How much radiant flux has my 100 lm LED?

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To use this Matlab live script, several routines from my Matlab Spectrum Library are required.

Open source, free download at https://github.com/JuliusMuschaweck/JMO_Spectrum

We consider a white LED with about 4000K color temperature.

A typical spectrum is this:

```
clear;
whiteSpectrum = ReadLightToolsSpectrumFile('LED_4003K.sre');
figure(); clf; hold on;
PlotSpectrum(whiteSpectrum);
```
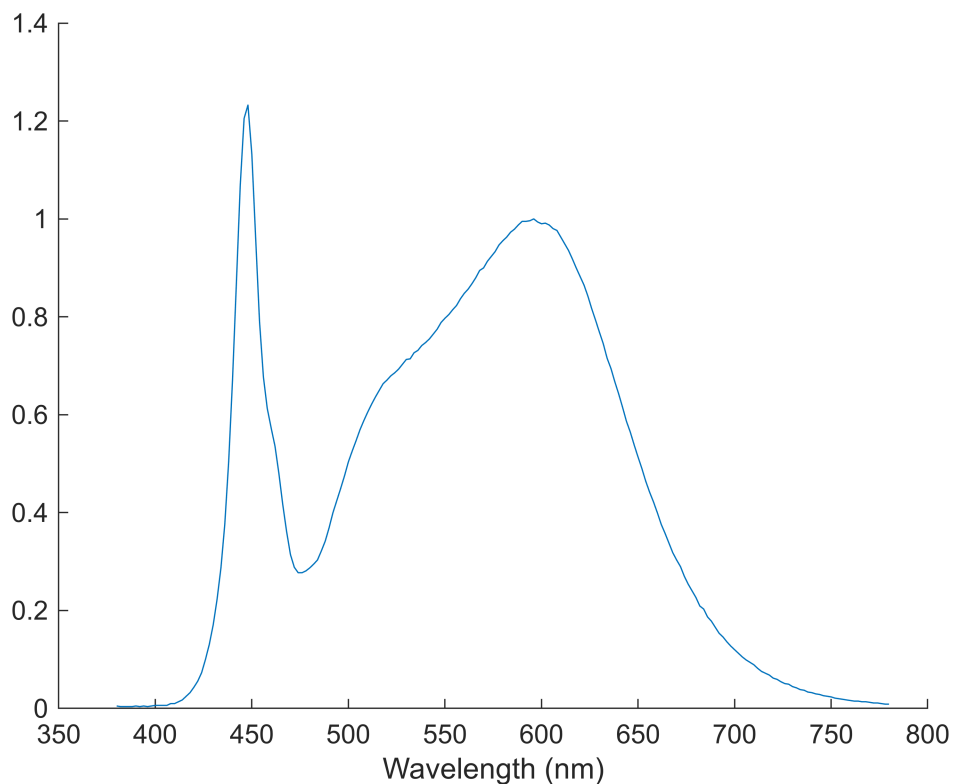

The spectrum has arbitrary units. But assuming we get 100 lm with this spectrum, what is the radiant flux?

To answer, we need the spectral luminous efficacy of this spectrum: How many lumens per Watt?

Let's assume this spectrum is given in W/nm. Then, its radiant flux is simply the integral over wavelength. The `IntegrateSpectrum` function of my library does that:

```
radiantFlux = IntegrateSpectrum(whiteSpectrum);
fprintf("radiant flux = %0.1f W",radiantFlux);
```

```
radiant flux = 175.6 W
```

To compute the luminous flux, we must weight with the VLambda curve and multiply with the 683 lm/W constant from the SI unit definitions:

```
figure(); clf; hold on; grid on;
ax = gca;
VLambdaWeightedSpectrum = MultiplySpectra(whiteSpectrum, Vlambda());
PlotSpectrum(whiteSpectrum);
PlotSpectrum(VLambdaWeightedSpectrum);
PlotSpectrum(Vlambda(),'--');
legend({"white LED spectrum","V(\lambda) weighted spectrum","V(\lambda)"})
```
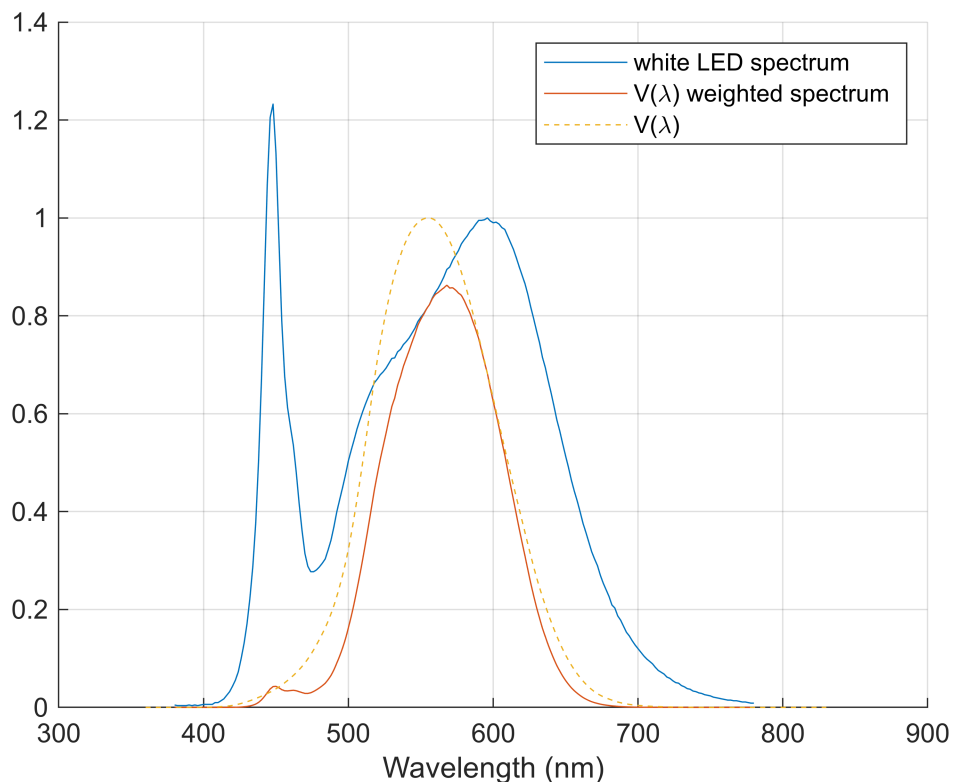


```
luminousFlux = 683 * IntegrateSpectrum(VLambdaWeightedSpectrum);
fprintf("luminous flux = %0.1f lm",luminousFlux);
```

```
luminous flux = 57646.0 lm
```

Now, efficacy is luminous flux divide by radiant flux. The original spectrum normalization is unimportant, any scaling factor cancels.

```
efficacy = luminousFlux / radiantFlux;
fprintf("spectral efficacy = %0.1f lm/W",efficacy);
```

```
spectral efficacy = 328.3 lm/W
```

And the radiant flux is now

```
LEDradiantFlux_at_100lm = 100 / efficacy;
fprintf("LED radiant flux at 100 lm luminous flux = %0.3f
W",LEDradiantFlux_at_100lm);
```

LED radiant flux at 100 lm luminous flux = 0.305 W