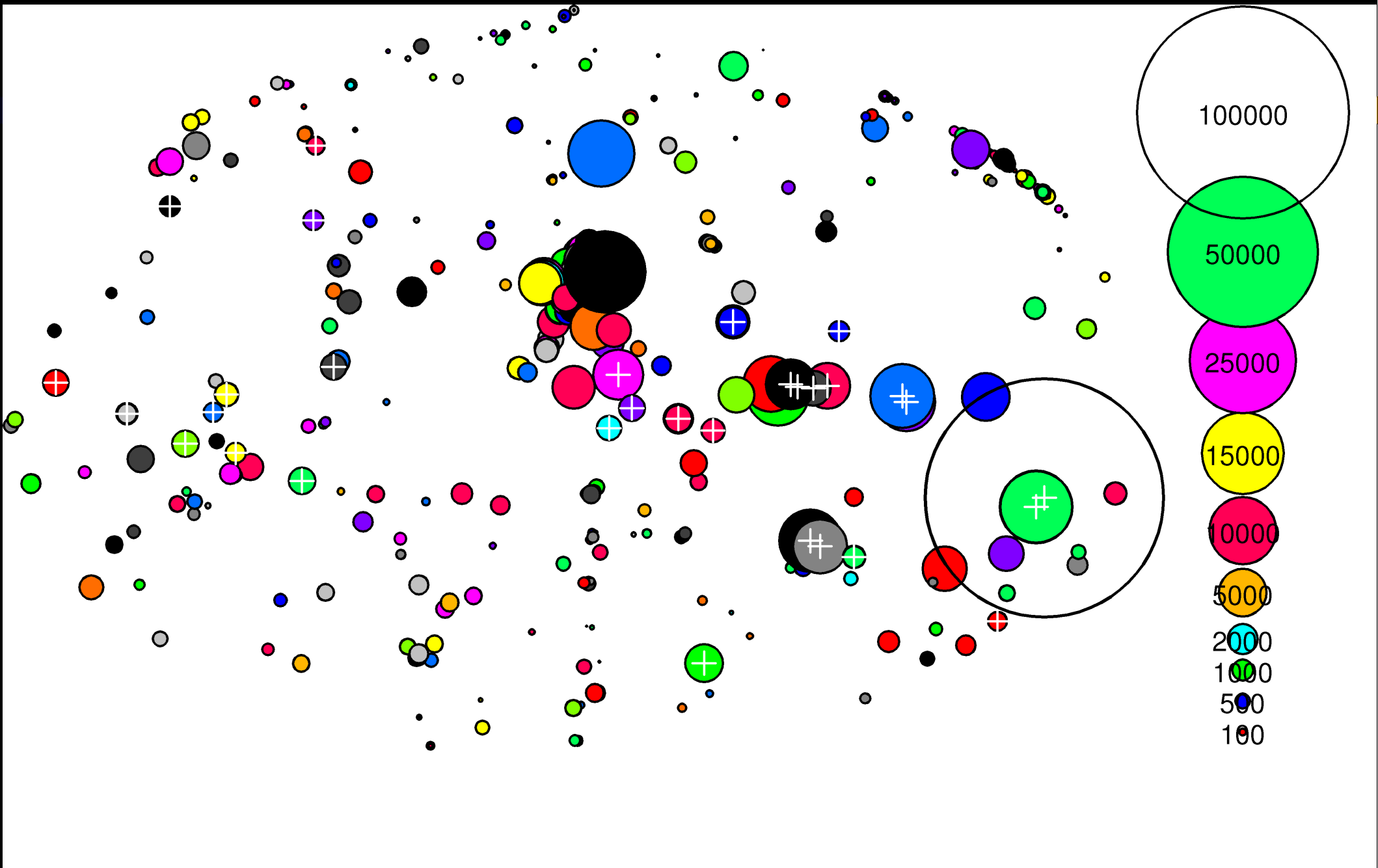


FIG. 4.—We have selected a small subset of data with well measured dark currents and with spectral information (*asterisks*). Although some of the excluded points may actually be of high quality, the present criteria ensure an unambiguous measurement and interpretation of the diffuse radiation field. Our model (diamonds connected by a thick line is for a scale height of 200, by a thin line for a scale height of 500 pc) fits this restricted data set quite well.

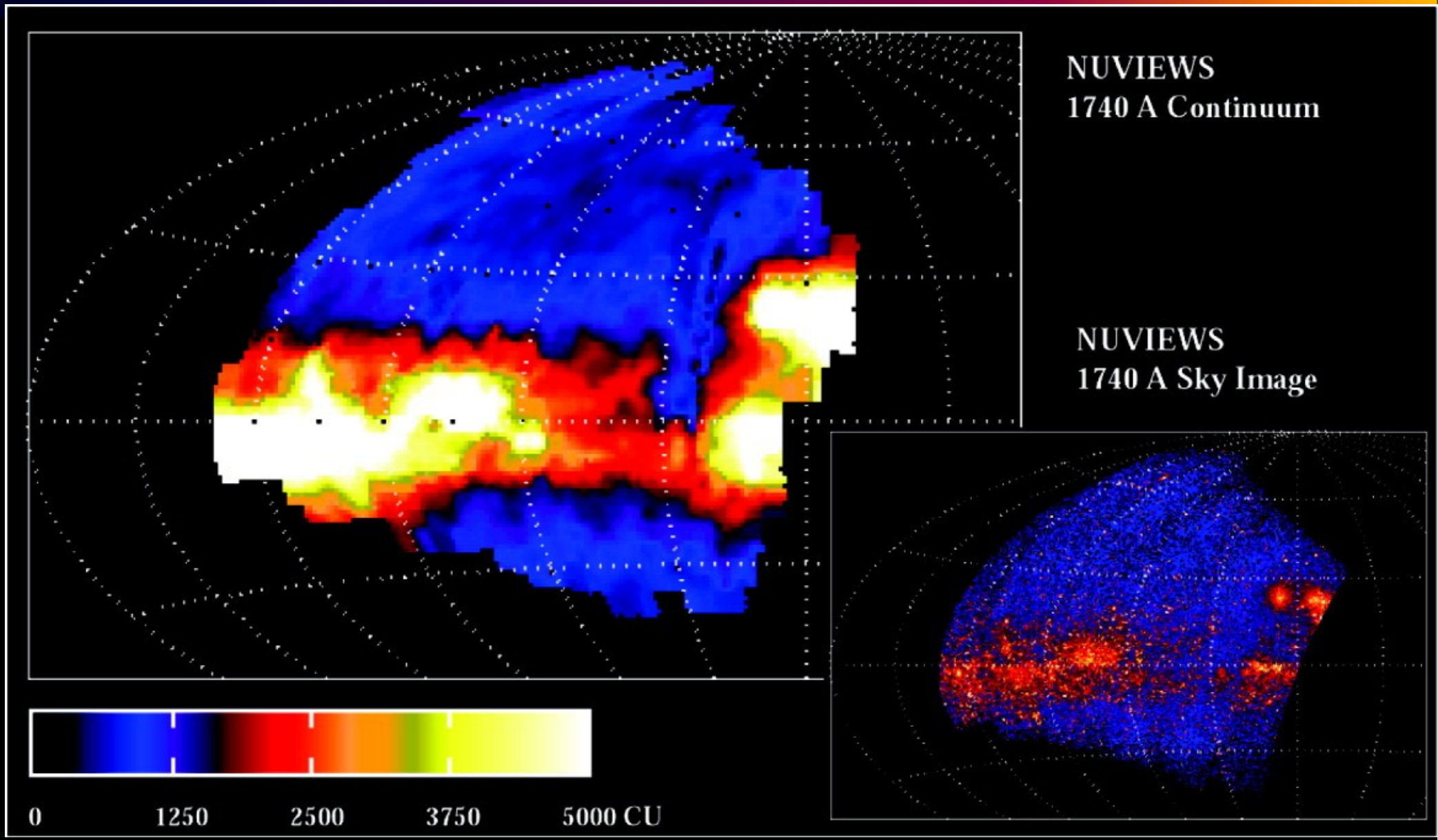
FUV Observations

- Voyager UVS (1977 – 1994).
  - Observations spread over the entire sky.
- FUSE LWRS observations.

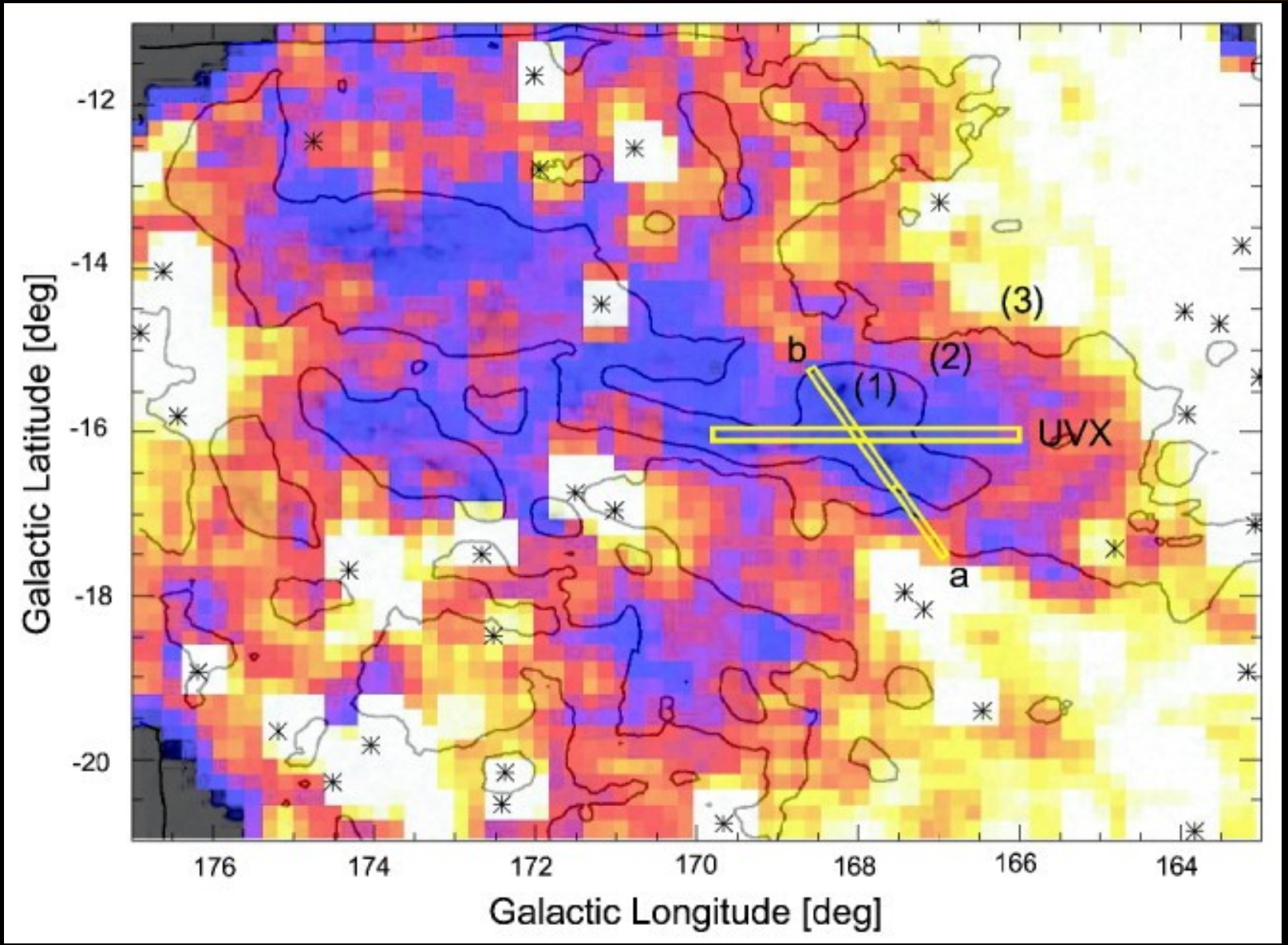



100000
50000
25000
15000
10000
5000
2000
1000
500
100

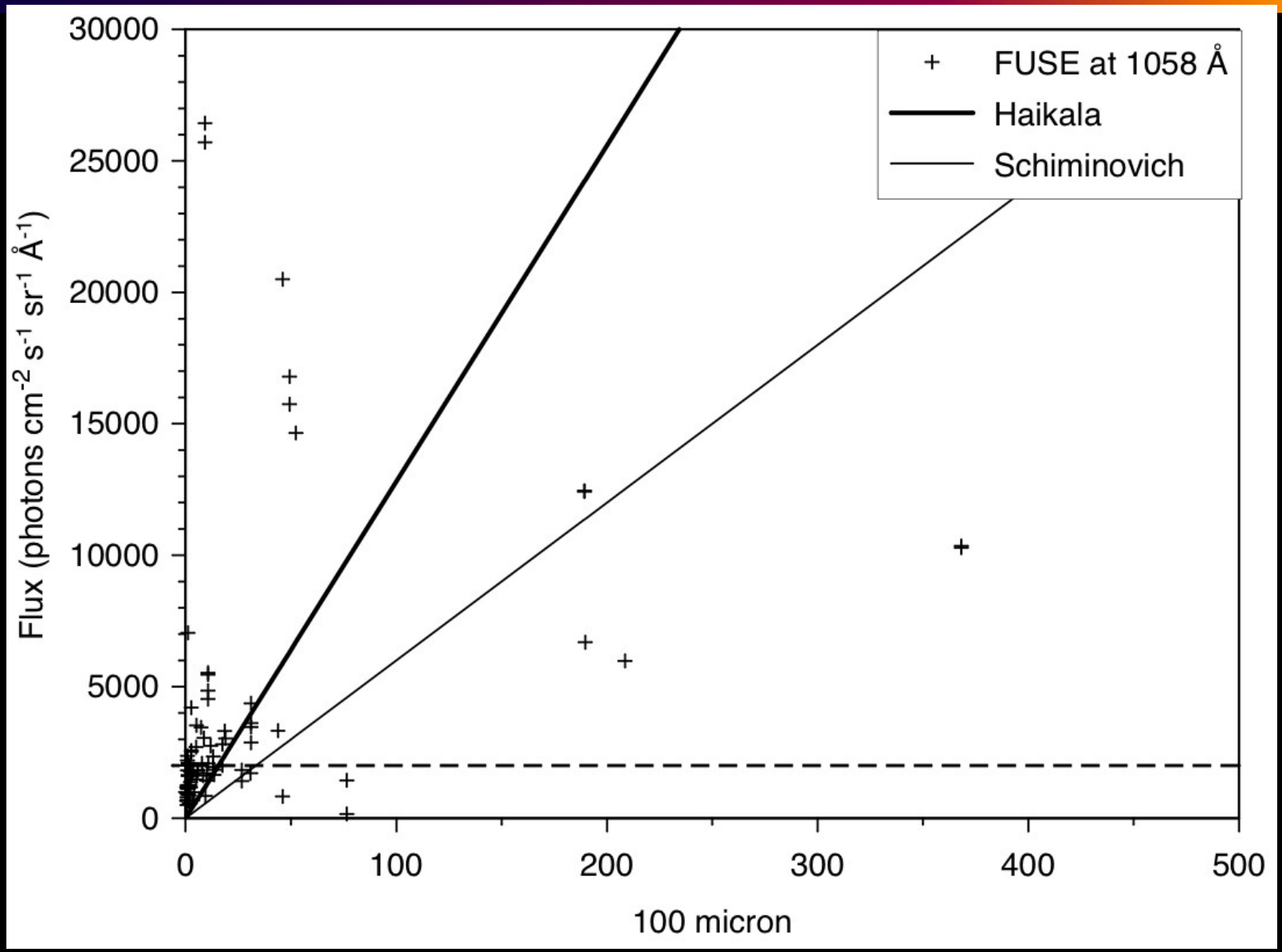
NUVIEWS (Schiminovich et al. 2001)



SPEAR (Lee et al. 2006)



IR Correlation



Modeling

- Assume that it is all dust scattered radiation.
- Convolution of stars with scatterers.
  - Assume that we know scattering function.
  - Position of stars known.
  - Assume dust distribution.
- Compare model predictions with observations.

Coalsack Prediction

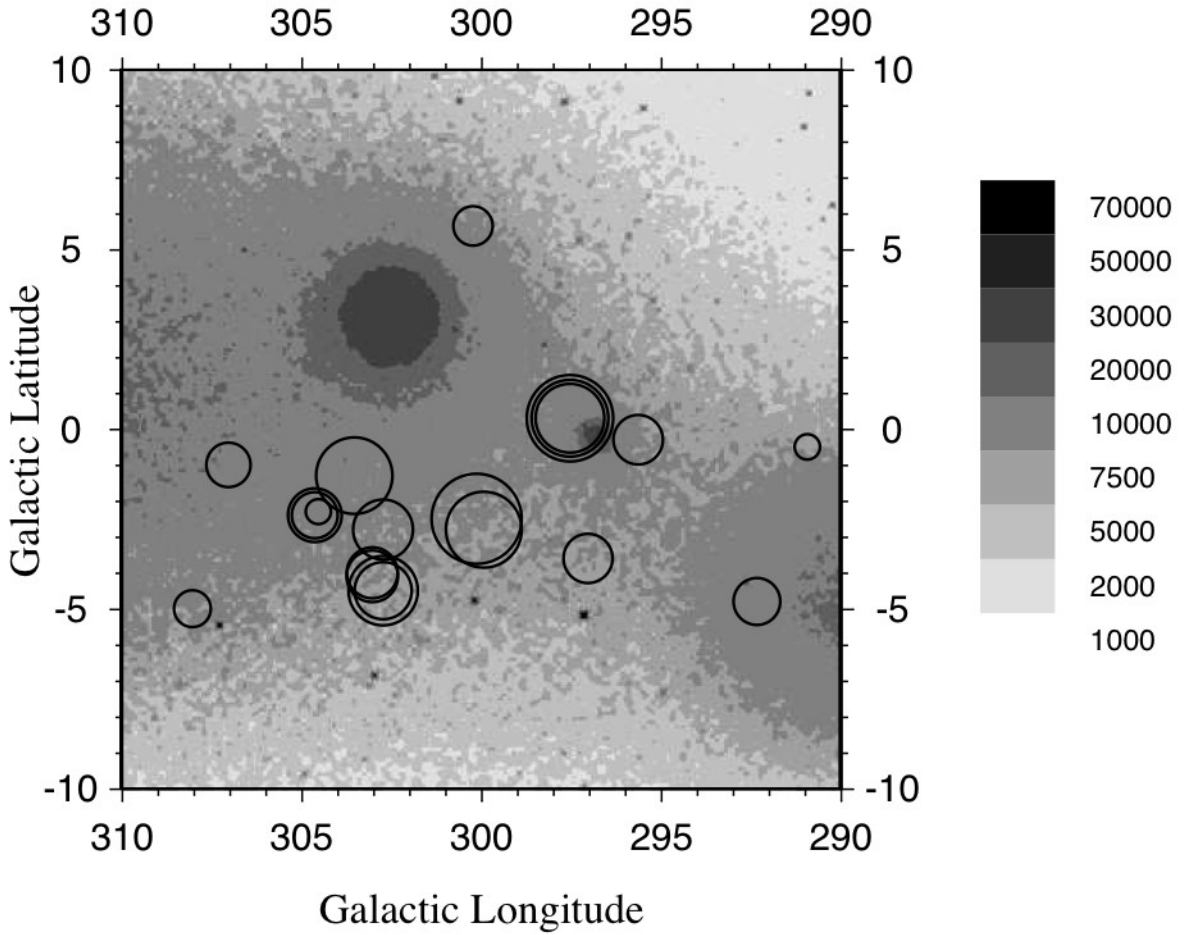


Fig. 4.— The scattered light predicted by our model with $a = 0.28$ and $g = 0.61$ is shown in figure in units of photons cm^{-2} s^{-1} sr^{-1} $Å^{-1}$. The observed locations are overplotted as circles whose radii are proportional to their intensity at 1114 Å.

Summary

- General consensus on diffuse UV background:
  - Scattering from dust predominates at low to mid-Galactic latitudes.
  - More scattering near bright stars/associations.
  - A continuum of about 300 photon units is observed at high Galactic latitudes which may or may not be due to dust scattering. This continuum is only observed at wavelengths greater than 1200 Å.

UV Astronomy at IIA

- TAUVEX (with Tel Aviv University) to be launched in April 2008.
- UVIT (part of ASTROSAT) planned for 2009 launch.
  - 2 UV telescopes to be integrated and calibrated at IIA.
  - Class 1000 facility available.
  - 6 m vacuum tank with UV lamps, detectors etc.