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Physics of projecting and perceiving 3-D movies: Depth perception, stereoscopic images, and polarized light

Given the immense financial success of the recent James Cameron/Fox film "Avatar," a review of the physics behind the 3-D projection technology is likely of interest to your students. The IMAX film version of the "Avatar" movie uses a different projection technology (Dolby 3D) than the digital non-IMAX version (RealD). Both of these systems (and there are several others) are described at Wikipedia, with links back to both the RealD and Dolby 3D websites, which are largely dedicated to marketing. The science behind the more widely viewed digital (RealD) version is a trifle more accessible system to follow, using much less expensive eyeglasses with left and right circular polarized filters over each eye, flashing alternately polarized frames for left and right eyes 144 times/second—24 frames per second x 2 separate movies (one for each eye) x 3 flashes each frame (integrating light from a much dimmer movie to improve brightness). See wikipedia.org/ and search on Avatar, RealD, Dolby 3D, Stereoscopy, 3-D film, and circular polarization. More technical detail on the RealD technology can be downloaded from www.edcf.net/edcf_docs/real-d.pdf. There are also some very welcome and largely complete student-generated descriptions of 3-D movie basics found on YouTube; one nice effort done by an AP Physics class is found by searching for "AP Physics 2009 3D" on YouTube.

This topic initiated and guided on PHYS-L by Leigh Palmer, Simon Frasier University Physics

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Fire pistons

A discussion of thermodynamic examples on PHYS-L recently directed me to details of construction for a fire piston (or fire syringe), in use for thousands of years particularly by cultures using the blowpipe, and widely prevalent (like tinderboxes) in Europe before the development of matches in the mid 1800s. Wikipedia has a nice article on the fire piston (implying it inspired Otto Diesel's engine) and linking to related calculations, sometimes taught in introductory chemistry courses as well as physics classes on thermodynamics. Some experimentation and calculation by a student of mine revealed the need for a small volume (usually a narrow column of air compressed through a long stroke) igniting a very small amount of tinder or punk with a very small heat capacity. Commercial fire syringes are inexpensively (under $25) available from suppliers like the AB Johnson Storefront on www.Amazon.com or Educational Innovations www.teachersource.com/.

However, you can also make your own. A detailed guide to constructing a fire piston from CPVC tubing from the local hardware store is found at www.wildwoodsurvival.com/survival/fire/firepiston/rbmodelt. Instructions are exquisitely photographed and a video of the completed tube in use is also shown at www.wildwoodsurvival.com/survival/fire/firepiston/rbmodelt/ModTVid.wmv. Construction and use of fire pistons are well documented on YouTube videos, with detailed instructions for a small metal fire tube demonstrated on YouTube at www.burghscouts.com/Flyers/FirePiston.pdf.

Fire piston aficionados are cautioned not to ignite alcohol, lighter fluid, match heads, or large squares of magician's flash paper in the tubes; resulting pressures can shatter tube cylinders, turning pieces of the tube wall and pistons into dangerous projectiles. Obtaining or making your own proper tinder and punk for fire pistons is described in the resources above.

Submitted to PHYS-L by John Denker

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Astronomy Education Review

The Astronomy Education Review has moved to the AIP Scitation system online and has just started publishing volume 9, available from scitation.aip.org/dbt/dbt.jsp?KEY=AERSCZ (select latest issue). This journal publishes articles on astronomy teaching and learning, and the latest edition includes an article on "Teaching Introductory Solar System Concepts" and links to a "Resource Guide to the Moon for Educators." An invaluable site for astronomy teachers.

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