

Absorption spectroscopy

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PH491/591, The University of Alabama, Fall 2022

1 Hypothesis

The absorption or transmission spectrum for visible light can reveal properties of the material's electronic structure. For glasses, it can reveal which dopant gives rise to color. For some semiconductors, it can measure the electronic band gap.

2 Introduction and procedure

The idea is simple: send light through your sample and see what comes out. You'll need a reference spectra of the light source with no sample to compare to, as well as a "dark" spectrum with no light at all. You can accomplish this with the OceanView software (create a new spectroscopy application when it asks . . .), the RedTide or USB-4000 spectrometers, and the light sources available.

Verify your setup is correct by measuring one of the neutral density or color filters from the h/e photoelectric effect setup - their characteristics are known. If using the Ocean Optics light source, use only the halogen lamp (not the deuterium). If using the second setup, use the LED bulb provided in the dark box for controlled illumination.

3 Task

If you have the set of glass filters, measure several of them and try to figure out how the transmission spectrum explains what color the glass is. Presuming this to be ordinary SiO_2 -based glass with a single atom colorant (dopant), what are some plausible dopants for each color? ⁱ Can you find example spectra to compare to?

If you have the setup with the round yellow piece, can you figure out what this thing is? Don't touch it with your fingers please. If you figure that out, ask the instructor about your second sample. If you have this setup, you have a little more work to do in calibrating and refining your setup.

ⁱAs a starter, "cobalt blue" glasses are named this way for a reason.