

# Spectrometer

Order a spectrometer kit (including one which attaches to your smartphone) now at the [Public Lab Store](#)

## Quick Links

- contributed open-source [Spectrometry research](#)
- [Foldable Mini-Spectrometer](#)
- [Desktop Spectrometry Kit](#)
- [Spectral Workbench](#) - software for using your DIY spectrometer
- [Spectral Workbench usage](#) - support for our spectrometry software

## DIY Spectrometry mailing list

Subscribe to the "plots-spectrometry" mailing list for support, discussion, and to share your work:

## Purpose

Chemists use [expensive tools called spectrometers](#) (there are several kinds) to analyze unknown solid or liquid samples.

We are working on a cheap version which we hope to use **to identify oil contamination in water and soil**, as well as a range of other possible toxins.

Spectrometers can also be used to identify species of plants or crop diseases, assess plumes from smokestacks, and have many other applications.

## What's spectrometry?

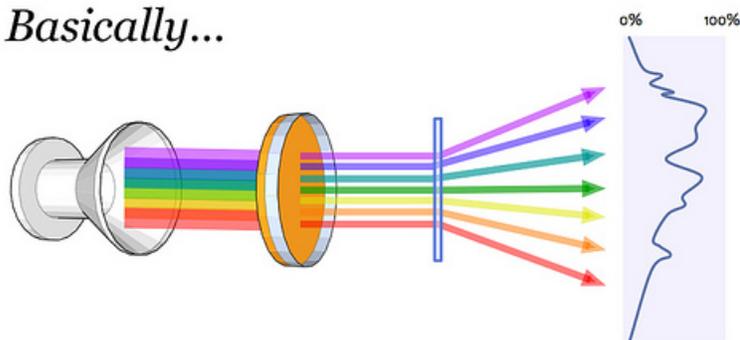
What we perceive as a single color consists of multiple blended colors- just as green paint can be made from mixing yellow and blue paint. A spectrometer is a device that splits light into the various colors it is composed of, which we otherwise cannot distinguish with the naked eye. By viewing a substance through a spectrometer, one can distinguish the exact mixture of colors, which correspond to specific wavelengths of light. These can be compared to other spectra to help identify the sample.

## Make a spectrometer

The PLOTS spectrometer is a Do-it-Yourself tool made from simple



## Basically...



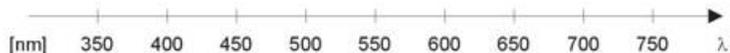
1. A broad-spectrum light (halogen, incandescent) is shone through a sample

2. Some colors are absorbed more than others depending on its composition

3. Diffraction grating splits light into colors so they can be measured separately

4. A webcam measures each color and graphs their intensities. This is compared to known samples.





materials:

- stiff black card paper
- a clean DVD-R
- an HD USB webcam
- a [Type LB conduit body](#)
- double-sided foam tape and a box cutter/x-acto knife

The DVD's tightly packed grooves act as a diffraction grating -- basically a prism.



### [Spectrometer construction »](#)

The above link offers step-by-step instructions on making your own spectrometer. It features:

- around 400-900 nanometer range, maybe wider (what you can see with the naked eye, plus some infrared)
- 5-10 nm spectral resolution
- 20-30 samples per second
- ~ \$15 in materials
- < 1 hour construction time
- [open-source software](#)

Though these specs look pretty good, they still need to be compared rigorously with a traditional laboratory spectrometer. Are you interested in trying it?

### *Uses for open source spectrometry*

As we ship to the different [Kickstarter backers](#), we are [posting how people have said they plan to use their spectrometers](#).

One group of toxins common to fossil fuel contamination are PAHs, polycyclic aromatic hydrocarbons, which are generally carcinogenic. We're trying to develop a step-by-step experimental procedure to prepare a soil or water sample, shine a full-spectrum light (like a halogen lamp) through it, and detect the missing wavelengths.

If you're interested, please chip in to develop and document a consistent way to read samples here:

### [Spectrometer usage »](#)

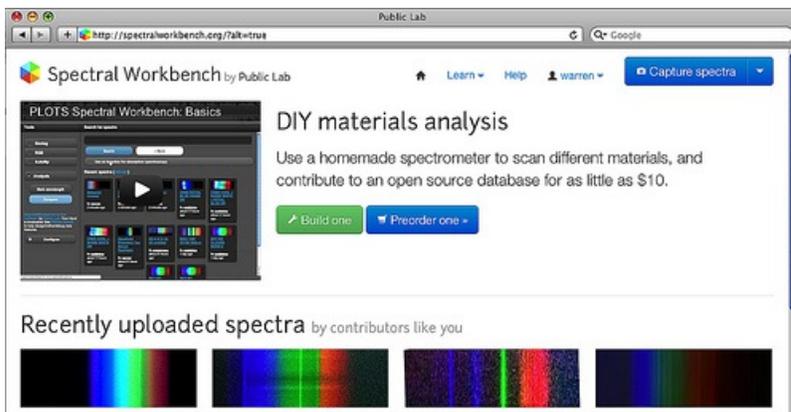
We're also putting together a list of research (some of it our own) to draw upon in developing spectral analysis techniques for anything from soil to grapes to coffee:

### [Spectral Analysis »](#)

### *Online spectral analysis*

Along with the physical tool itself, the PLOTS community has also developed a [software suite and online database](#) which allows anyone to upload their data and work with others to try to interpret it. These tools are early prototypes and we're looking for help developing them.

Finally, a FAQ with some insights about actually *using* your spectrometer can be found here: [Spectrometer FAQ](#)



## Advanced topics

- [Analyzing concentration of a sample](#)

## Goals

This is an early-stage, speculative project, but our goals include:

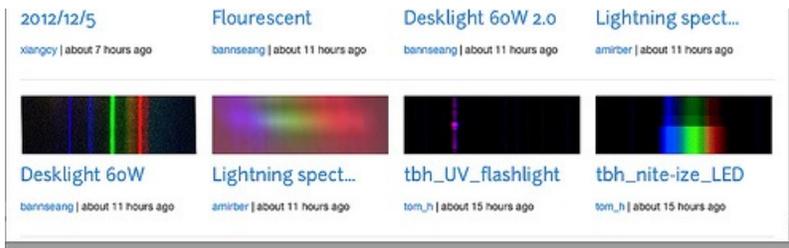
- Identify a contaminant in a sample, like a polycyclic aromatic hydrocarbon -- i.e. [naphthalene](#), [anthracene](#) or [tetracene](#). Tetracene has absorption bands well into the visible range.
- Identify a plant species by its spectrum. (see [this helpful paper by Zomer et al](#)) Or perhaps a mineral, using the [ASTER spectral library](#)
- Try to identify something in a smokestack plume, like a refinery plume

## Older designs

Several [older designs](#) have been documented on this site. Guides have been made showing you how to make some of these; they include:

- [plots-spectrometer-guide-small.pdf](#) - by the PLOTS team for our workshop at the Whitney Museum
- [Make a Spectrometer.pdf](#) - by Alex McCarthy
  - [partsandcrafts-spectrometer-guide.pdf](#) - by [Parts and Crafts](#) (21mb, print quality)

## Spectrometers in popular culture





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