Report on: On the phenomenon of the blue Sun
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Overall I expect that the authors will adequately deal with my comments, therefore I assume that the paper will be acceptable after a revision.

So my official recommendation is: some amendments needed

The paper presents an extensive theoretical study of how aerosol and Rayleigh scattering can modify the perceived color of the sun. It does so using aerosol layers of given optical thickness containing aerosol size distributions with variable mean size and width, as defined by log normal distributions. As expected, the results indicate that anomalous scattering (σ increases with λ, which can give rise to blue suns or moons) are rather rare phenomena and require special conditions such as sometimes happening after volcanic eruptions or intense forest fires. The authors nicely describe the effects of optical depths including Rayleigh scattering which was previously mostly neglected when explaining blue suns.

Overall the paper is well structured and serves its purpose. I have however several suggestions and questions which should be dealt with.

First general comment: Starting to read I immediately missed a reasoning why absorption by aerosols is neglected. I had to wait for Sect. 4 where – in a more or less vague and qualitative manor – it was discussed that absorption has been dismissed due to results of several studies. I cannot help but think that instead of qualitatively arguing, you should compute maybe just one example for typical imaginary parts from the literature and compare the results to the absorption free case. Then any reader would accept your arguments. Right now I have just to believe them which is unsatisfactory.

Second general comment: Color perception is more than just the xy-coordinate in a chromaticity diagram. It is very helpful to plot the color, however, in real observations the influence of attenuation is dramatic when moving for 30° SZA to 90°SZA and one must consider the influence of changing contrast. The least I would expect is to not only show the color of the sun, but also how it´s relative brightness changes. Even better would be to add a short discussion of how color perception is expected to be influenced by the variation in brightness and contrast.

Third general comment: I missed a discussion concerning the influence of ozone absorption (Chappuis bands) on the color, in particular for large SZA. It had been shown e.g. for lunar eclipses that blue color during totality can be influenced by ozone (Appl. Opt. 47, No. 34 / H149 (2008)). The effect of ozone has also been briefly discussed for blue moons (see literature). I assume that your model does also allow to assume an ozone distribution and check how / if results change.

In the following I mention some additional thoughts which I had when reading the text.

line 77, see first general comment

line 91 Sect. 2.2: of course this depends on the physics/optics knowledge of the general reader of the journal, but to my opinion, the topic of color as treated in the section is basic textbook knowledge. This section can be shortened appreciably including deleting Fig. 1. I suggest to just quote respective textbooks. Reason: those who are not familiar with chromaticity diagrams and respective definitions will not get a better knowledge when reading this condensed textbook knowledge and those familiar with the topic do not need it. I would just keep the last sentences, i.e. lines 110-117

line 128; discussion of figure 2: Maybe I am old fashioned here, but I personally think looking at Fig. 2 alone makes it harder to see the point. I suggest that you should add the classic diagram of extinction efficiency versus size parameter which explains anomalous extinction at one glance. Having this in mind greatly helps to understand your admittedly nice representation of the same content in Fig. 2.

Line 147: you mention standard atmospheric trace gases are used, is ozone included ? see third general comment

Line 161: have you used the exponent 4.00 for Rayleigh scattering or averaged 4.08 which includes dispersion effects of air (e.g. Young, Phys Today Jan 1982, p2-8)?

Line 72: question: is the vertical optical depth of 1 only the aerosol or the total optical depth ? please clarify!

Line 152: Starting Sect. 3.2, discussion of diagrams 3-6 and 8: see second general comment.

Line 220: from fig. 7 I estimated a change in attenuation from 400 nm to 630 nm from around 10^{-4} to 4.3 10^{-5} i.e. a factor of 2.3 between blue and red. You describe the change in depth as only being 10%, that is true, but misleading. It is the factor of 2.3 difference for the radiometric quantities entering the eye of an observer which is relevant. Maybe you could amplify the change by plotting from 8 to 11 rather than 6 to 12.
And of course, the attenuation of more than 10,000 also means that sun is not very bright, though still bright enough for color perception. One may compare this to totality of a solar eclipse where attenuation with regard to daylight is around 10^{-5}.

Line 222: “were” only available (you refer to Wilsons data)

Line 223: maybe better to write … variation with about 10% change is not …

Line 265: see general comment 1

references:
I propose that the authors carefully check all refs. I found e.g. one misspelling.

Line 325. Should probably be Dietze (e missing), as G. Dietze in his book on atmospheric optics from 1957 mentions blue suns.

I had expected some other general standard textbook refs. which at least shortly discuss blue suns in the context of Mie scattering such as Van de Hulst, Light scattering by small particles from 1957 or Bohren/Huffman, Absorption and scattering of light by small particles, Wiley 1983.

In addition, Gedzelman / Vollmer Twice in a blue moon, Weatherwise Sept/Oct 2009, 28-35, discussed blue moons including the role of ozone and also a but of optical depth discussion