

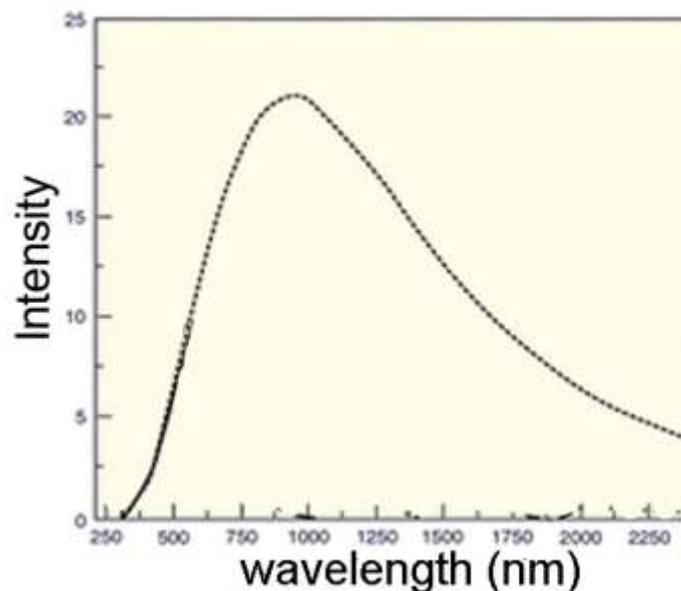
# There is more about light than our eyes can see

(STUDENTS' HANDOUT)

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We placed on a table a large sheet of black paper and on this paper we placed one black and one white square made of cardboard and a marker. We took images of this setup in three different electromagnetic (EM) wavelength regions (see Table 1). In each wavelength region we took two images: the first one, right after a bright incandescent lamp was switched-on and the second one 5 minutes later (the lamp was on all the time). After taking each pair of images we switched off the lamp for some time, allowing the temperature of all objects to become equal to room temperature. The lamp was aimed at the setup and did not change its position during the experiments.

The following graph shows the spectrum of the light emitted by the incandescent bulb that was used in our experiments.

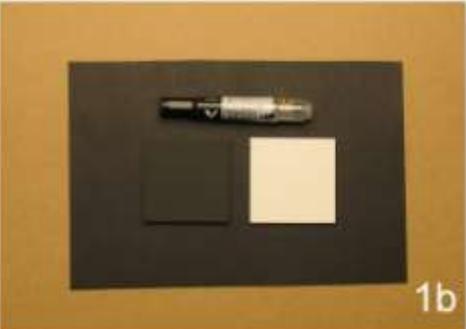
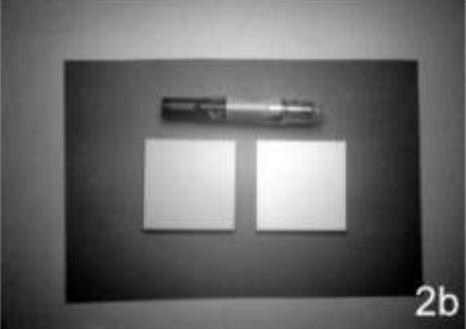
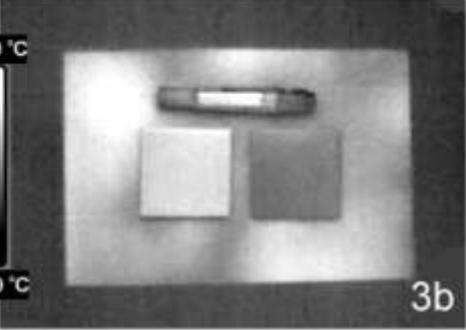


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<sup>1</sup> The MUSE group, Zdenka Koupilova, Andreas Mueller, Gorazd Planinsic, and Laurence Viennot, takes responsibility for the content of this paper (June 2015).

Read the short descriptions of the experiments and carefully observe the corresponding photos (see Table 1). Then follow the instructions on the following pages.

**Table 1.** Short descriptions of the experiments and their outcomes.

	Right after the incandescent lamp was switched on.	Five minutes later (the lamp was switched on all the time).
<p><b>Images in visible light.</b> Visible light covers wavelengths from about 400 nm to 750 nm.</p>	 <p>1a</p>	 <p>1b</p>
<p><b>Images in near infrared light.</b> Photos have been done with a digital camera and a filter that passes EM waves with wavelengths from about 850 nm to 1000 nm = 1 μm.</p>	 <p>2a</p>	 <p>2b</p>
<p><b>Images obtained with a thermal camera.</b> Camera detects EM waves with wavelengths from about 7 μm to 14μm. Based on these measurements the camera determines a temperature of the particular spot on the object.</p>	 <p>3a</p>	 <p>3b</p>

**1. Describe everything you notice on the images in Table 1. At this stage do not make any explanations – focus only on description of your observations.**

**2. Propose explanations for the observed patterns. If possible, try to find several different explanations for each pattern.**

**3. Suggest testing experiments for your explanations. For each testing experiment make predictions based on explanations under test. Describe also any assumptions that you made in your reasoning.**