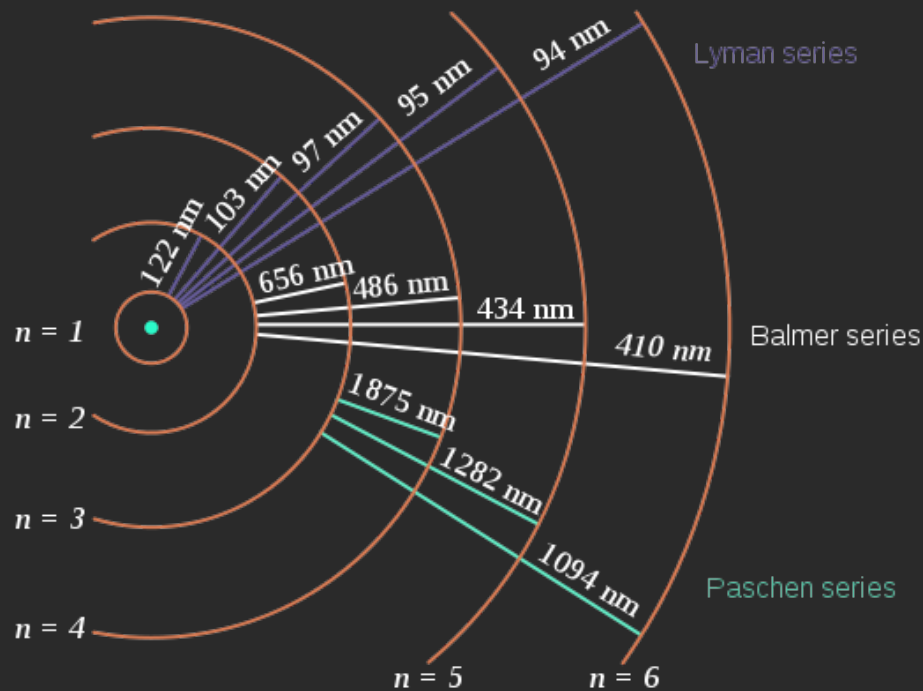


Energy Levels



Energy E is inversely proportional to wavelength λ :

$$E = \frac{a}{\lambda}$$

From the diagram we see that

$$E_2 - E_1 = \frac{a}{122}$$

$$E_3 - E_2 = \frac{a}{656}$$

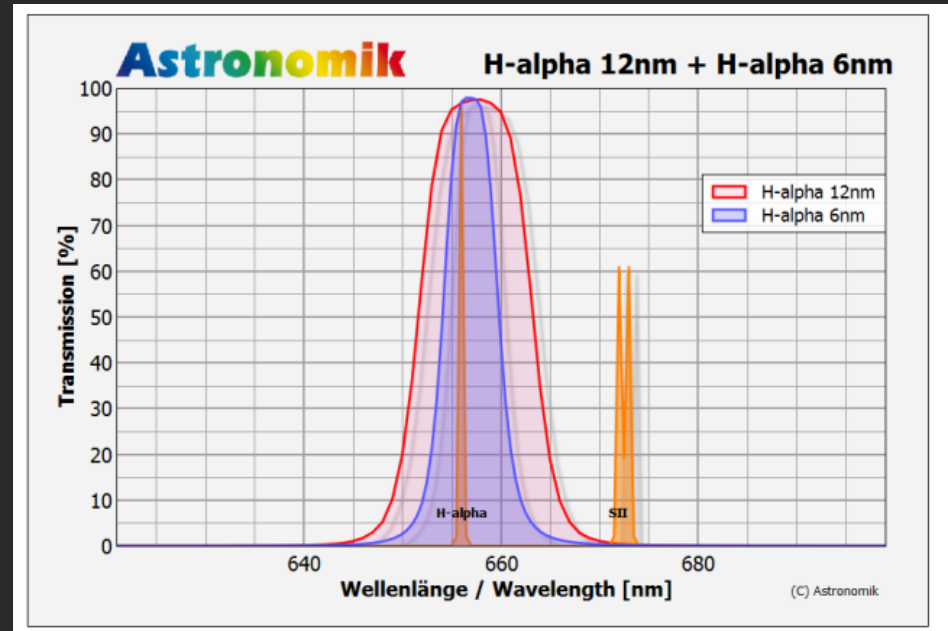
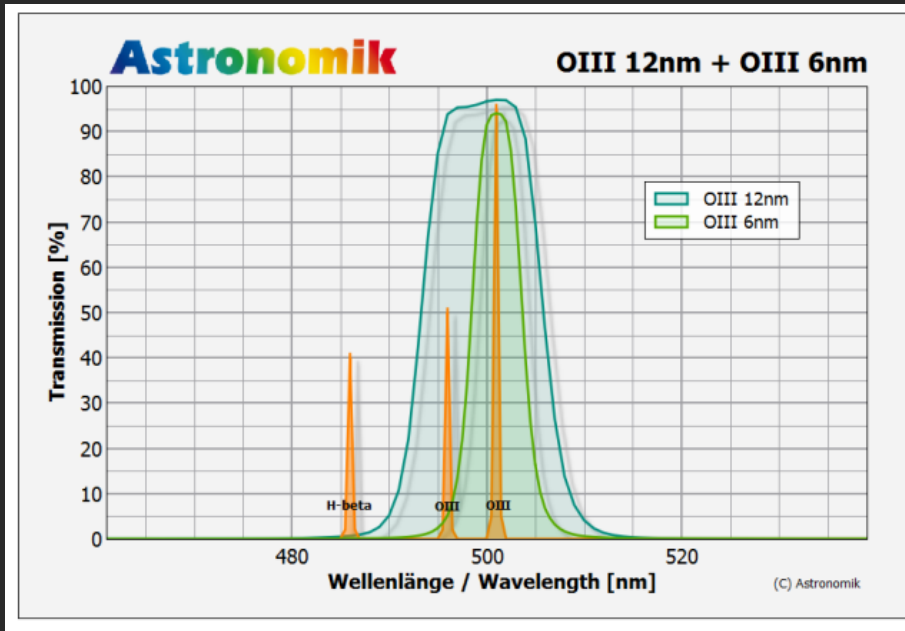
And so we can calculate

$$\begin{aligned} E_3 - E_1 &= (E_3 - E_2) + (E_2 - E_1) \\ &= \frac{a}{656} + \frac{a}{122} \\ &= a \frac{122 + 656}{122 * 656} \\ &= \frac{a}{102.9} \\ &\approx \frac{a}{103} \end{aligned}$$

NOTE: Energy is also inversely proportional to n^2 :

$$E_n = -\frac{b}{n^2}$$

H α , O-III



Diffraction Grating

A couple of years ago I bought a *Star Analyser 100* diffraction grating from *RSpec Astro*:



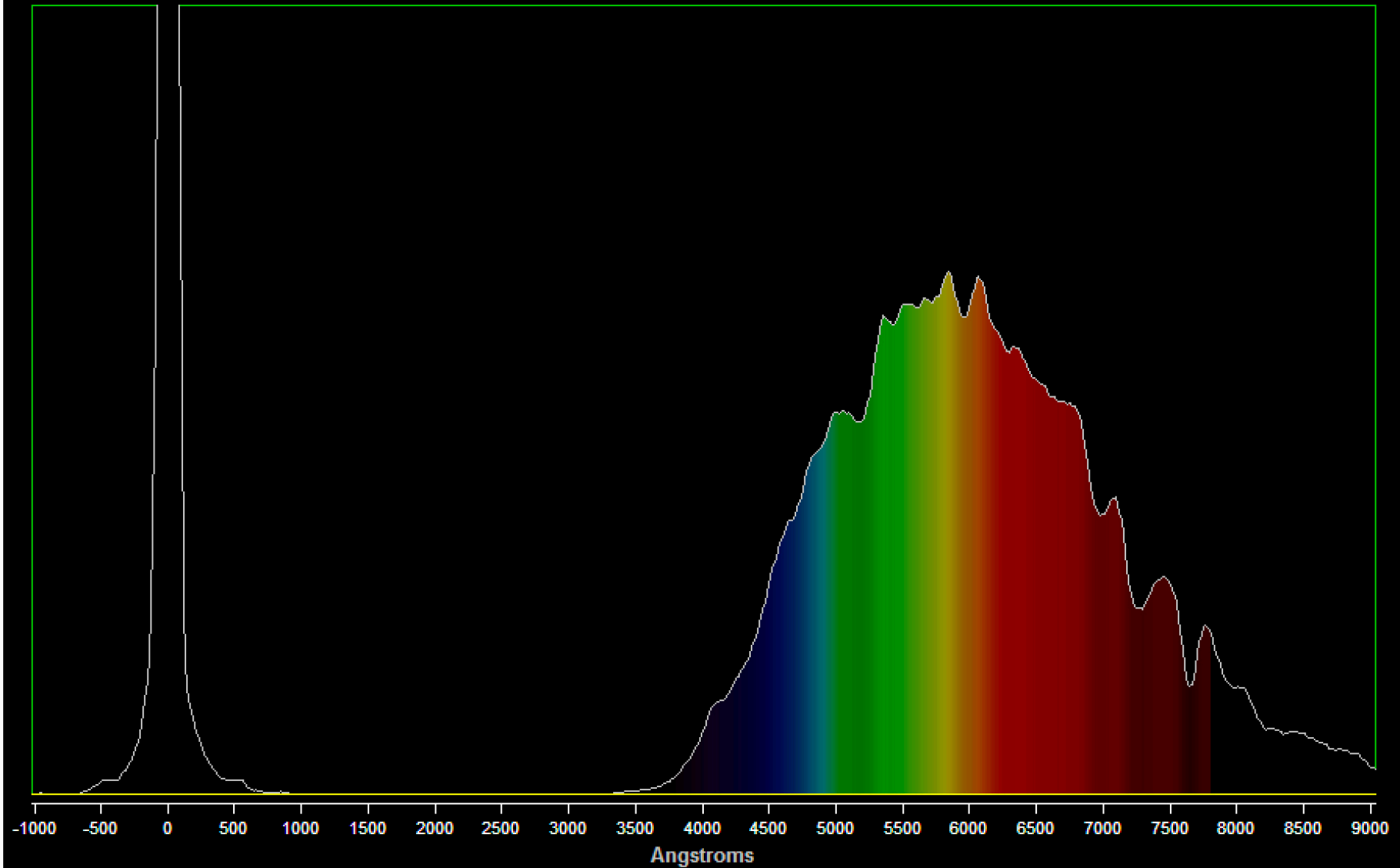
Albireo



Albireo A

Angstroms/Pixel: 14.3

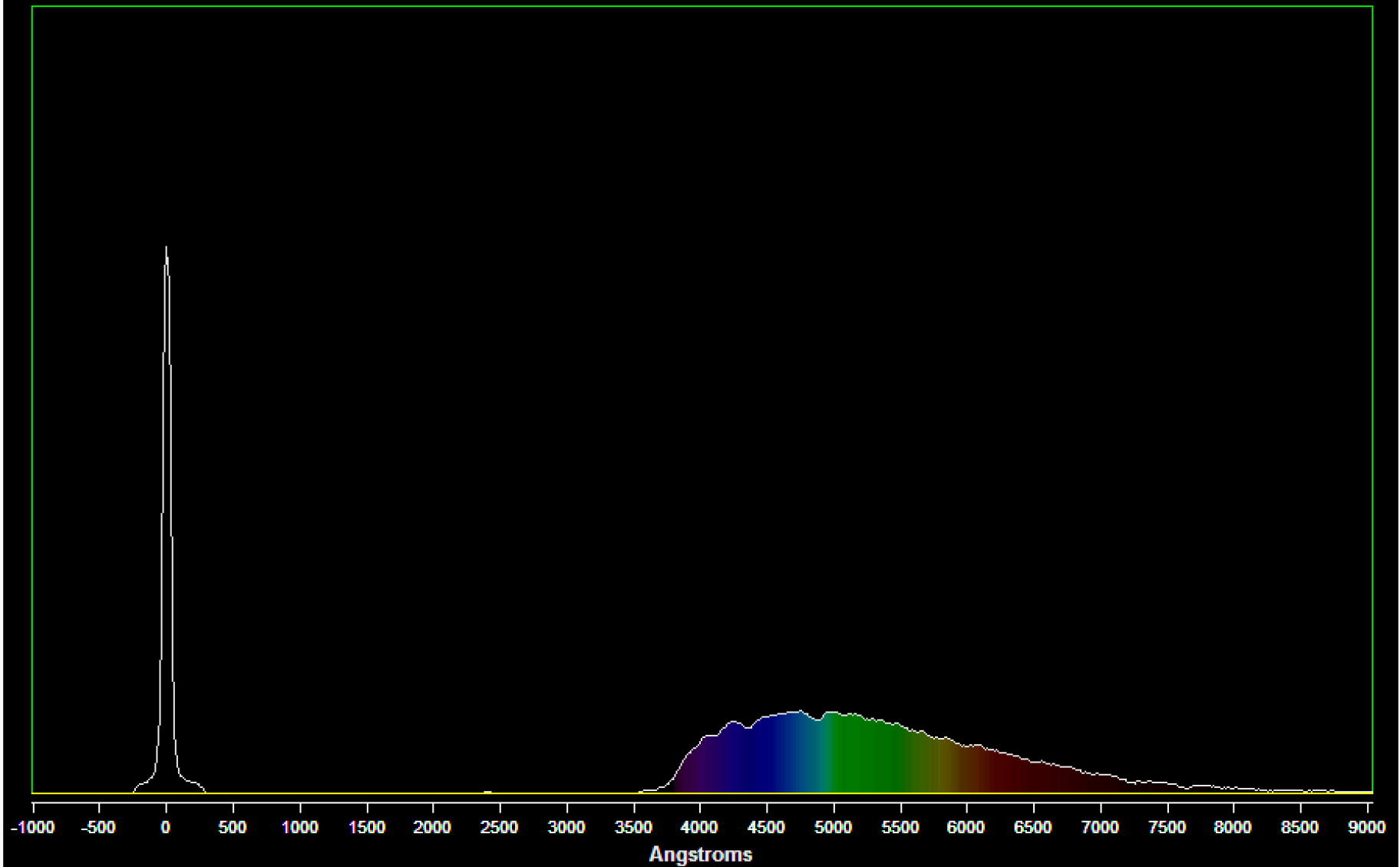
Albireo A



Albireo B

Angstroms/Pixel: 14.3

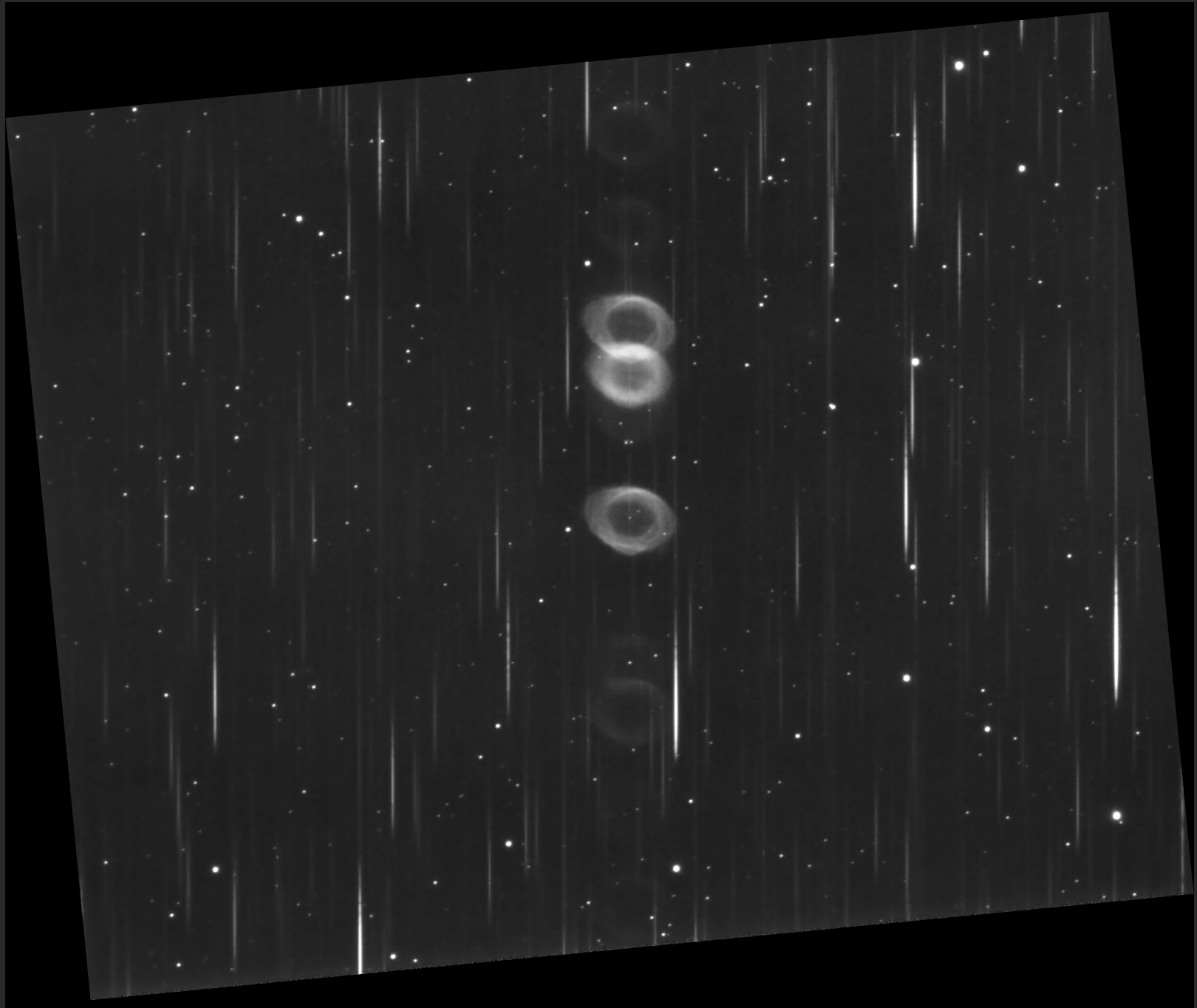
Albireo B



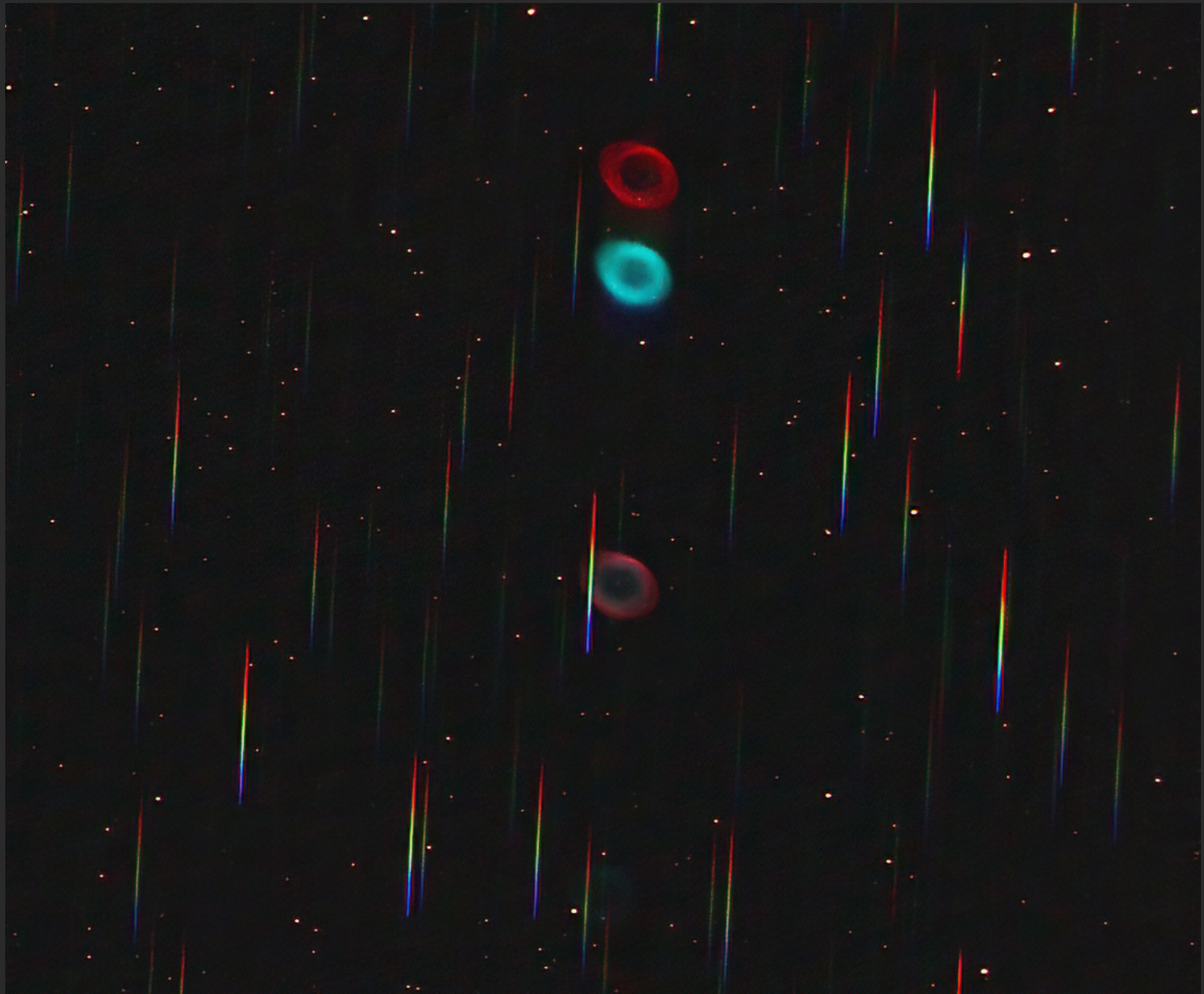
The Ring Nebula



The Ring Nebula



The Ring Nebula



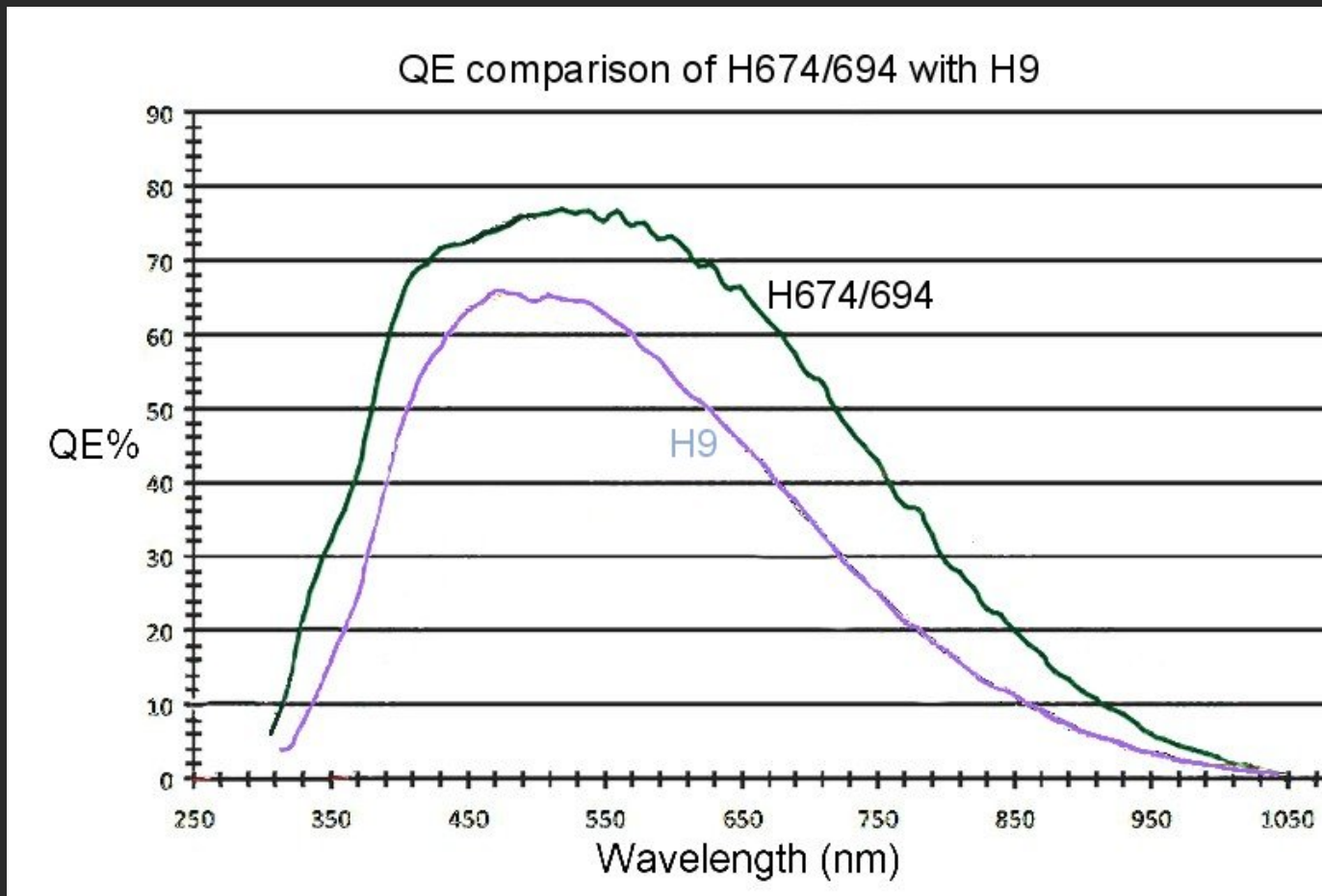
The Ring Nebula

Prize Winner



Camera Response Curve

The RSpec software can automatically correct for the nonuniformity of a camera's sensitivity.



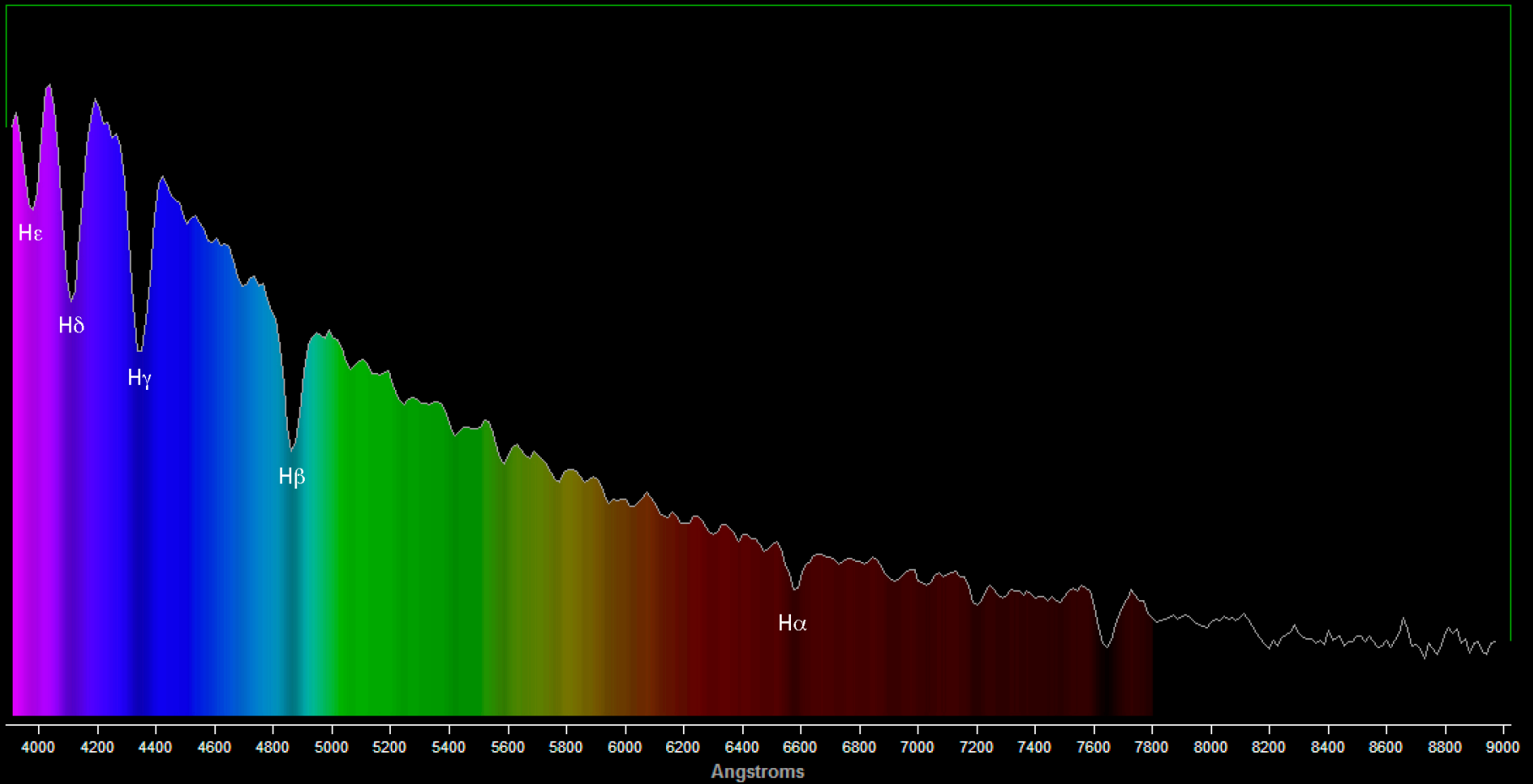
Vega



Vega

Angstroms/Pixel: 14.3

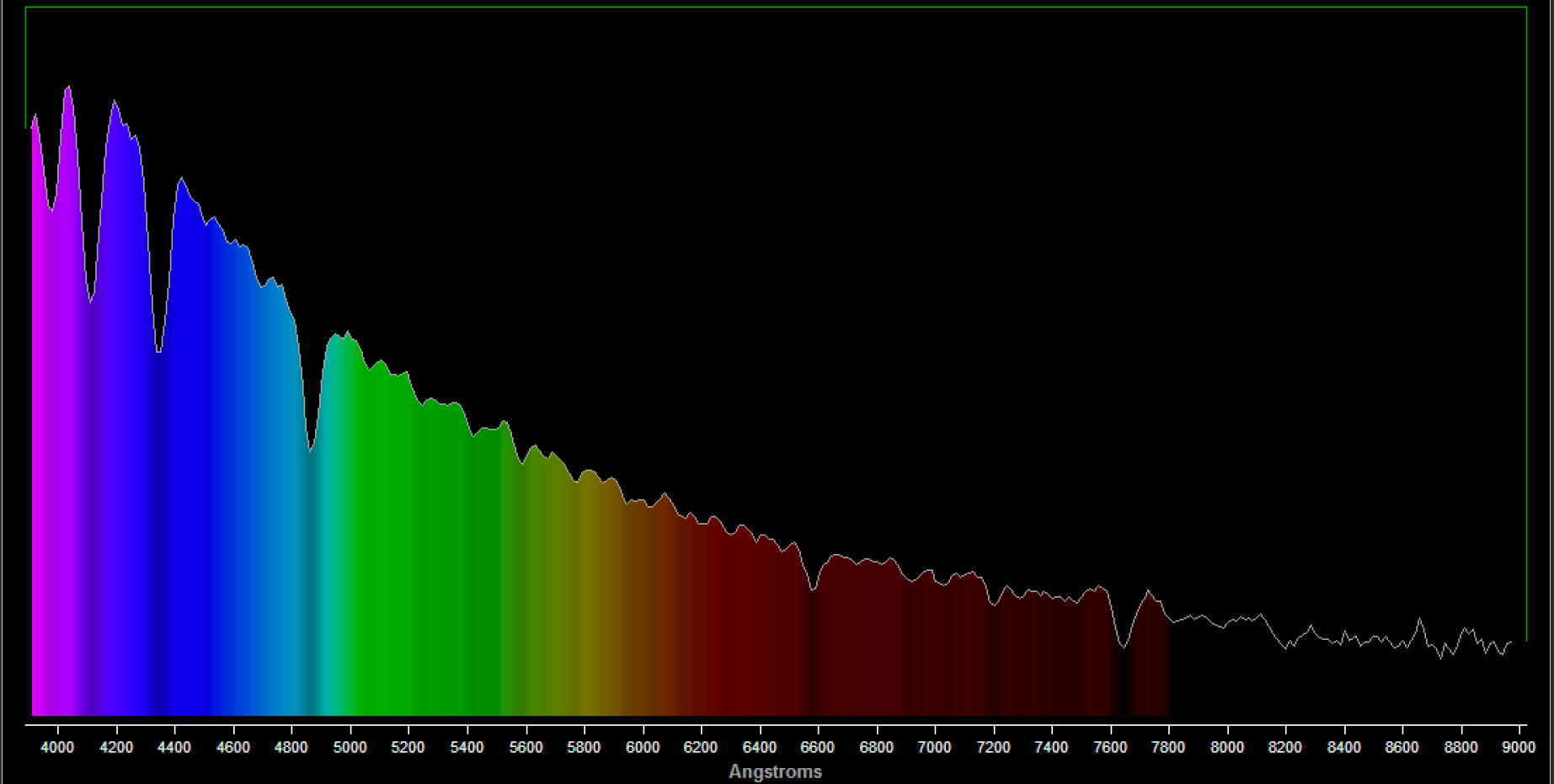
Vega



Vega

Angstroms/Pixel: 14.3

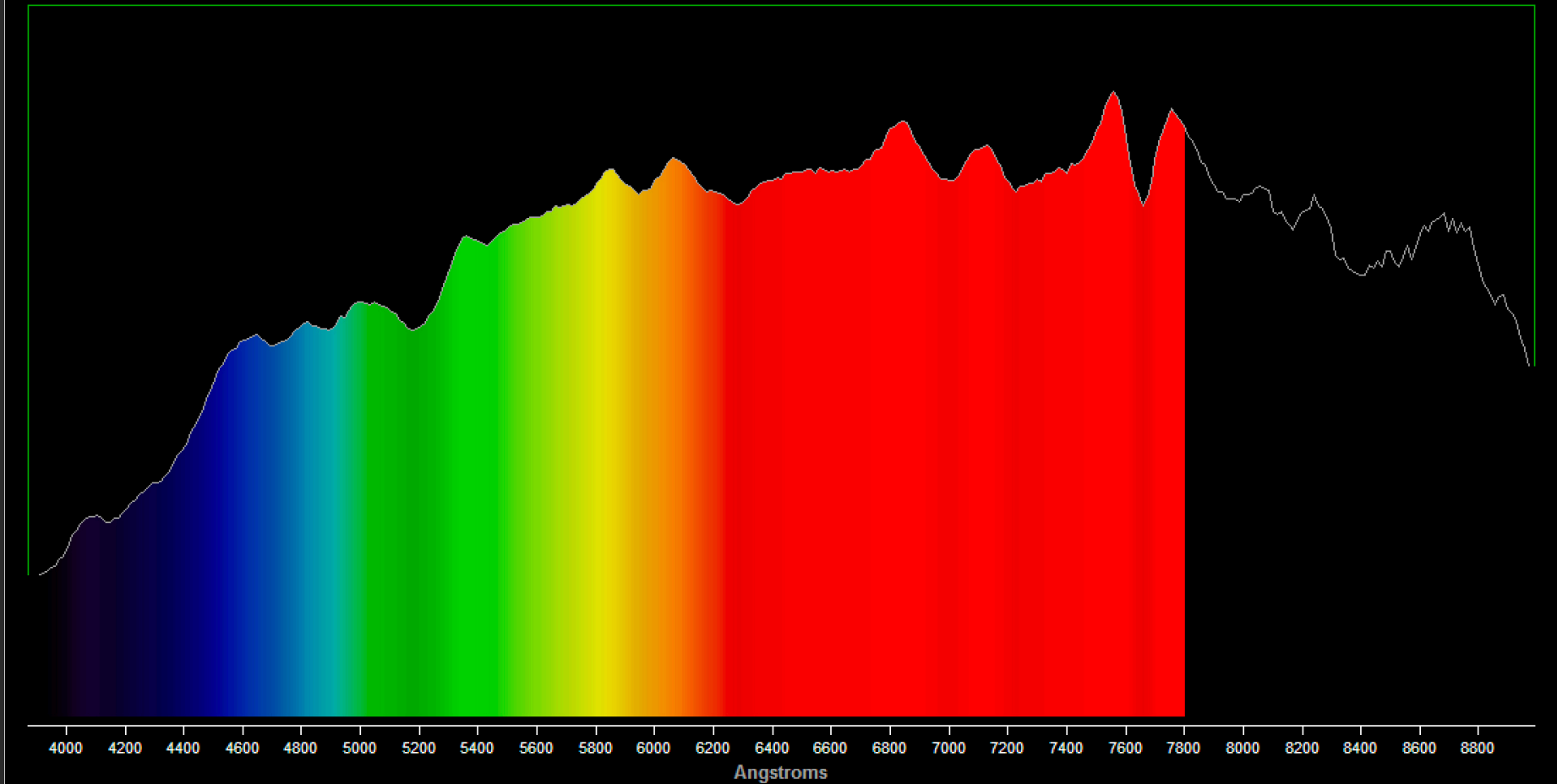
Vega



Albireo A

Angstroms/Pixel: 14.3

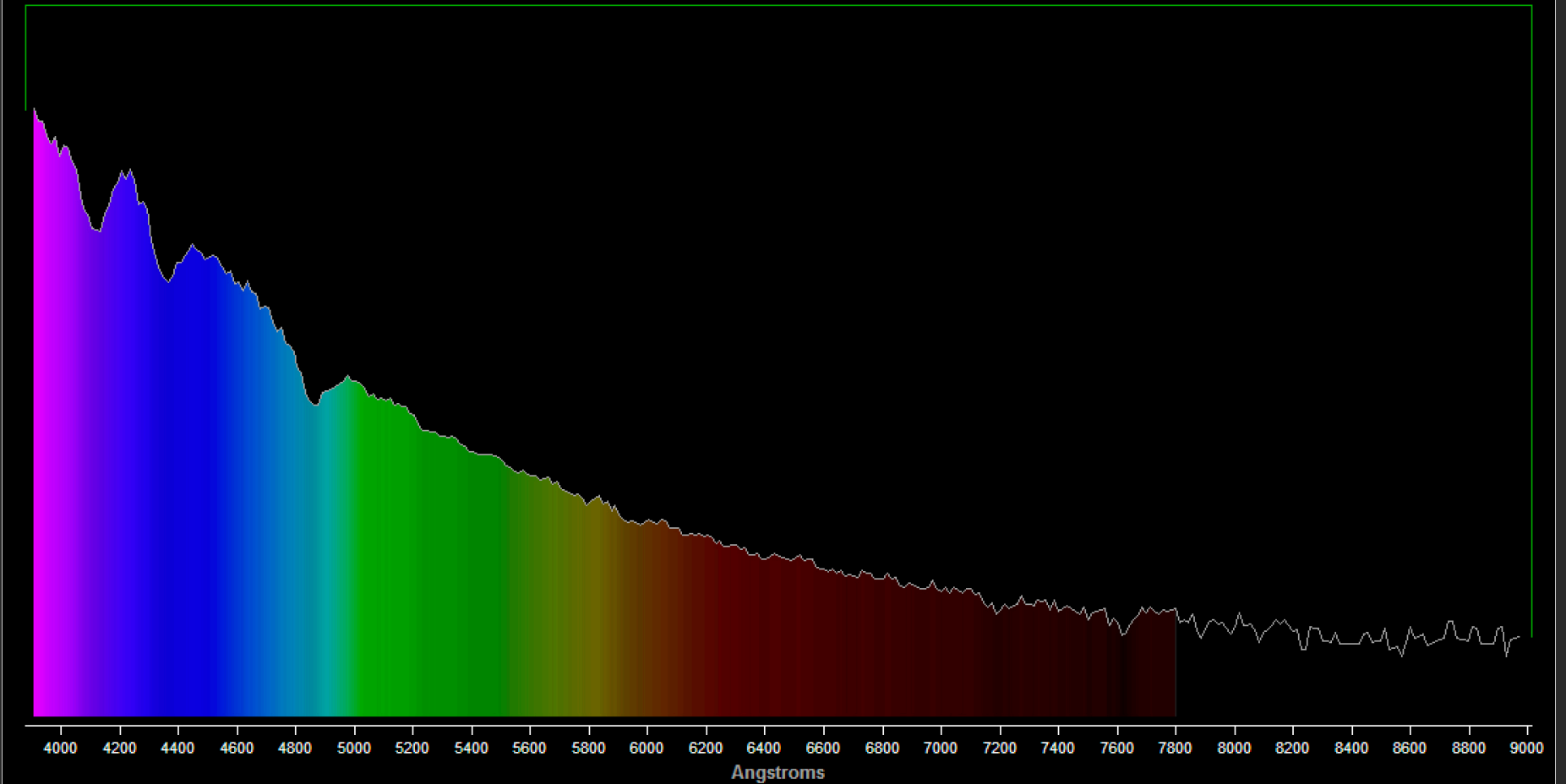
Albireo-A



Albireo B

Angstroms/Pixel: 14.3

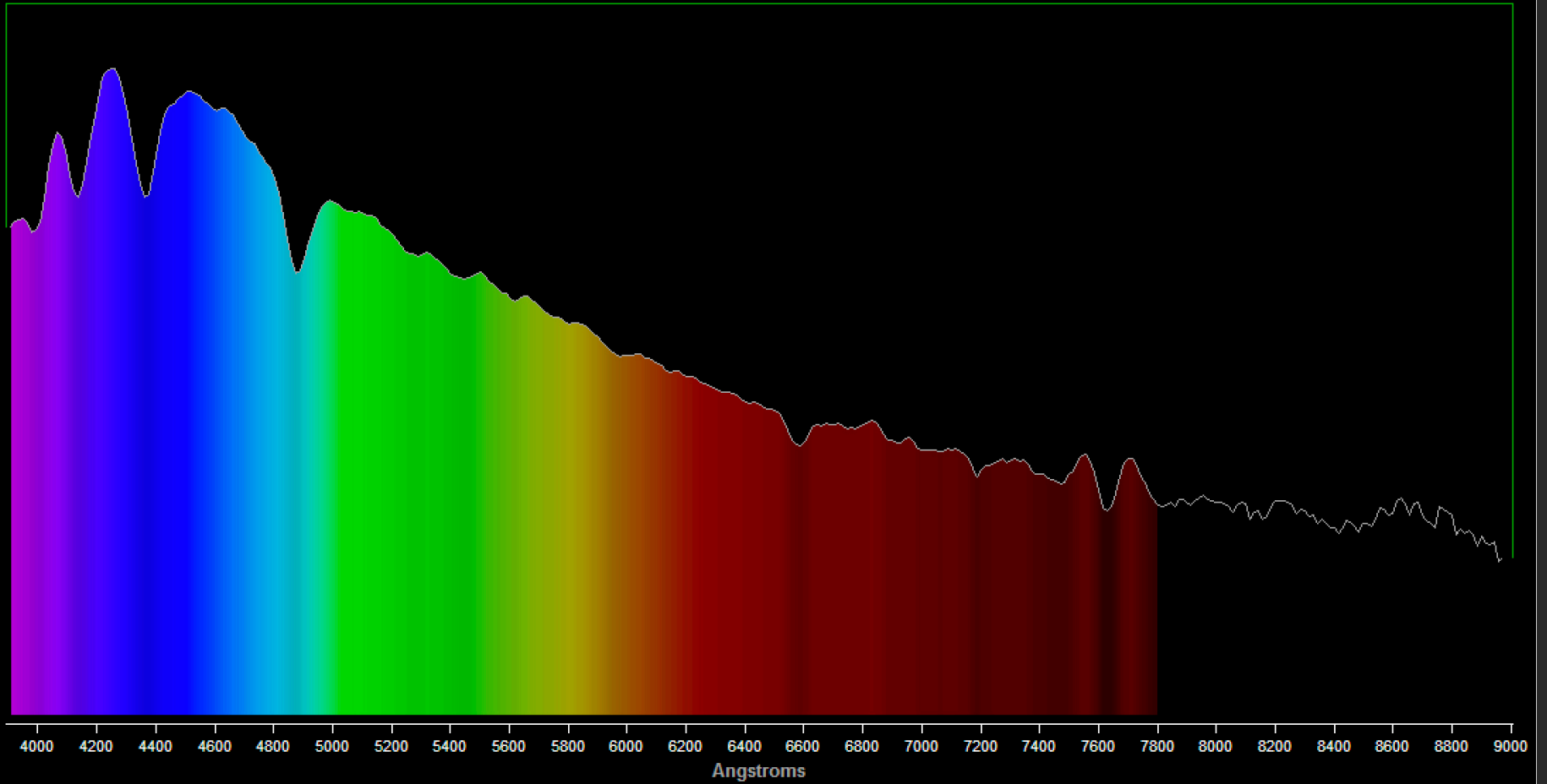
Albireo-B



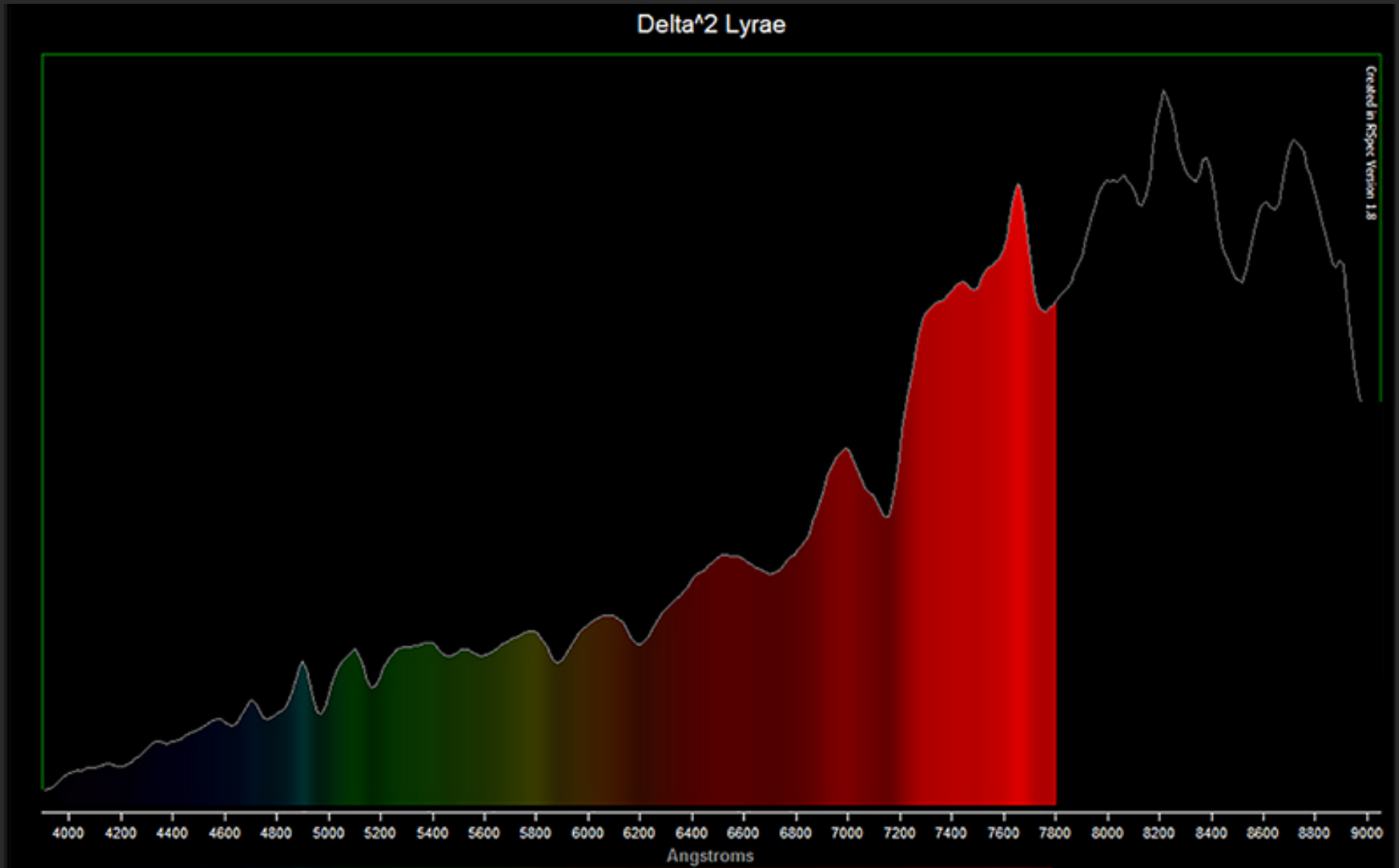
Altair

Angstroms/Pixel: 14.3

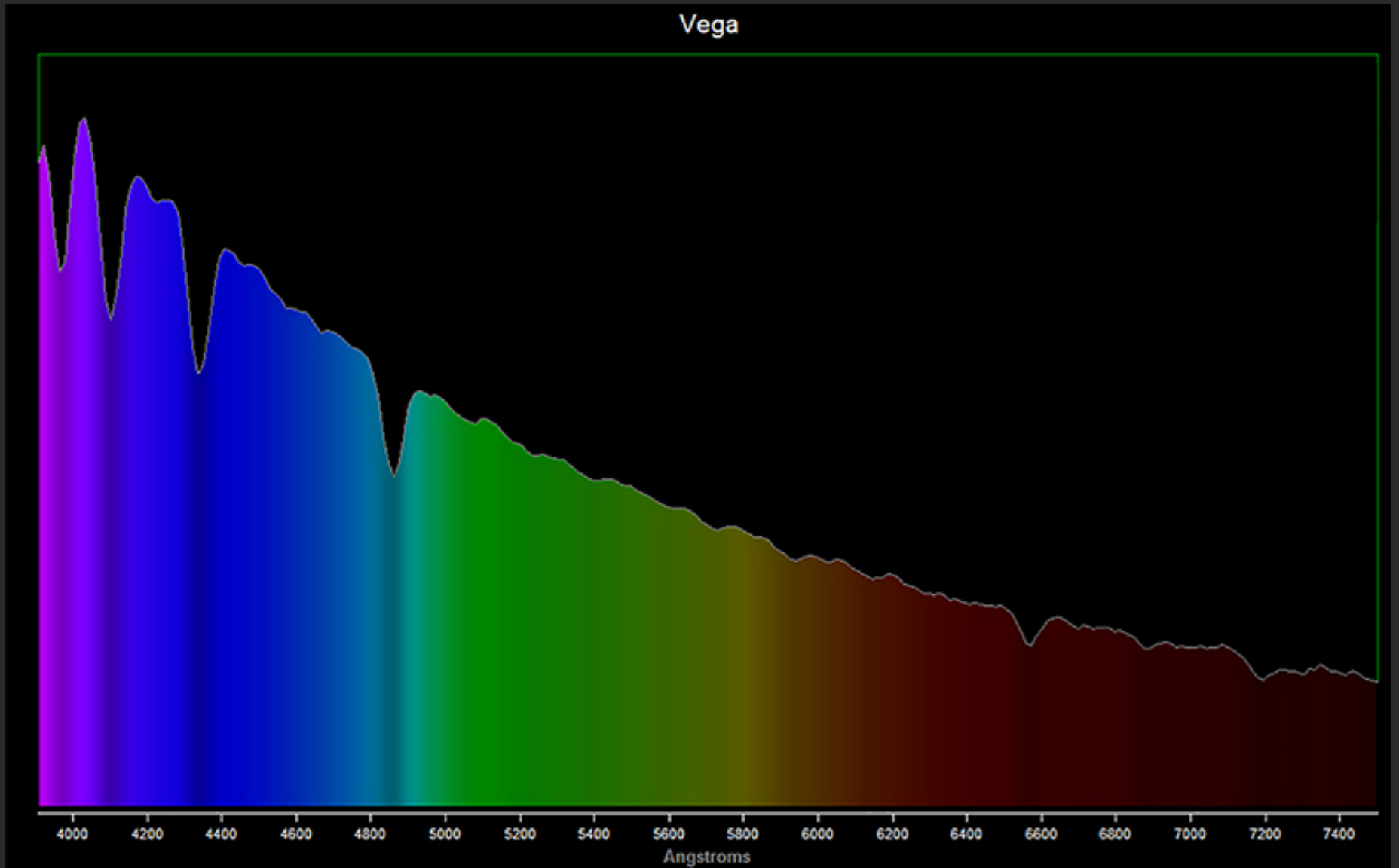
Altair



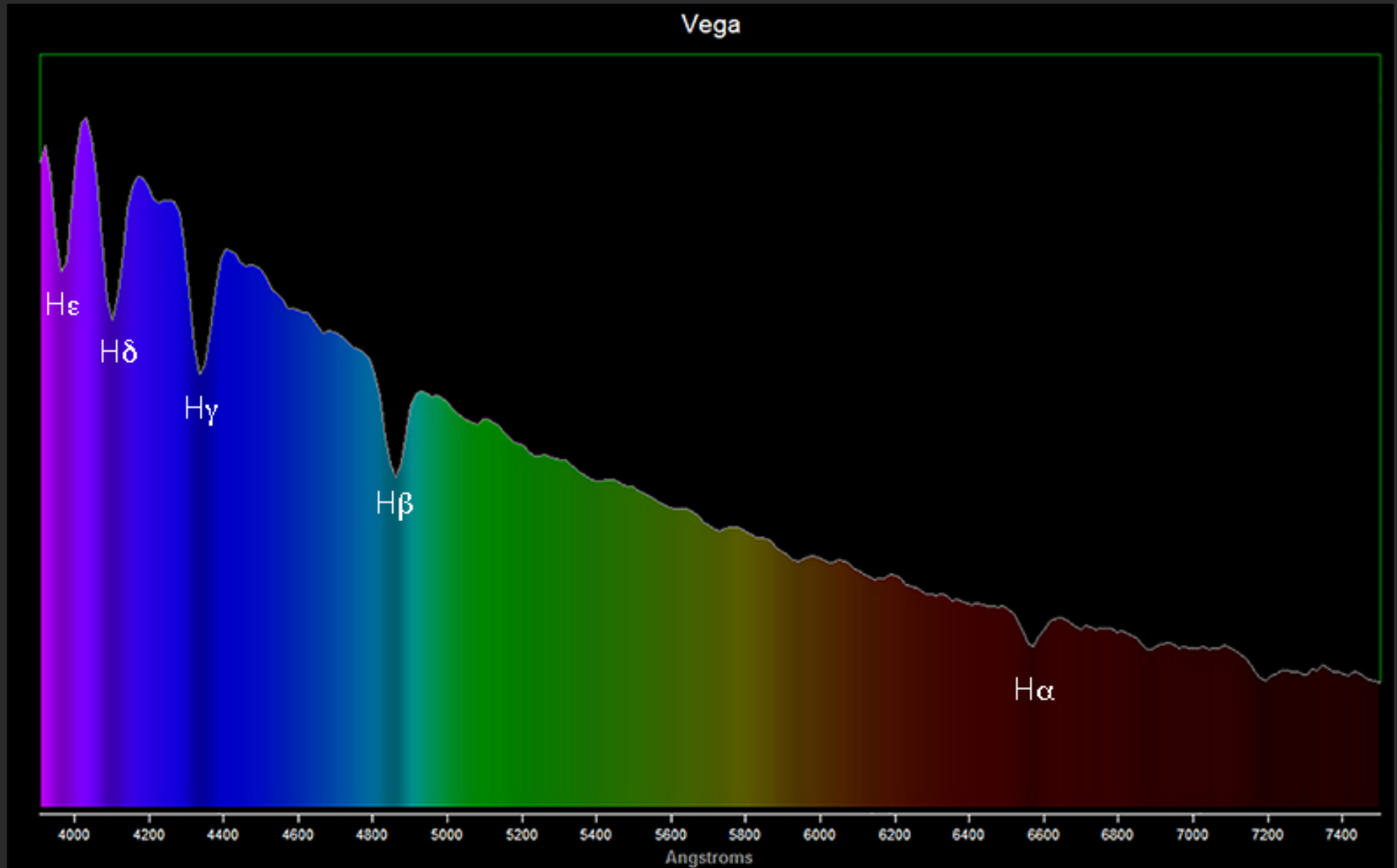
δ^2 -Lyrae



Vega Again



Vega Again



Redshift – Blazars and Quasars

Blazar Markarian 501



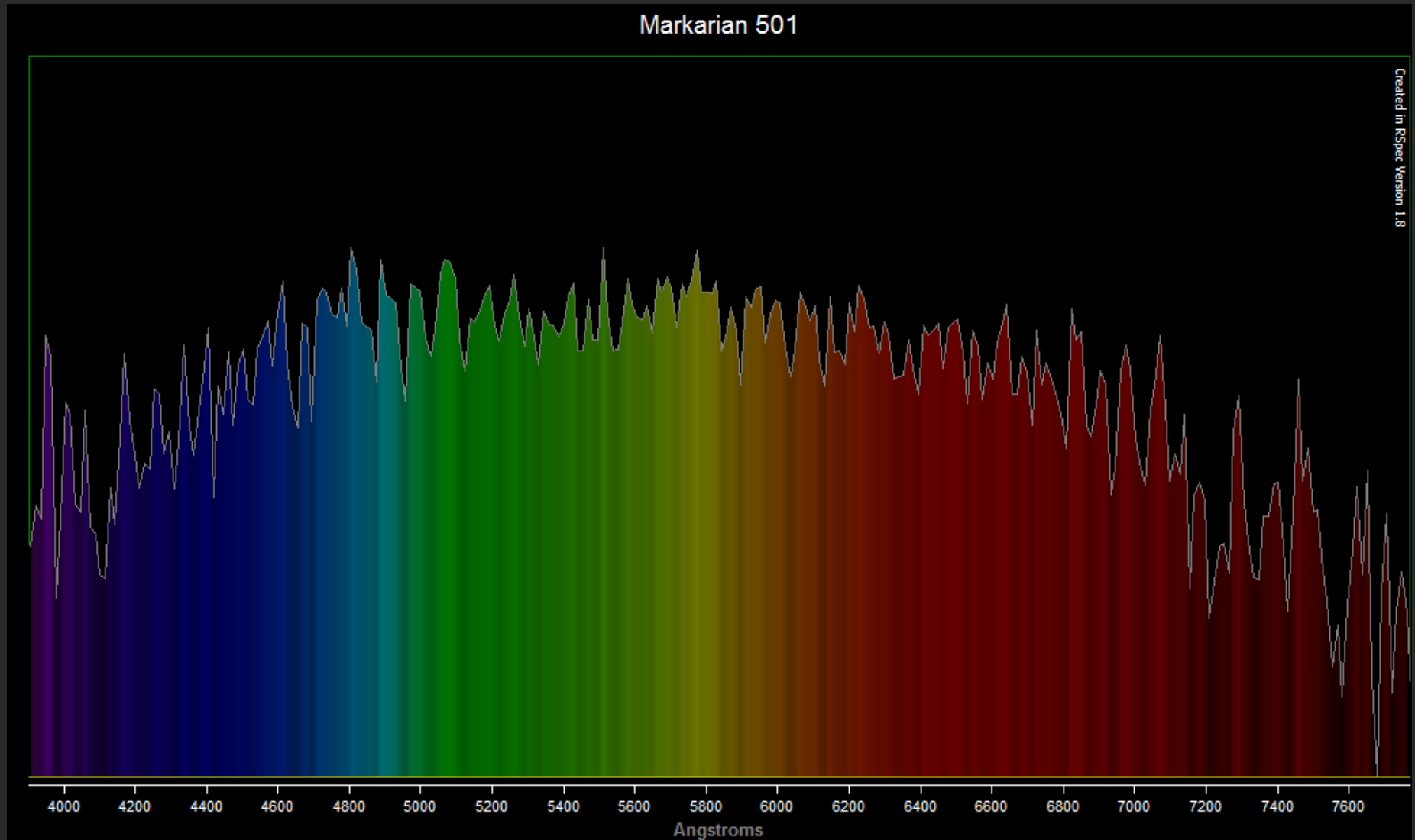
Blazar Markarian 501



Blazar Markarian 501



Blazar Markarian 501 Spectrum



Quasar 3C-273



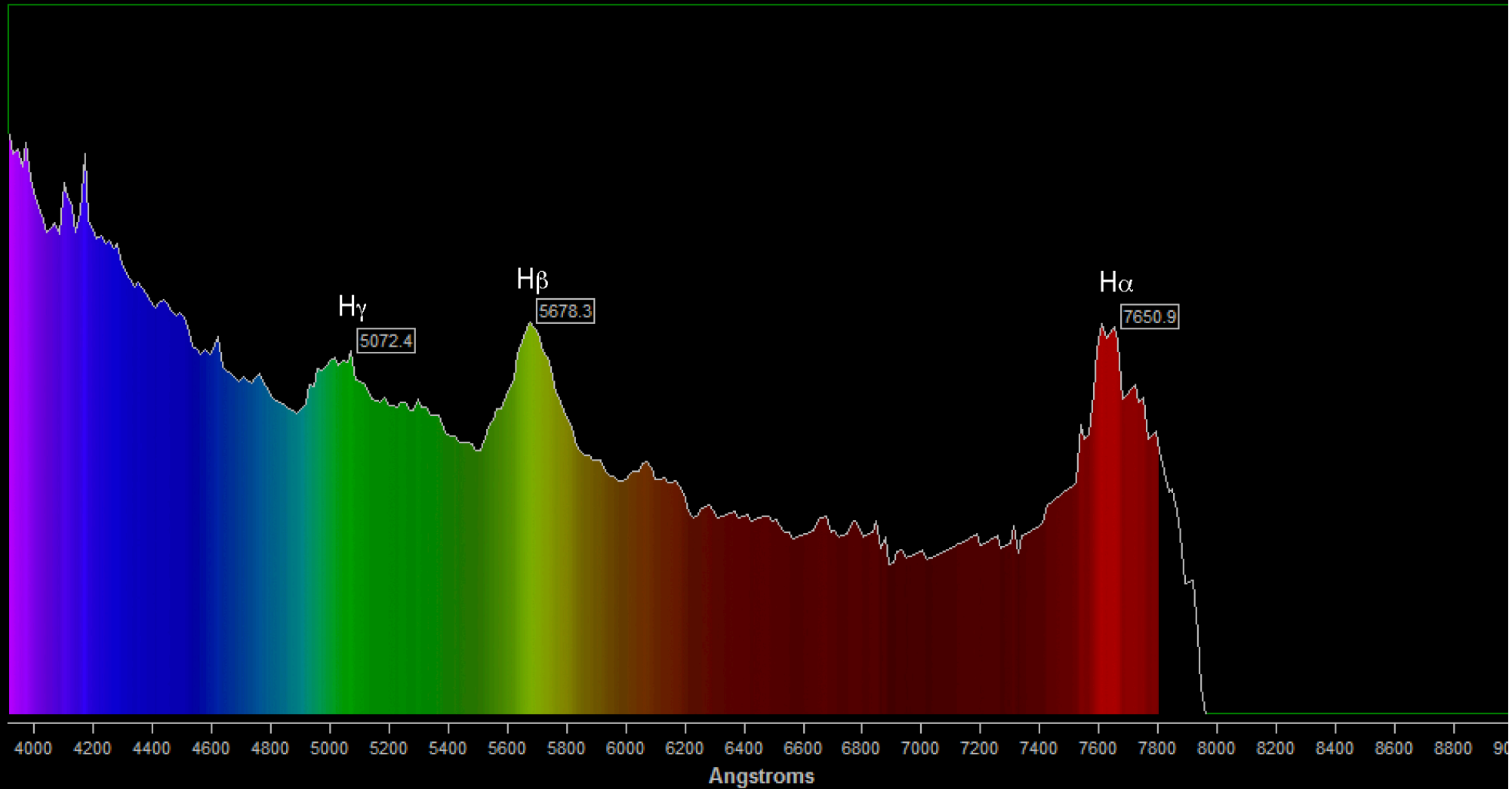
Quasar 3C-273



Quasar 3C-273

Angstroms/Pixel: 14.1

Quasar 3C-273



Calculating the Redshift

To calculate the red-shift, we divide the shifted wavelengths by the unshifted wavelengths and subtract one:

$$\text{For } H_{\alpha}, \text{ we get: } \frac{7651}{6563} - 1 = 0.166$$

$$\text{For } H_{\beta}, \text{ we get: } \frac{5678}{4861} - 1 = 0.168$$

$$\text{For } H_{\gamma}, \text{ we get: } \frac{5072}{4340} - 1 = 0.169$$

According to Wikipedia, the correct answer is 0.158.

That's a long way away:

$$0.158 z = 667,000,000 \text{ pc}$$

$$= 2,170,000,000 \text{ ly}$$

$$= 9.4 \times 10^{22} \text{ miles}$$