

FEATURING THE FS-522 WITH *FASTSpec*<sup>TM</sup>  
LAB INTERFACE, ASSOCIATED SENSORS  
AND WINDOWS BASED SOFTWARE



## E-Newsletter

Volume II, Number 2

September 2011

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Spectroscopy Module  
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Meetings

### [193rd 2YC3 Conference](#)

Brevard Community  
College  
Coca, FL,  
September 16-17, 2011

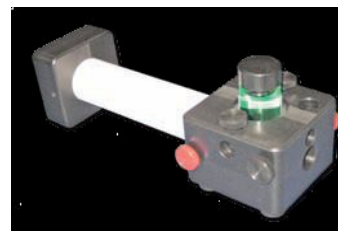
[MACTLAC Annual  
Meeting](#), Beloit College,  
Beloit, WI,  
October 21-22, 2011

### Quick Links...

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MicroLab's new Visual  
Spectroscopy module is a  
terrific educational tool at a  
great price.



Visual spectroscopy and much more - MicroLab's new  
\$115 Visual Spectrometer makes abstract  
spectral concepts *real!*

Let's assume that you are an educator - high school or college - and you want your students to experience the interaction of light with matter. Until now, this has not been an easy task. You can give them a diffraction grating or a cardboard spectroscope to observe the emission spectra from various sources and ask them what they see. If your students are like mine were, you will almost certainly have several who see nothing at all - you can only hope that they tell you rather than go along as if they can see the spectrum. Those who do tell you that they aren't seeing anything require some trouble shooting: is the grating oriented properly for observation? Is the slit properly aligned with the grating? Are they looking in the right place so they can actually see the spectral lines? Has someone lost the grating from the spectroscope? It can be a frustrating session.

The new [Visual Spectrometer](#) (patent pending) from MicroLab is an inexpensive, rugged teaching tool that takes the guess work and the frustration out of observing emission and absorption spectra.

## ***We want to hear from you!***

If you have a question about the capabilities of the FS-522, please ask us. You may be surprised at its potential in your situation!

Email us

([info@microlabinfo.com](mailto:info@microlabinfo.com))

or click the MicroLab Support in the Quick Links box (above) for other contact information.

If you have an interesting application of the MicroLab system in your lab, we would love to hear from you! Send us an email - just click on the link above.

If you want to contribute a featured lab application to the E-Newsletter, please contact the editor!

[mjcollins@viterbo.edu](mailto:mjcollins@viterbo.edu)

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## **What some of our colleagues using the FS522 say:**

"MicroLab has made our labs much more economical. Experiments use smaller samples and run more quickly, and students use their time more effectively."

*-Virginia Wairegi,  
Rice University*

"Y'all are doing wonderful work...MicroLab is a

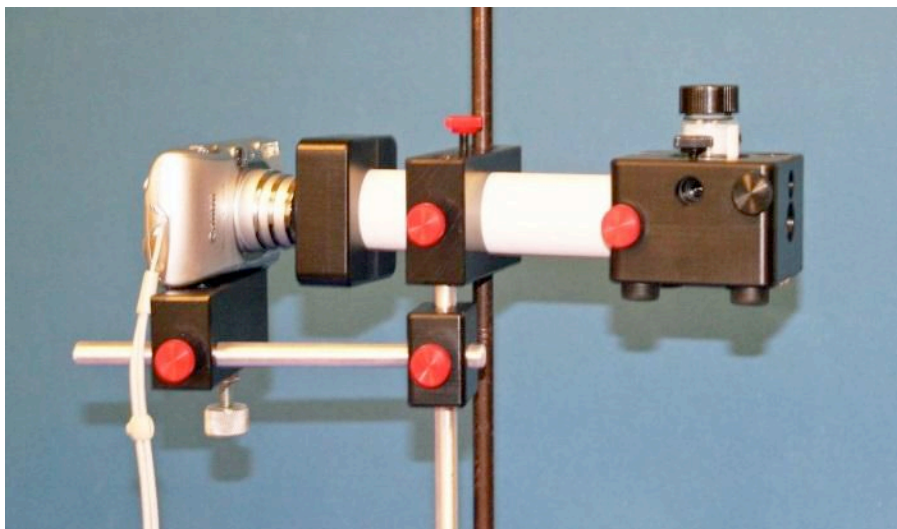


The view of a continuous white light source through the Visual Spectrometer eyepiece. Photo was taken with a digital camera and the optional Model 143 Camera Mount Accessory.



The lamp emission spectrum as seen to the right of the slit. Photo was taken with a digital camera and the MicroLab Model 143 Camera Mount Accessory.

***Students can show you what they see*** - the eyepiece easily accommodates a digital camera or smart phone so they can show you exactly what they are seeing. As an instructor, you can use a camera in a lecture demonstration to demonstrate emission spectra. (The right webcam can be used, but most webcams do not process color as well as a camera in a smart phone.)



Optional Model 143 Camera Mount Accessory shown with camera attached (camera is not included). The attachment allows the camera to be aligned with the Visual Spectrometer using included clamps and metal rods and attached to a ring stand support.

quantum leap in teaching the fundamentals of chemistry."

**Sam Stevenson**  
*Marion Military Institute*

"It used to be that students would spend a three-hour lab gathering data. Now, students can focus on what the data means; this enables them to decide quickly whether or not they need to do the experiment over. The discovery process - how the numbers relate to a concept - takes place in the lab, not when the students are writing their lab reports."

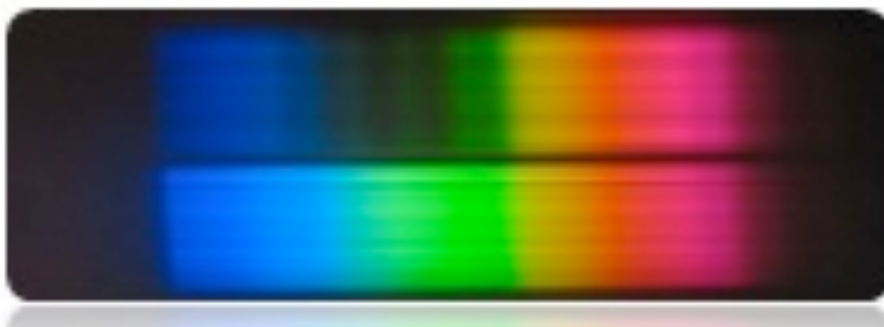
**Dr. Carolyn Mottley**  
*Luther College*

"I have been using the MicroLab FS-522 in our general and physical chemistry laboratories. I am impressed with the versatility and the low cost of this interface, it opens new possibilities for experiments."

**Dr. David Saiki**  
*California State University Bakersfield*

"MicroLab's

**Students can see the missing colors!** It has not been easy, or even possible, for students to see visually which colors of light are being removed by the sample. Sure, you can show a graphical display from an expensive spectrometer or a meter readout on a colorimeter, but can your students actually relate the display to what is going on with the light? Most students think in terms of light transmission: if you show a student a purple solution, he or she is likely to explain it in terms of purple light being transmitted rather than red and blue light being transmitted and the middle of the spectrum being absorbed by the sample in solution.



Visual Spectrometer view of a purple  $\text{KMnO}_4$  solution showing the missing colors from the middle of the spectrum. The source is an incandescent lamp. The unattenuated source spectrum is viewed immediately below the  $\text{KMnO}_4$  sample spectrum, allowing the viewer to see immediately which colors are absorbed by the sample.

MicroLab's Visual Spectrometer is an ingenious and easy to use device for seeing exactly what portion of the visible spectrum is being removed by the sample. Simply put a vial of the colored sample into the integrated sample compartment, point it at the source, and observe. The placement of the vial relative to the light transmission allows the observer to see both the unattenuated spectrum of the source (the "reference" spectrum) and the spectrum that is transmitted by the sample.



This is the eyepiece view of a vial of yellow food coloring in the sample compartment, illuminated with an incandescent lamp source. The source spectrum is seen by the viewer displayed immediately below the sample spectrum, allowing the viewer to see immediately which colors are absorbed by the sample.

software is an enormous aid for non-major students to visualize data collection in real time, and leads them to clearly understand the concept of the lab."

*Dr. Angie Sower  
Montana State  
University*

"I'm continually amazed at the research quality data we get from MicroLab. We can do things in teaching and in under-graduate research at a small institution that we never dreamed possible."

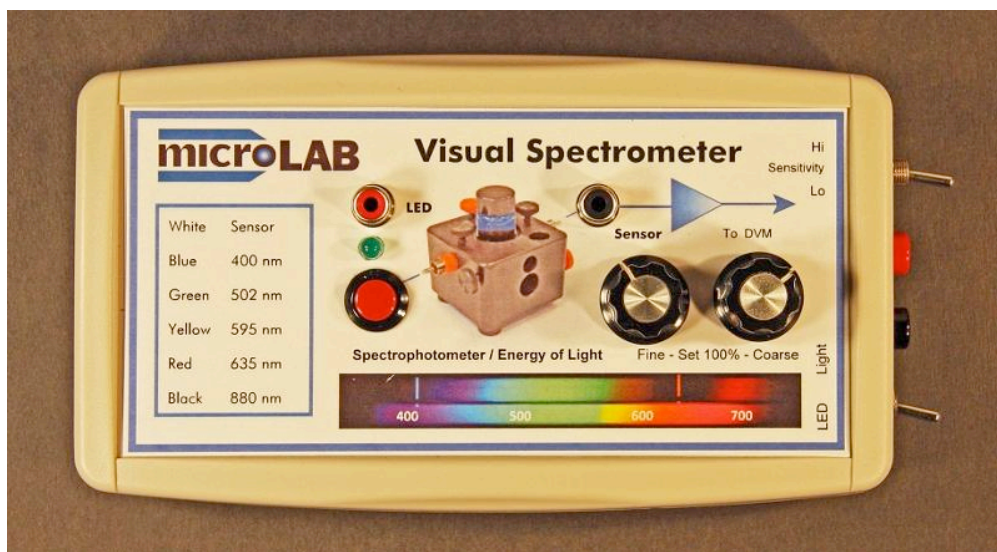
*Dr. Tom Kuntzleman,  
Spring Arbor  
University*

"You have an exceptional product. Money is very tight, and I wouldn't be spending this much of it if I didn't think that the MicroLab units were the best such devices on the market. I think that they will transform and reinvigorate the way we teach chemistry at Oglethorpe."

*Dr. Keith Aufderheide  
Oglethorpe University*

**The Visual Spectrometer makes a great Distance Learning tool.** The relatively low cost of the Visual Spectrometer and its ease of use combine to make it a great addition for home use in distance learning. Students can use diluted food coloring, ink, or vegetable extracts to safely relate spectral properties to colors. They can use it to observe the emission spectra of incandescent and fluorescent lights, LEDs, candles, "cold light" glow sticks, and other light sources.

**Students can use MicroLab's [Model 245 Spectrophotometer Module](#) and the [MicroLab Visual Spectrometer](#) to make a functional, low-cost single wavelength spectrophotometer.** This module provides an adjustable, regulated power supply for the LED's. Output may be read on MicroLab's FS-522 interface, other manufacturers' data loggers that will read voltage, or even a digital voltmeter. Five plug-in LED assemblies ranging from 880 nm to 400 nm and a modular sensor are provided with the kit. These connect to the photometer module with common "RCA" audio cables. The module is powered by a 9-volt battery. The "100%T" controls set the voltage applied to the LED, setting light level at the LED instead of changing sensor gain, emulating a Spectronic-20.



**Model 245 Spectrophotometer Module**, which converts the Visual Spectrometer into a single wavelength battery operated electronic colorimeter. It comes with easily interchangeable LEDs of 400, 502, 595, 635, and 880 nm and a photodetector. It also comes with RCA cables to make necessary connections. It allows the user to adjust the LED intensity through a blank solution to 100%T and to output the measured %T on samples as a 0-1 volt analog signal.

**Students can use the Model 245 to determine the band-gap energy** of several LED's by observing the voltage required to initiate emission of light. They can relate energy to color and wavelength and can make a reasonable estimate of Planck's Constant.

**Students can use the Visual Spectrometer and the Model 245 Spectrophotometer Module to explore fluorescence** Samples of chlorophyll or

"MicroLab has given us a great step forward in the Physical Chemistry lab."

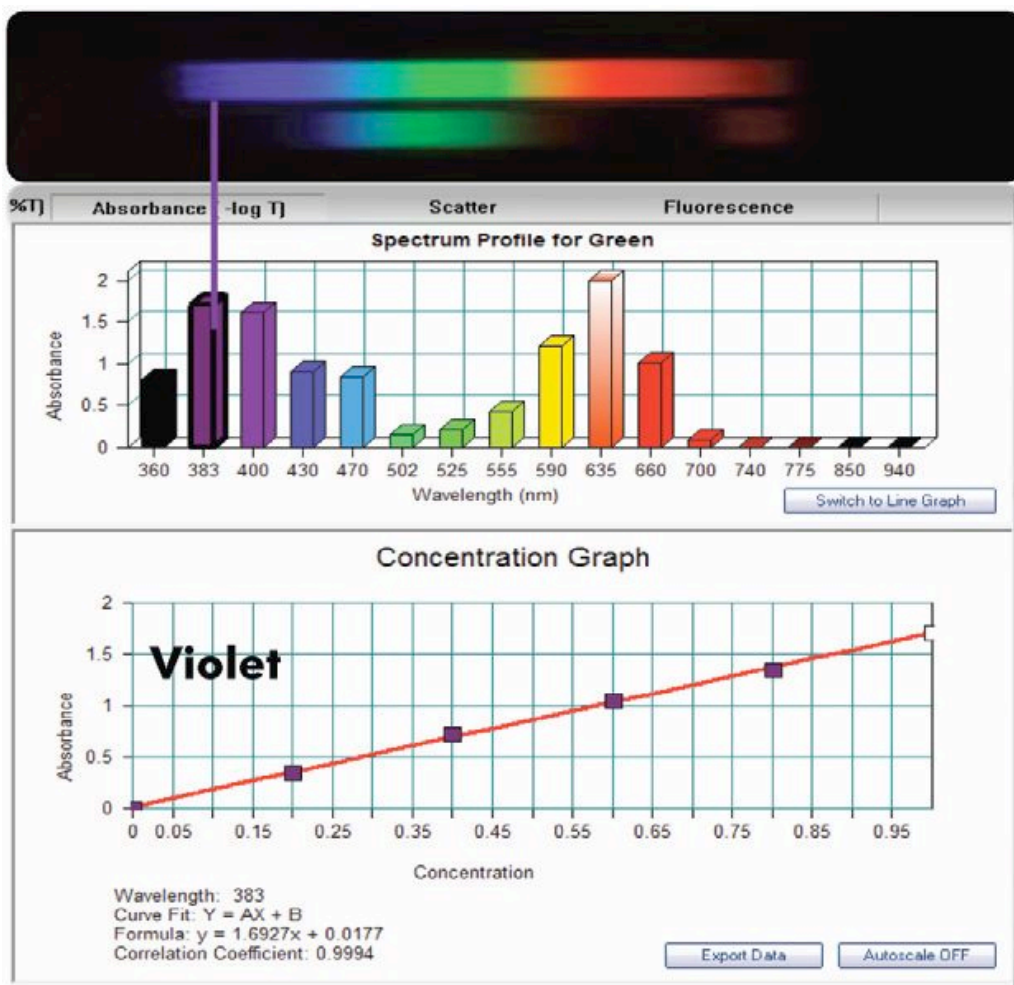
*Dr. Clemens Heske  
The University  
of Nevada  
Las Vegas*

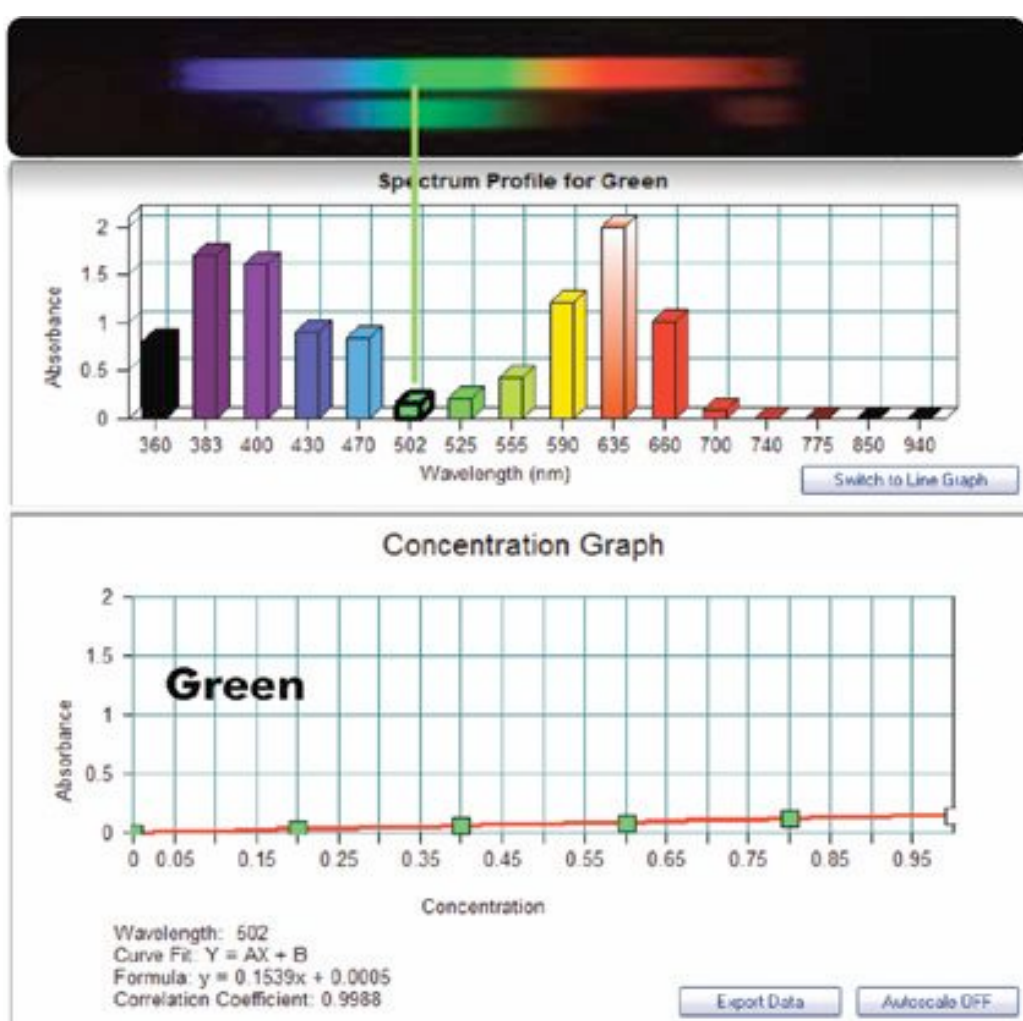
"We used the built-in spectrophotometer to study the absorption/transmission properties of different food dyes. The students really took to the graphs produced for transmittance and absorbance ... they all said it made the ideas we were talking about really clear to see the two graphs."

*Dr. "Skip" Wiley  
Middlesex Community  
College*

spectrophotometer module to explore fluorescence. Samples of chlorophyll or quinine water can be excited with the 400 nm LED. Students can vary the intensity of the light from the LED and see the effect on the fluorescence intensity. They can also observe easily the effect of changing the excitation wavelength by swapping the 400 nm LED for other LEDs in the kit.

*Students can use the Visual Spectrometer in conjunction with MicroLab's FS-522 built in FAST-spec(TM) 360-935 nm scanning spectrophotometer to enhance learning.* The figure below shows the Beer's Law plot obtained with the soon to be released version 5.8.0 MicroLab software to control the *FAST-spec* spectrometer on the FS-522, MicroLab's top of the line laboratory interface. The PC windows below show the graphical rendering spectra one obtains on a series of green food coloring samples using the *FAST-spec* spectrometer. The software also displays computed "visual spectra" of the blank and sample to relate the graphical absorbance spectrum to what one would see visually through the Visual Spectrometer or a diffraction grating. The Beer's Law plot's wavelengths can be changed instantly by clicking on the color bar in spectrum. The spectrum of any one sample can be displayed by clicking on the Beer's Law point.





The two Beer's Law plots are on the same diluted *green food coloring* samples. The one on top was obtained using 383 nm to generate the plot, which shows a good linear fit. The plot on the bottom was obtained using green light at 502 nm data. The plot at 502 nm, though linear, has a very low slope, about one tenth that of the 383 nm data, because of the low molar absorptivity for green light. The new software, version 5.8.0, will be available soon from [MicroLab's Downloads page](#).

## Upcoming Article in the *Journal of Chemical Education* Highlights the Use of the MicroLab FS-522 Interface to Do a Coulometric Titration

Professor Thomas Kuntzleman (Spring Arbor University) and co-authors will have an article published in the coming issue of JCE describing a ["Simple and Automated Coulometric Titration of Acid Using Non-isolated Electrodes."](#) The article describes a logistically simple coulometric titration suitable for an Analytical Chemistry course or for any acid assay in a quality control lab. MicroLab's FS-522 is used as the power source. It is connected to the MicroLab Model 290 Sensor Adapter Module, to which the electrodes are attached by alligator clip leads. The MicroLab interface is programmed to provide a voltage across the electrodes and to record and plot current and time; the potential between electrodes is set to provide sufficient voltage to drive the electrochemical reaction. An acid-base indicator is added to the solution. Starting the MicroLab software initiates the

electrolyzing potential and records the current and time data while plotting the data in real time. The operator stops the program when the indicator changes color. The coulombs passed are obtained by integrating the current vs. the time to reach the indicator end point. This can be done with the MicroLab software. Alternatively, the data can be exported easily to Excel for analysis and plotting.

The novel aspect of the experiment is that it uses a silver wire as the counter electrode. As the Ag is oxidized to Ag(I), the Ag(I) is precipitated by added halide ions (as NaBr) to prevent it from interfering with the reduction reaction at the working electrode, where water is reduced to hydrogen and hydroxide ion, which serves as the titrant.

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## Meet the Editor: Michael Collins

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Michael Collins is Emeritus Professor of Chemistry at Viterbo University in La Crosse, WI, USA. He taught undergraduate chemistry for 38 years at virtually every level - from introductory chemistry for liberal arts, nursing, pre-med, biology and chemistry majors to advanced courses for senior chemistry and biochemistry majors. He was the 1988 CASE Wisconsin Professor of the Year and has won awards at Viterbo for his scholarship, teaching, and service. He has been active in his local American Chemical Society section, and chaired the planning committee for the Great Lakes Regional Meeting that was held in La Crosse.

His interest in computer data acquisition began in the early 1980s, and he became convinced of its ability to enhance the lab experiences of his students as well as to prepare them to function in a modern lab setting. He has developed experiments across Viterbo's curriculum that use MicroLab for guided inquiry experiments as well as for more routine data logging and analysis. He has also given presentations on the role of computers in the laboratory to facilitate learning chemistry and in the assessment of lab outcomes. He has been using MicroLab products since they first arrived on the scene, and he continues to develop ideas for new applications of MicroLab in undergraduate teaching and research.

Please contact us at MicroLab for more information and to learn how simple it is to put these experiments and others just as exciting into your lab classes with the MicroLab FS522 and accessories.

Thanks for reading! We invite your feedback, ideas, and suggestions. As college educators ourselves, we on your MicroLab team value your feedback.

Sincerely,

Your MicroLab team  
[info@microlabinfo.com](mailto:info@microlabinfo.com)

