

Teaching Physics Through Medicine

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Supported by the NSF under grant number DUE 04-26754

<http://web.phys.ksu.edu/mmmm/>



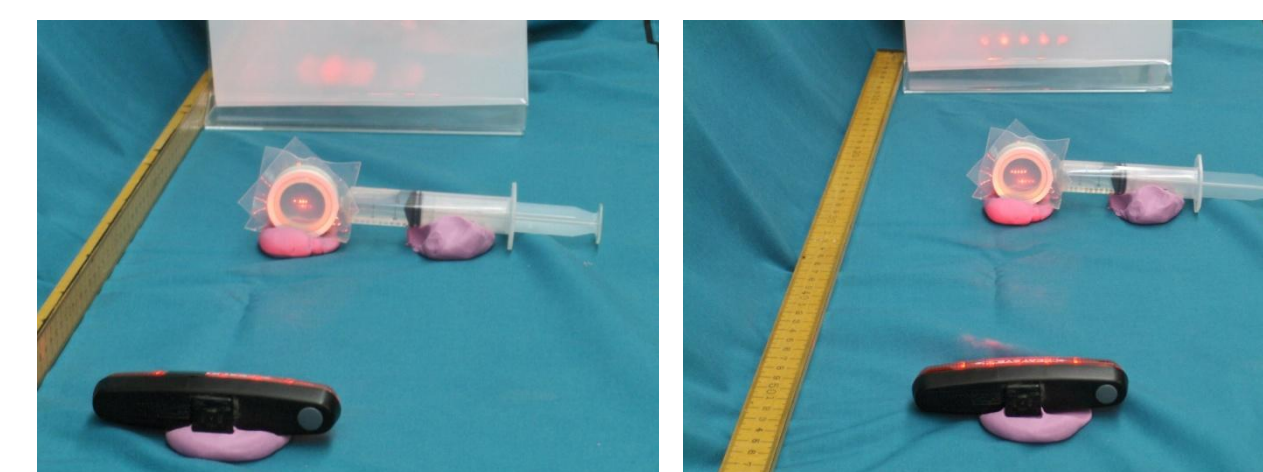
Vision

Activity Overview

- Pinhole as an eye
- Pinhole and lens as an eye
 - Images from converging lenses
 - Images from diverging lenses
- Accommodation by the eye
- Vision defects
 - Nearsightedness (myopia)
 - Farsightedness (hyperopia)
 - Astigmatism
- Correcting vision defects

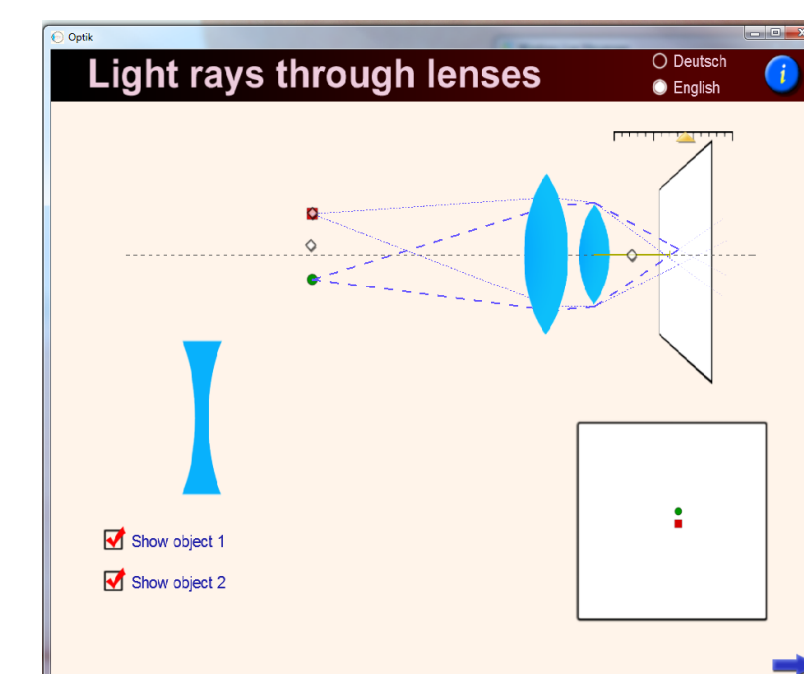
Hands-on Activities

- Manipulation of pinholes, lenses, and screens
- Manipulation of a variable focal length lens



Visualizations

- Able to adjust fixed lens focal length and location of objects and screen relative to the fixed lens
- Can add either a converging or diverging lens in front of the fixed lens



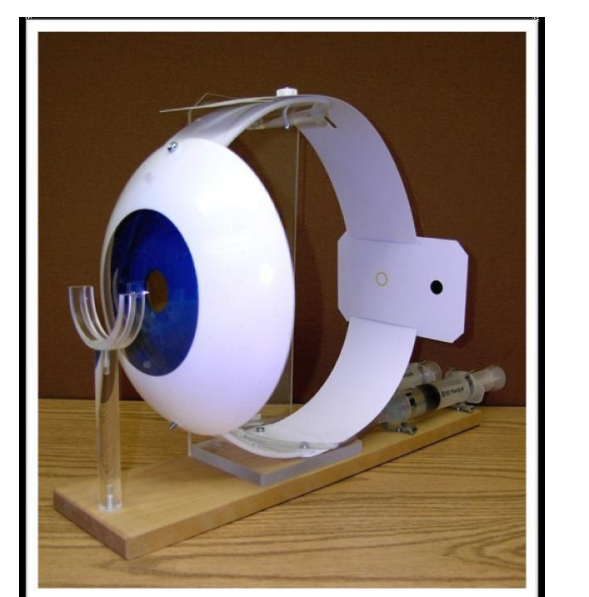
Aberrometry

Activity Overview

- Review of the eye (from Vision activity)
- Diagnosing vision defects with a chart
- Diagnosing vision defects with an aberrometer
- Effect of lens aberrations

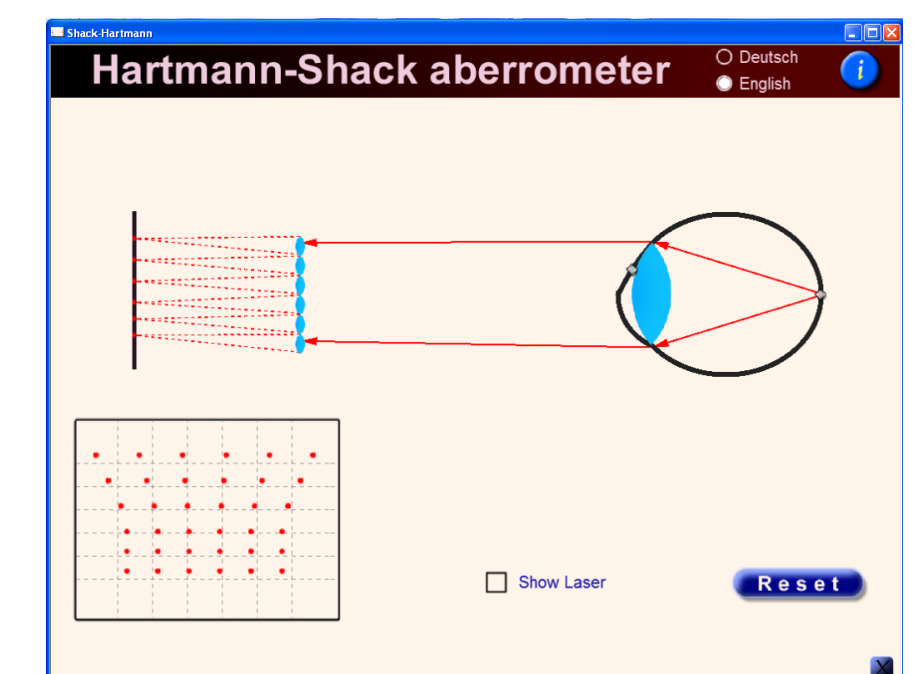
Hands-on Activities

- Manipulation of an aberrometer model to see changes in aberration grid



Visualizations

- Able to adjust shape of cornea and distance of retina from front of eye
- Red dots in the grid pattern shift to indicate aberrations.



In collaboration with Hartmut Wiesner and co-workers, Ludwig-Maximilian University, Munich

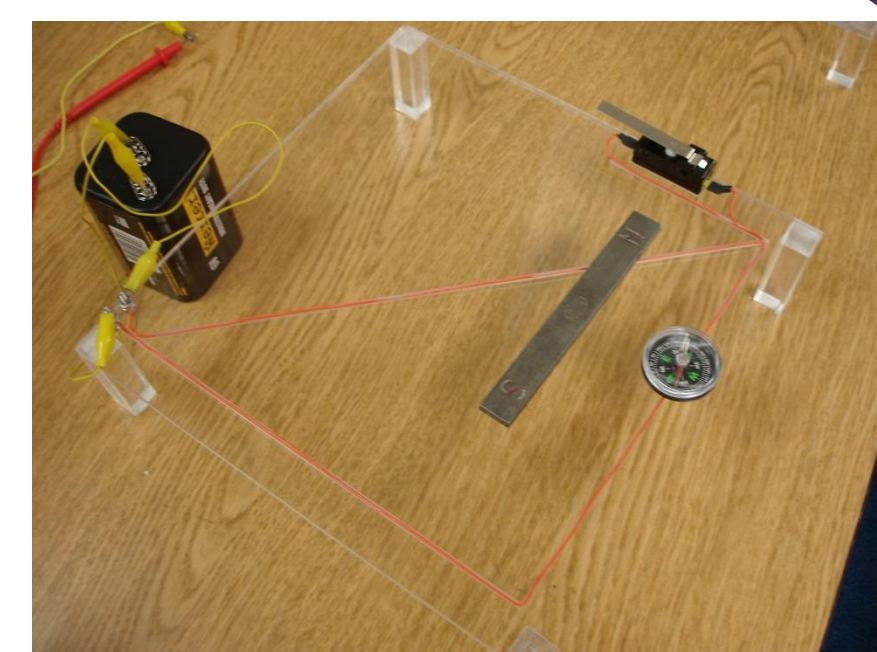
Magnetic Resonance Imaging

Activity Overview

- Magnetism basics
 - Magnetic poles
 - Compass as field detector
- Properties of a field due to a current carrying wire
- Resonance
 - Pendulum
 - Compass/wire system
- Nuclear magnetic resonance
- Magnetic resonance imaging

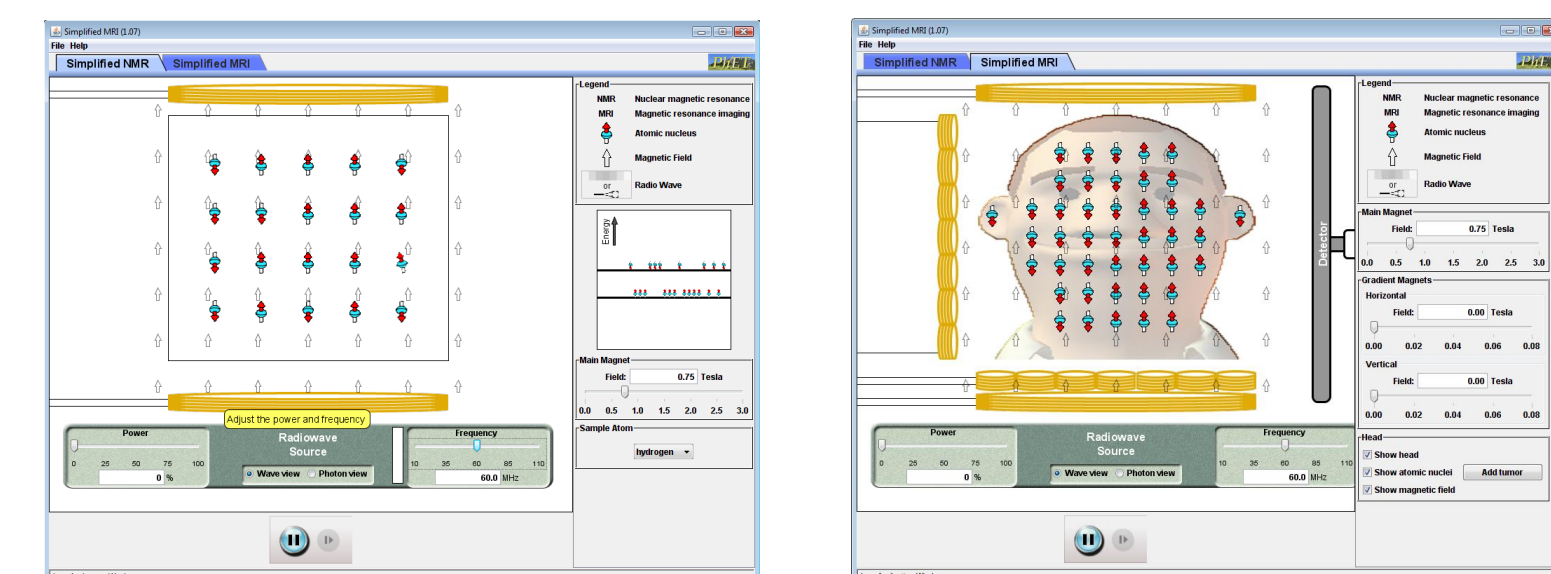
Hands-on Activities

- Manipulation of magnets and compasses
- Magnetic resonance apparatus



Visualizations

- PhET NMR simulation
- Can adjust magnetic field strengths, radio source power, and frequency



Positron Emission Tomography

Activity Overview

- Understanding conservation of momentum
- Time of flight calculations
- Explosions of paired photons
- Understanding gamma ray emission during annihilation
- Applying time of flight information to gamma ray detection

Hands-on Activities

- Investigating conservation of momentum and time of flight with low friction carts



Visualizations

- Analogy with light for both visible and hidden sources (shown)
- Simulated PET scan with control over number and location of sources (not shown)



Computed Tomography

Activity Overview

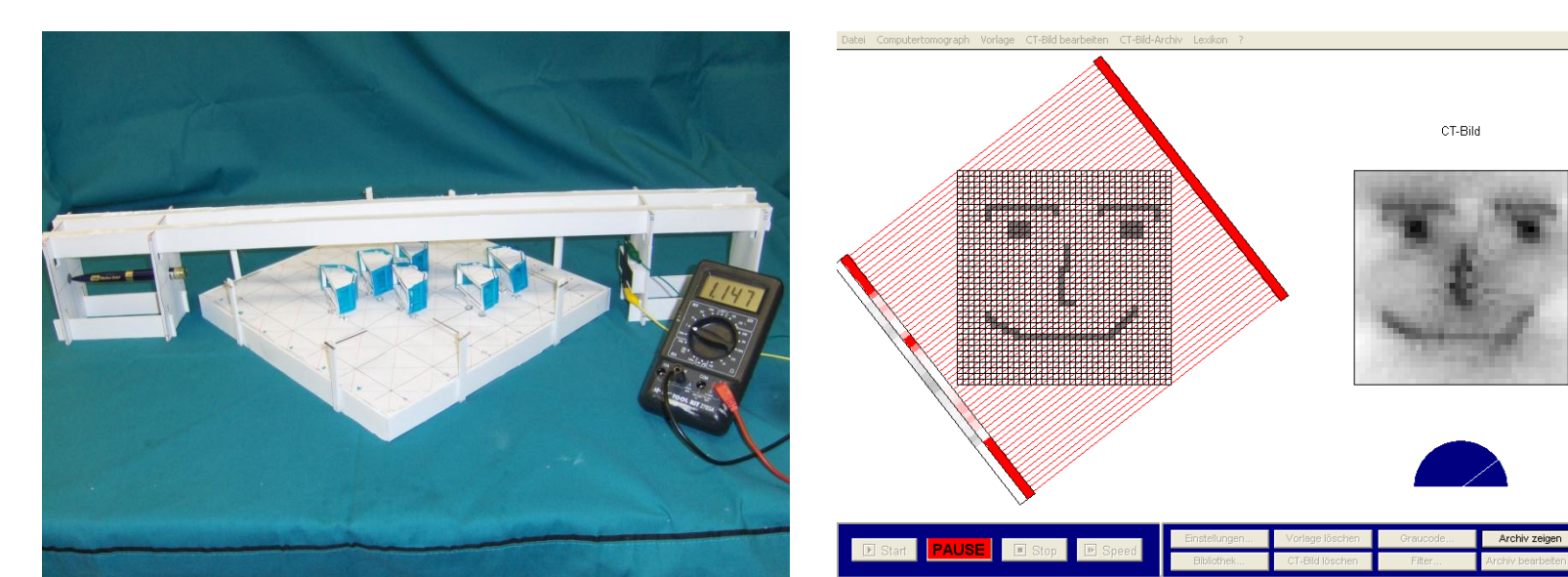
- In progress
- PhD dissertation forming research base

Hands-on Activities

- Creation of mock scan

Visualizations

- Control over "tumor" shape



Alexander Graham Bell's Experiment

Activity Overview

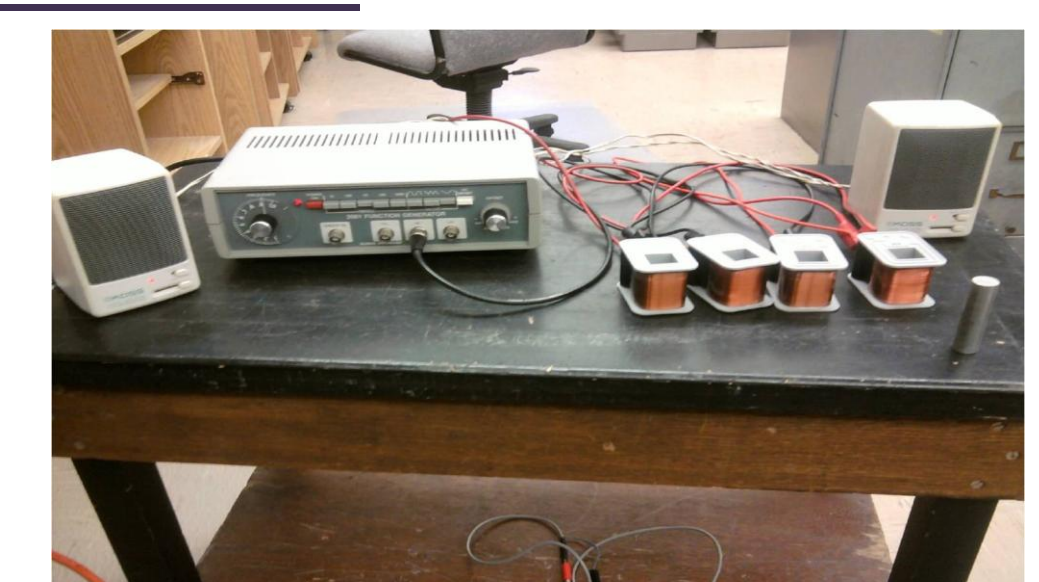
- In progress

Visualizations

- To be determined

Hands-on Activities

- Inductor-based wheat-stone bridge
- When system is unbalanced, it hums



In collaboration with Johannes v. d. Wirjawan, Widya Mandala Catholic University, Surabaya, Indonesia