

## ***Interactive comment on “Complex refractive indices of Saharan dust samples at visible and near UV wavelengths: a laboratory study” by R. Wagner et al.***

**Anonymous Referee #1**

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This is a generally well-written manuscript covering laboratory measurements and numerical calculations of mineral dust optics in a very thoughtful and detailed manner. This manuscript should be published in ACP if the following comments can be addressed:

1) Error analysis and error bars shown in figures: Figure 14 shows frightening error bars for the measurements of dust absorption coefficients by SOAP, that is error bars covering an order of magnitude or more for most visible and near-infrared wavelengths (450 nm and above). However, fig. 13 showing retrieved spectra for the imaginary part of the imaginary part of the refractive index  $k$  does not show corresponding error bars.

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If careful error analysis shows that errors in  $k$  are comparable in size to those of the absorption coefficients and exceed the spectral variation in  $k$ , the main result of this manuscript would be gone. While the authors claim “that a detailed inter-comparison of the two techniques for measuring particle absorption [i.e., SOAP and photoacoustic] which would also help to better constrain their respective measurement uncertainty is beyond the scope of the present manuscript.”, I would think that this would be the most promising way for possibly reducing the excessive errors in their SOAP absorption measurements. In any case, fig. 13 needs error bars and a discussion if any spectral variations exceed these error bars.

2) T-matrix modeling of optical particle properties is based on the axis ratio AR determined from SEM and TEM images. However, the use of 2-d images to determine 3-d particle properties depends critically on assumptions about particle orientation on the filter substrate. Do the particles have random orientation or are they oriented on a flat substrate minimizing the distance between their center of gravity and the substrate plane? What is the surface roughness of the filter substrate?

3) The authors talk multiple times about “re-dispersed soil samples”. This makes perfect sense for the Burkina Faso sample consisting of “wind-blown material”. However, it is not clear if the other soil samples are “re-dispersed” or simply dispersed.

4) The authors state on p. 5 “Since light absorption by the dust particles is governed by their volume concentration,...”. My understanding is that this is true only in the Rayleigh regime (size parameter  $x \ll 1$ ) where the absorption coefficient is proportional to the particle volume, while for very large particles in the geometric optics regime ( $x \gg 1$ ) the absorption coefficient is proportional to the projected area. The dust particles considered here include large particles ( $x > 1$ ), so this statement is questionable.

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