REVIEW RESPONCE LETTER [10]

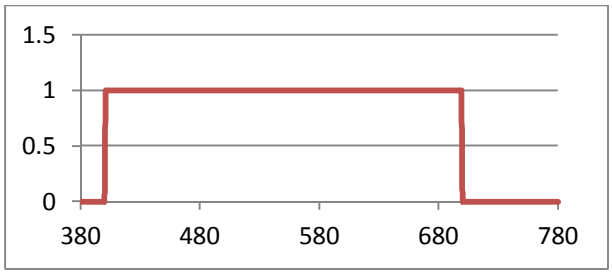
Dear Reviewers,

Thank you for reviewing our manuscript, which hopefully will help us improve it to a better scientific level.

In the following, we discuss the points mentioned in the review:

"In my opinion, introducing the Luminosity Function incurs too many complications. You might have considered that only a certain interval of wavelengths constitutes luminous energy; both the calculations and the experimental proof would be simpler."

We agree that the explanations on the luminous efficiency may have lead to complication, and the assumption recommended by the author makes it much simpler. It is, assuming the light to be fully visible in a range of wavelengths and invisible out of this range. We did try this approach in our theory programming after the revision. Two cases were compared; one is the method recommended by the reviewer, assuming the luminous energy only and with same effect in the range of 400 to 700 nanometers. The other is using the luminosity function. The luminous efficiency was calculated, and in the constant approximation had an average efficiency 3 times more than the one calculated by the function. Multiplying the efficiency of the first set by the ratio of the averages, we reached to the next plot which compares the efficiencies. The luminous experiments were analyzed with both methods, using the measured lumens and the efficiency to find the total power. The total power was plotted against the fourth power of temperature, and we see that the simplified assumption leads to a linear relation with a considerable amount of intercept. This error causes to the disagreement of the experiments with the assumption of gray body, which predicts that this linear relation should have an intercept of zero. This error may be considered small, but we decided to mention the more precise approach in the paper, although complication arises.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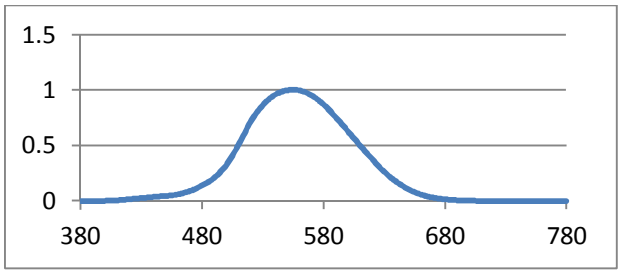
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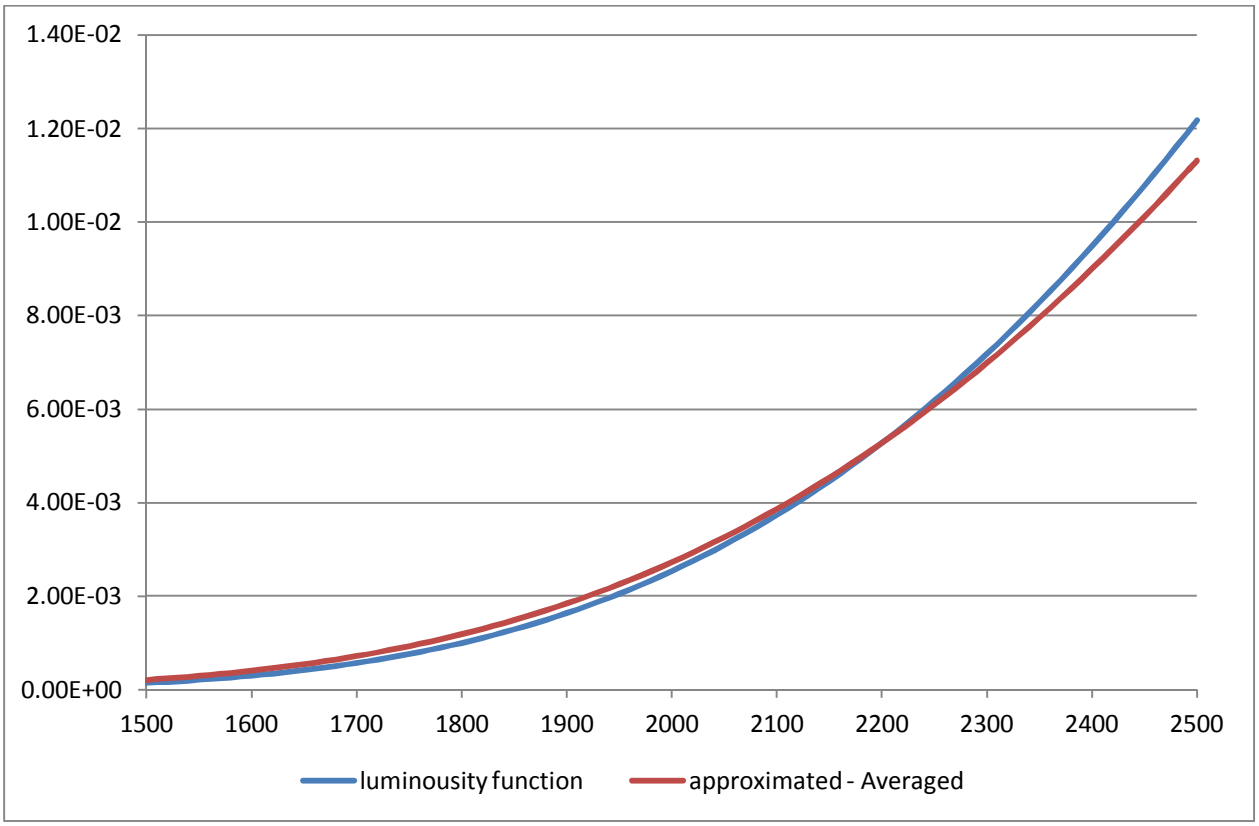
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1.20E-02
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8.00E-03
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4.00E-03
2.00E-03
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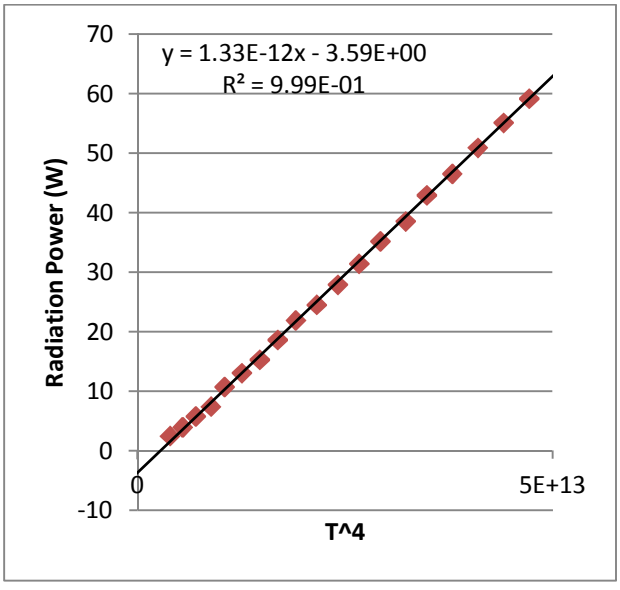
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
luminousity function
approximated - Averaged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R² = 9.99E-01
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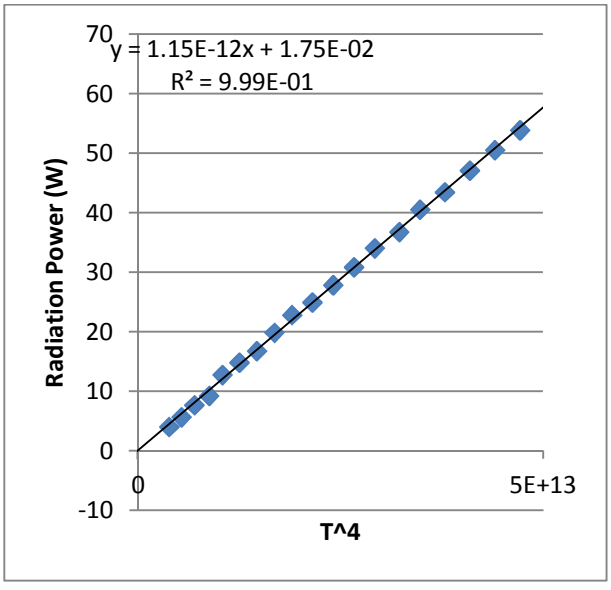
70
60
50
40
30
20
10
0
-10
0
5E+13
T^4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R² = 9.99E-01
Radiation Power (W)
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60
50
40
30
20
10
0
-10
0
5E+13
T^4

"Page 2, calculation of Luminous Efficiency: using Planck's Law to calculate the emission of a gray body emission looks questionable as the spectral emissivity coefficient for tungsten is strongly dependent on temperature and wavelength. (Cf. an appropriate reference book)."

In our investigation, we assumed the emissivity to be constant and the results seem to be quite acceptable. Probably the errors caused by this assumption are being cancelled by each other. Because of the functionality of the emissivity to temperature, the results would probably have about 5% of error from 2000K to 2800K, but investigation on the effect of the wavelength dependence emissivity is quite complicated.

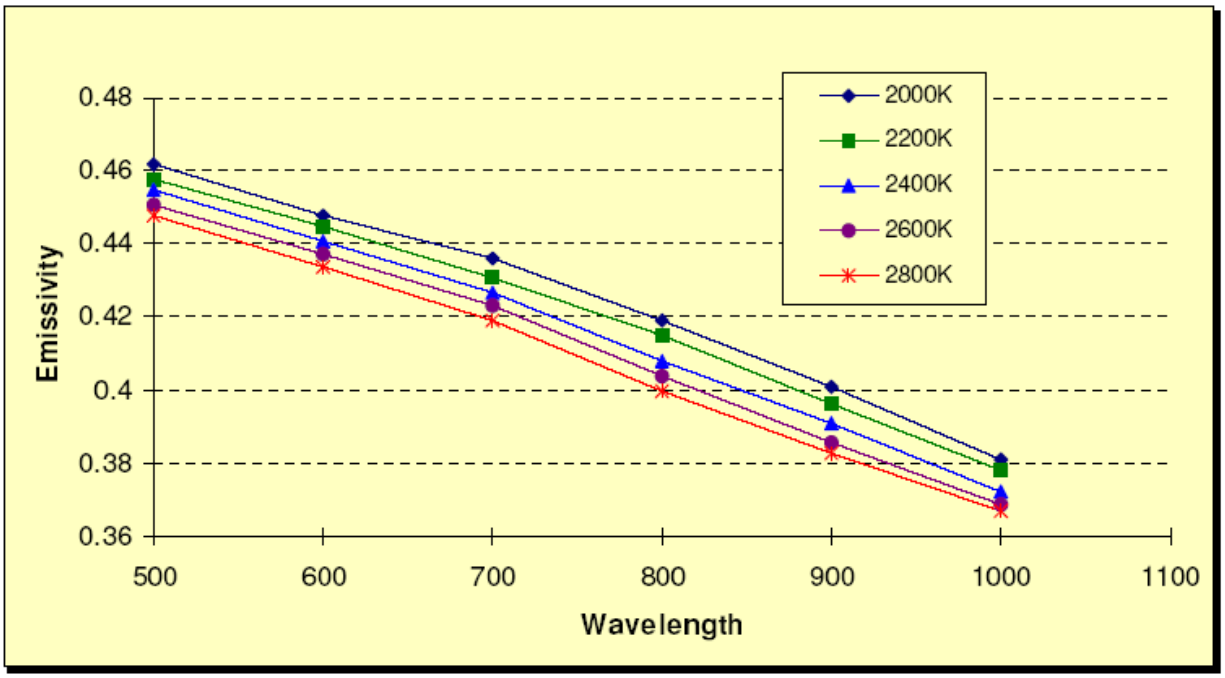


Figure 2. Data taken from CRC Handbook of Chemistry and Physics, 60th Ed., pp. E-381

"Page 3, calculation of tungsten filament resistance: the equation with dimensional variable T in a fractional power looks quite bad. I have already seen similar equations in such a form, but would suggest to briefly clarify this issue in the text."

We agree with this point, and it is corrected by placing the dimensionally right formulas in the manuscript:

$$R(T) = R_0 \left(\frac{T}{T_0}\right)^{1.2048}$$

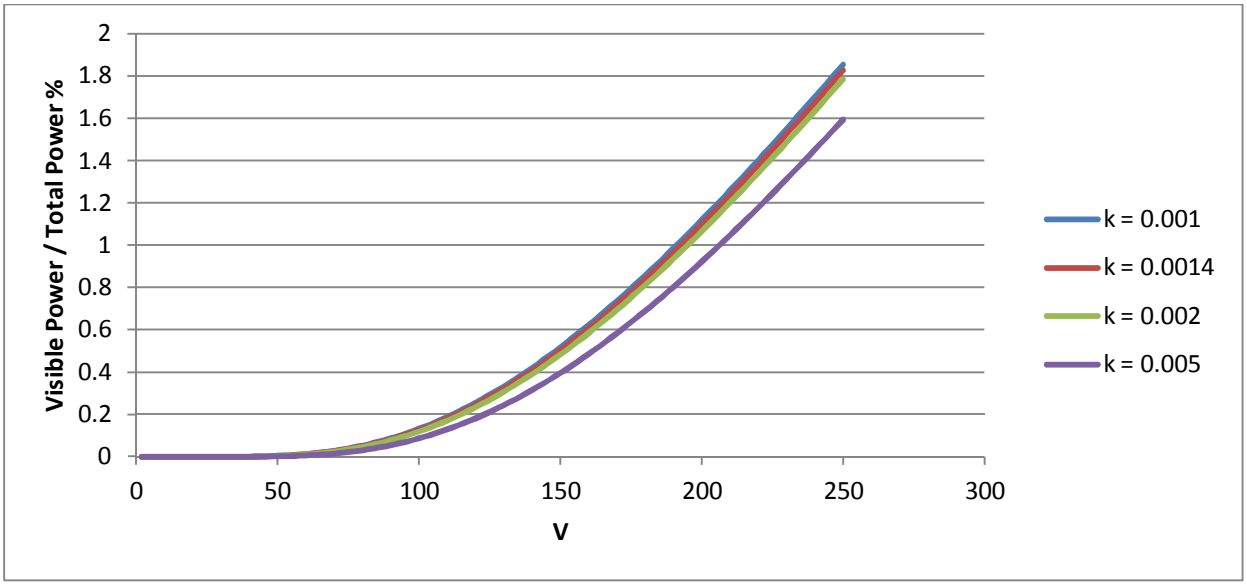
"The experiment with heat measurement: more information is needed on the error of the measurements. Water absorbs not all heat energy, while an amount of luminous energy is also absorbed. At the same time, the heat from the box is lost into the environment. The heat losses through the wires are never considered."

We agree; the error determinations may have not been enough explained.

1) Absorption: Water does absorb all the heat energy, because our definition of the heat is the energy transferred by means of conduction. Neither visible nor invisible spectrum was assumed as heat in the theory. So the radiation is not considered as heat. However, in the experiments some part of the radiation energy is absorbed. This amount was estimated using the beer-lambert law and absorption coefficients in different parts of the lamp. It was calculated that the amount of absorption is about 0.04% in the gas in the bulb, 0.1% in the bulb surface and 4% in the water in the container (water absorption coefficient assumed to be 0.1). So it is all less than 5 percent of all the radiation energy. We edited the manuscript, adding some explanation on these errors.

2) Leakage: We made a 2 layered box, to decrease the heat loss as much as possible. Also, we did the opposite experiment; we turned off the bulb and measured the temperature vs. time while the temperature was decreasing. The gradient of that graph helped us to calculate the amount of heat loss/second in any temperature. Using that thing we were able to add the amount of this heat loss in the experiments.

However, the reason that we did not explain all these was that the sensitivity of the solution to the heat conduction constant was very low. Even doubling k does not lead to significant changes in the results.



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Again, we thank the reviewers for reading and reviewing our manuscript, hoping the response has been acceptable.

Regards,

Reza M. Namin

Alireza Tahmaseb Zadeh