



The Caliper

A Publication for Users of Vernier Products

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Innovative Uses

LabPro's Antartic Adventure

Four years ago, Heike Robinson started sea kayaking. The more she learned about paddling, the more she discovered about the physics behind it. She started using examples from boating to help her students visualize many concepts such as force, resistance, heat-flow rate (hypothermia), vector addition, and moment of inertia. In February 2004, Robinson and several companions paddled on an unsupported expedition to the Antarctic Peninsula. Fewer than 20 people in the world have ever taken on this challenge, and she wanted to take Vernier sensors with her!

Using a Palm handheld with a LabPro, Heike measured temperature and conductivity of the water, temperature of the air, and visible, UVA and UVB light intensities. "The UVA and UVB data will be incorporated into my unit on radiation," she says. "I will also share these data with our environmental science classes, where I make presentations on the ozone holes in the Arctic and Antarctic. One of my classes builds a flexible solar charger for kayak decks. The light intensity measurements will help them determine if solar panels can be used as power source on these kayak expeditions."

The conductivity of the water is interesting, because the meltwater released from icebergs, ice flows, and glaciers freezes at a higher temperature than the saltwater of the bay.

Heike Robinson is a physics teacher with Mentor Public Schools at Lakeland Community College, Kirtland, OH. The journal of her trip can be found at <http://www.mentorhigh.com/teacher/robinson/>

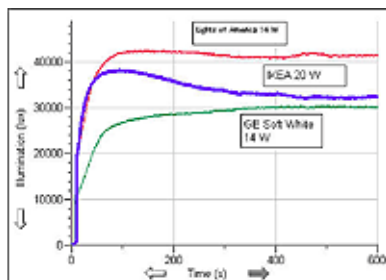
And Now for Some Light Reading

Compact fluorescent lamps (CFLs) have become a popular choice among energy-conscious homeowners. CFLs consume as little as one-fifth the power and last up to 13 times longer than incandescent lamps. A single CFL can save enough electricity (coal-fired) to keep a ton of carbon dioxide out of the atmosphere¹.

While CFLs may save a lot of energy, some people comment that they are not as bright as they would like when they first turn them on. We decided to put some bulbs to the test to see how long it takes for various CFLs to reach maximum brightness, using our Light Sensor. We tested a 14 W GE Soft White 60 Energy Saving Bulb, a 14 W Lights of America® Mini Twister, and a 20 W IKEA® bulb.



Heike Robinson, physics teacher, and sea kayaker, measures the temperature of Antarctic waters with a LabPro, Palm, and Stainless Steel Temperature Probe.



We found that the Lights of America CFL took about 100 seconds to reach maximum brightness, and it stayed at that brightness for the remainder of the experiment. The GE Soft White CFL took about 360 seconds to reach maximum brightness. The IKEA light settled in at its operating brightness at about 470 seconds, after reaching a maximum, and then decreasing to its operating brightness.

¹ *Compact Fluorescent Lamps: What You Should Know*, D.W. Finn and M.J. Ouellette, http://irc.nrc-cnrc.gc.ca/practice/liq3_E.html

Sound Level Meter Experiments

Our Sound Level Meter (SLM-BTA, \$209) offers lots of possibilities for the kind of investigations that students really get into. Here are some ideas:

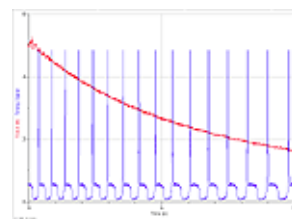
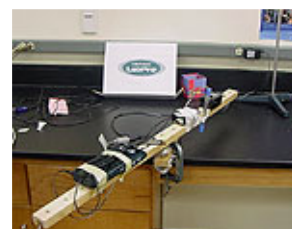


- Some hair dryers are really noisy, and the noise source is right next to your ear. This inspired us to do a little checking. We tested five hair dryers, recording the sound level with the dryer about 2 cm from our Sound Level Meter (about the closest distance the hair dryer gets to your ear). The noisiest hair dryer read around 101 decibels and the quietest read near 90 dB.
- We went to a "Battle of the Bands" concert a few months ago, and recorded sound levels of 104 to 110 dB during performances.
- The October issue of *Physics Today* had a small article on sound had a small article on sound levels in aerobics and other exercise classes in fitness clubs. They report levels as high as 120 decibels.
- Other noise situations that might be interesting for student investigations include headsets, pep rallies, and traffic.

It is easy to find OSHA noise standards on the internet for comparison with measured levels.

Centripetal Force

Bill Jameson (DeForest Area HS, DeForest, WI) sent us a clever, inexpensive lab idea for studying centripetal force. This is an improvement on an idea he had written for *The Physics Teacher* in December 1999. The photo shows the setup. A Dual-Range Force Sensor is mounted on the rotating board. A Light Sensor is fastened near it, pointing down. On the other end of the board, the LabPro is taped to counterweight the system. A mass has been attached to the force sensor. When the system is spun, the Light Sensor passes over a flashlight, which allows the students to determine the time for one rotation. In one run, you can measure the centripetal force for several different angular speeds as the device slows down in its rotation. One graph gives you the force data for many different rotation speeds. The period can be determined from the time between peaks from the Light Sensor, and the force is measured directly.



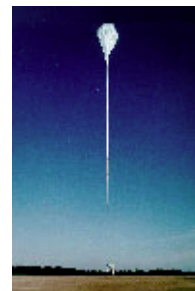
Police Car and Speeder

Ralph Newell, (South Portland HS, South Portland, ME) has developed an exercise using toy cars, which he reports has been a real hit with his students. Students use a

Photogate to measure the speed of two constant-velocity toy cars. The challenge to the students is to predict where the faster (police) car will catch the slower (speeder) car if they start at the same instant, with the faster car one meter behind. The students are encouraged to solve this problem graphically, with Graphical Analysis or Logger *Pro*. Their grade depends partly on how close their prediction comes when the race is tried with the two cars.

High Flying Physics

Eric Muhs and his physics students (Roosevelt HS, Seattle WA) constructed a portable cosmic ray detector and sent it 35 kilometers into the atmosphere, recreating Victor Hess' Nobel Prize winning discovery of cosmic rays. The cosmic ray detector took two trips aboard a NASA high altitude balloon, along with a Temperature Probe, Magnetic Field Sensor, Barometer, and Relative Humidity Sensor. The data were recorded by a Vernier LabPro and transferred to a computer upon the balloon's recovery. The entire C.H.E.S.S. (Cosmic ray High-altitude Experiment by Science Students) project is wonderfully documented on Eric's web site, along with countless other creative ways to teach physics. See http://www.invisiblemoose.org/site_material/front_pages/teaching_projects.html



A New Slant On Slope

Connie Johnsen and Trena Wilkerson developed a set of lessons aimed at helping students better understand slope. They did this by using hands-on activities and real-world situations. For example, in one lesson the students analyze the motion experienced on roller coaster rides. In another lesson, the students use a Motion Detector to study walking students. The article, entitled "My Journey toward a New Slant on Slope," appeared in the October, 2003 edition of the *Mathematics Teacher*.

Motion on an Incline

Brian E. Martin (The Kings College, Edmonton, AB) and Martin Connors (Athabasca University, AB) had an article in the Dec. 2003 *The Physics Teacher* titled "Testing a Model for Sliding Motion on an Incline." It explains how to use our Logger *Pro* and a Photogate to do a very nice modeling exercise.

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