Georgia Tech Research Institute

STEM@GTRI

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STEM@GTRI maintains a library of portable science demonstrations called **STEM Road Kits**. Our staff of real scientists and engineers can bring these Road Kits to Georgia schools, science festivals, and anywhere excitement about science is needed – for free!

Most of the kits contain more than one activity or demonstration associated with a single topic. Many of the kits can be combined into a themed presentation. This allows enough flexibility to fit any reasonable amount of time or any size audience. What's more, most of the Road Kits obviously address Georgia science teaching standards, something teachers really appreciate.

STEM@GTRI offers a wide variety of topics with more in development. The list that follows describes the Road Kits that are currently available. If you really want a topic but don't see it listed here, just ask!

Electrostatics-Van de Graaff Generator

(Addresses science standards for: 5th, 8th, high school)

(Appropriate for 3rd – 12th)

[Good for small or large groups. Can be interactive. 15-30 minutes.]

A Van de Graaff generator is a device designed to create static electricity and make it available for experimentation. The operation of the device is similar to the way that you get a static charge of electricity on your body by walking across a carpet in a dry room. When your body develops an excess electric charge, that charge will not leave (discharge) until it finds a path (such as a doorknob or another person). When the Van de Graaff globe develops an excess charge, it, too, will only discharge along a suitable path. This path is any route to ground, or through an object connected to the ground terminal on the base of the unit. With the generator you can discuss electricity in general, static electricity, lightning and weather, etc. You can demonstrate significant arcs of electricity accompanied by crowd-pleasing cracks. You can have subjects touch the globe and have their hair stand on end.

Acoustics

(Addresses science standards for: 8th, high school)

(Appropriate for 6th – 12th)

[Good for small groups. Interactive. 10 minutes.]

A variety of demonstrations are included in this kit. One allows a volunteer to hear audio peaks and nulls created by constructive and destructive interference of sound waves. An oscilloscope is included so that observers may visualize concepts such as wavelength and frequency.

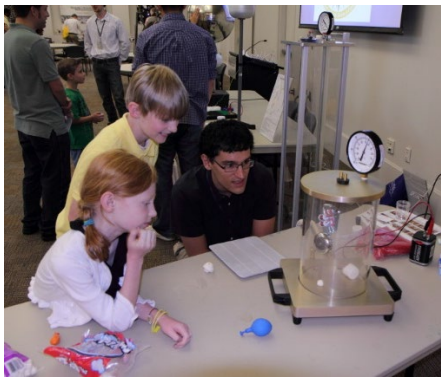
Vacuum Chamber Physics

(Addresses science standards for: 5th, high school)

(Appropriate for K-12th)

[Good for small or large groups. Not interactive. 15-30 minutes.]

Two vacuum chambers and a vacuum pump provide the tools needed to explore sound, air pressure, air friction, and the effects of vacuum on all of these. You can show that a bell ringing in air sounds dramatically stronger than a bell ringing in a partial vacuum. Balloons swell and contract as the air around them leaves and returns. Marshmallow men turn to Michelin men then dwindle to raisins when delivered into a vacuum and back out.



Rotational Physics

(Addresses science standards for: 2nd, 8th, high school)

(Appropriate for 2nd – 12th with modification for lower grades)

[Good for small groups. Interactive. 10 minutes.]

We built a turntable with a very low friction bearing. You can stand on it, spin yourself gently, and vary your rotational speed just by extending and retracting your arms, much like a figure skater performing a tight spin on the ice. By holding a spinning bicycle wheel, you can investigate the concept of precession and transfer of angular momentum by tilting the wheel which causes you to rotate on the turntable. We also spin up a chain and make it roll across the floor until gravity overcomes the centrifugal force that briefly makes the chain a wheel.

- - Scale of the solar system

(Appropriate for 2nd – 12th)

[Good for small or large groups. Interactive. 15 minutes.]

First explore the idea of scale models by comparing dolls and toy vehicles to the size of people and real vehicles. Then, measure out a scale model of the solar system. The scale is set by assigning the sun to be the size of a basketball. Typically, only the inner planets (represented by beads and marbles) will fit into a long school hallway.

- - Earth-Moon scale model

(Appropriate for 3rd – 12th)

[Good for small groups. Interactive. 15 minutes.]

This is an activity that allows students to create their own scale model of our part of the solar system using string and carefully chosen beads. Students get to take home their simple model. Other scale models are included as demonstrations.

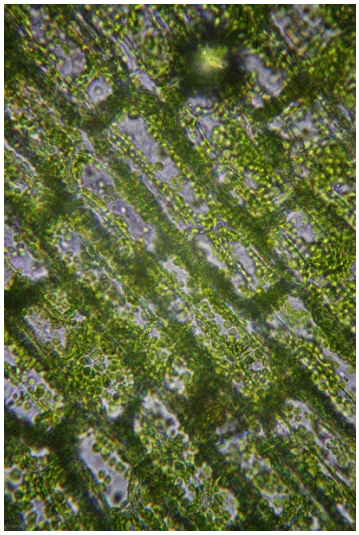
Microscopes

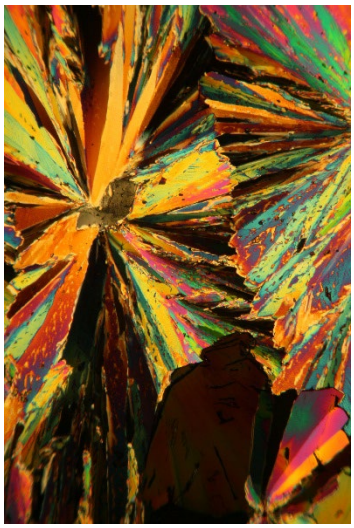
(Addresses science standards for: 3rd, 5th, 7th, high school)
(Appropriate for 1st – 12th)

[Good for small groups. Interactive. 15-45 minutes.]

We have at least a dozen microscopes and a few that allow SLR digital cameras to be attached so that groups can see the view through a microscope on a monitor at the same time.

Application #1: biology – live one celled organisms and other traditional subjects.
Application #2: biology – cheek smear activity (30-45 minutes) where students get to sample, stain, and see their own skin cells
Application #3: earth science – view crystals growing before your eyes as liquid evaporates leaving behind crystalline material that was previously dissolved in the liquid. View with polarized light.
Application #4: examining random or student-selected objects under low magnification, i.e. exploring the world around us





Non-Newtonian Fluids (Slime)

(Addresses science standards for: 2nd, 5th, high school)

(Appropriate for 2nd – 12th)

[Good for small groups. Interactive. 15 minutes.]

A non-Newtonian fluid is a fluid whose flow properties differ from Newtonian fluids such as water. These differences are most commonly found in the viscosity of the fluid. You can lead your participants through the process of making slime, a non-newtonian fluid whose viscosity changes depending on the shear or force applied to it. Students can take the slime home with them.

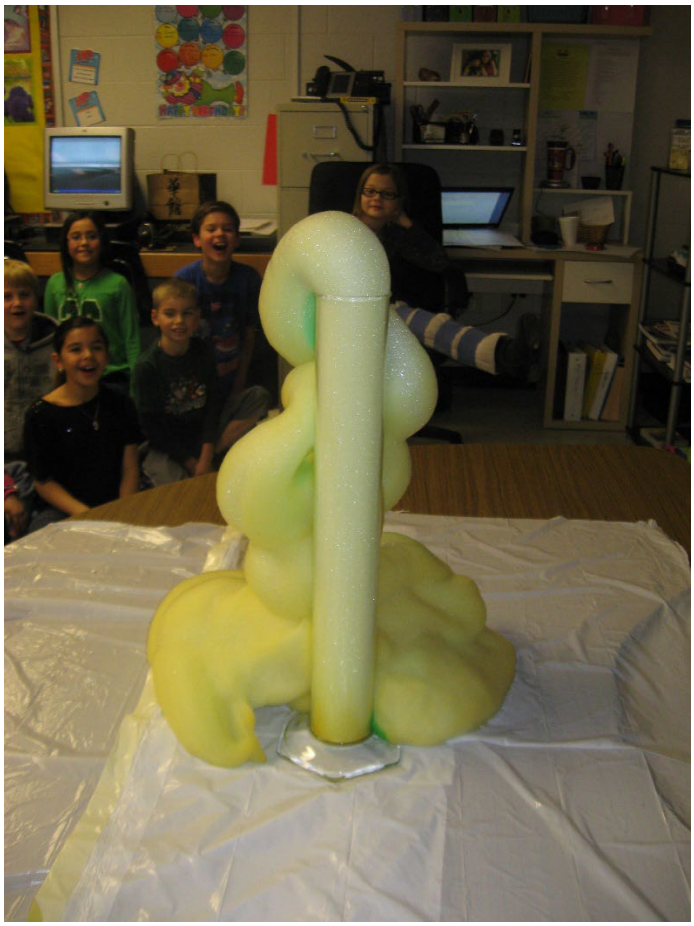
Basic Chemistry

(Addresses science standards for: 2nd, 5th, high school)

(Appropriate for K-12th)

[Good for small or large groups. Not interactive. 15 minutes.]

We can do basic color-changing experiments as well as elephant toothpaste (pictured).



Fossils

(Addresses science standards for: 3rd, high school)
(Appropriate for 3rd – 12th)

[Good for small groups. Interactive. 30-45 minutes.]

Make your own fossil that incorporates 2 basic fossil types, a mold and a cast. Mix plaster of paris in a paper bowl and make impressions using fossil or animal replicas included with the kit.


Light

Basic Optics

(Addresses science standards for: 4th, high school)
(Appropriate for 4th - 12th)

[Good for small or large groups. Not interactive. 30 minutes.]

This is basically a stage show where 6-12 different themed demonstrations are presented. This can be tailored to fit desired topics and time frames. The demonstrations can include the following: Comparing light sources, including thermal sources (full rainbow emitters) and quantum-based light sources (discrete color emitters) such as LED's, spectrum tubes (see later), lasers, and fluorescence. This can include measurements with a small spectrometer. It can include demonstrations of atmospheric scattering (think car headlights through fog) and atmospheric effects like how turbulence steers light randomly (think mirages over the highway on a hot day). For small groups, more interactive components can be added such as a laser/fog box for exploring how lenses and other optical elements work.

Spectrum Tubes

(Addresses science standards for: 4th, 5th, 8th, high school)

(Appropriate for 3rd – 12th)

[Good for small or large groups. Quasi-interactive. 15 minutes.]

Using rainbow glasses (diffraction gratings), students observe the different colors produced by different types of lights – incandescent light bulbs (full rainbow) and spectrum tubes (discrete colors). Spectrum tubes are glass tubes filled with pure gases that are excited by electricity until they glow.

Multispectral Imagers

(Addresses science standards for: 1st, 3rd, 8th, high school)

(Appropriate for K – 12th)

[Good for small or large groups. Not interactive. 15 minutes.]

Three cameras (attached to tablets) that detect and display images using ultraviolet, visible, and infrared (heat) light respectively.

How Digital Cameras Work

(Addresses science standards for: 4th, high school)
(Appropriate for 4th - 12th)

[Good for small groups. Interactive. 15 minutes.]

This is more of a museum style set of interactive demonstrations. Students are presented demonstrations in order, marching them through the science behind the technologies present in the now ubiquitous digital camera. Topics include the spectrum tubes (see above), the photoelectric effect, single-pixel light detectors (solar panels), matrices of light detectors (detector pixels) and how they map to display pixels, lenses, and three cameras that detect ultraviolet, visible, and infrared (heat) light respectively (see above).

Air, Air Pressure, and Vacuum

Air, Air Pressure, and Vacuum discussion

(Addresses science standards for: K, high school)
(Appropriate for 1st - 12th)

[Good for large groups. 30 minutes.]

This is basically a lecture-style time consisting of 6-8 different themed demonstrations. This can be tailored to fit desired topics and time frames. The demonstrations can include the following: plunger tug-of-war, vacuum chambers (see above), cloud-in-a bottle, weight of air, gasses with different densities, gases that alter the voice, putting out candles with carbon dioxide, and liquid nitrogen activities (see below).

Liquid Nitrogen

(Addresses science standards for: 2nd, 5th, high school)
(Appropriate for 1st - 12th)

[Good for small groups as an interactive activity where students can sample frozen treats. 15 minutes.]
[Good for large groups as a culminating activity added to other demonstrations. 5 minutes.]

Liquid nitrogen is simple tool that you can use to elicit immediate awe from students. You can freeze items like flowers or bananas and break them in dramatic ways. You can freeze marshmallows and give them immediately to students to eat. By pouring various amounts of liquid nitrogen into warm water, you can create effects that vary from low lying fog to giant mushroom clouds. (See the photos that follow.)

For more information, contact:

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