Answers to IR-lab Part2

**Task 1.** The default camera setting of the emissivity is 0.95, which is in good agreement with the emissivity of human skin (~ 0.98). Use the camera to measure the apparent temperature of your or friend's skin. Does the value seem reasonable? Can you think out the apparent temperature if the emissivity setting is changed to an erroneous value, e.g. 0.30? Find out the answer using the camera!

Stefan-Bolzmann's law gives that $W=\varepsilon\sigma T^4$. Suppose a skin temperature of 30°C = 303K. If the emissivity is set to 0.30 instead of 0.95, the camera will show $303\cdot(0.95/0.3)^{1/4}$ = 404K=131°C.

**Task 2.** A problem with imaging in the infrared region is that expensive lens materials such as germanium must be used, due to that the transmission of ordinary lens materials is very poor. Investigate the infrared transmission of the glass plate! Now compare with the transmission of the plastic bag. Can you find out why plastic lenses are not used in infrared imaging?

Both glass and plastic have low transmittance. The reason why IR is transmitted through the plastic bag is that is very thin. In addition, a plastic lens is easily scratched.

**Task 3.** The camera is not needed in this task. As you have found out the camera is not able to see through e.g. the table. The "see-through" ability is achieved using longer wavelengths, 70 µm – 3 mm (i.e. the THz region). However, based on the characteristic features for a thermal detector, it should be possible to use the camera to "see-through" but the camera needs to be both modified and complemented. Can you figure out what modification and complement is required? Hints: Consider Task 2 and the figure below (you can also compare a motorist daytime and nighttime).

1) The optics needs to be modified (the lens is not optimized for THz wavelengths).
2) A THz source is required due to the low levels.

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