SHAULA (LAMBDA SCORPII)

As another example of calculating the colour indices of a star using the blackbody radiation rate, we’ll look at the star Shaula (λ Scorpii), which has a surface temperature of around 22000 K. We can use the formulas:

\[
U - B = -2.5 \log \frac{\lambda_B^5 \left( e^{hc/\lambda_B k_BT} - 1 \right) \Delta \lambda_U}{\lambda_U^5 \left( e^{hc/\lambda_U k_BT} - 1 \right) \Delta \lambda_B} + C_{U-B}
\]  

(1)

\[
B - V = -2.5 \log \frac{\lambda_V^5 \left( e^{hc/\lambda_V k_BT} - 1 \right) \Delta \lambda_B}{\lambda_B^5 \left( e^{hc/\lambda_B k_BT} - 1 \right) \Delta \lambda_V} + C_{B-V}
\]  

(2)

where

\[
C_{U-B} = -0.87
\]  

(3)

\[
C_{B-V} = +0.65
\]  

(4)

Plugging in the numbers, we get

\[
U - B = -1.076
\]  

(5)

\[
B - V = -0.227
\]  

(6)

The measured values given by Carroll & Ostlie are \( U - B = -0.90 \) and \( B - V = -0.23 \) so the blackbody values are quite close to those measured.

The apparent visual magnitude of Shaula is \( V = 1.62 \) and its parallax as measured by Hipparcos is 0.00464″. The distance of Shaula from Earth is therefore

\[
d = \frac{1}{p} = 215.517 \text{ pc}
\]  

(7)

The absolute visual magnitude is therefore
\[
M_V = V + 5 - 5 \log d \tag{8}
\]
\[
= -5.047 \tag{9}
\]

If it were 10 parsecs from Earth, it would be the second brightest object (after the moon) in the night sky, outshining even Venus.