A COSMIC RAY BIBLIOGRAPHY (Books, papers and internet sites)

ULR LISTS

http://www.mpi-hd.mpg.de/hfm/CosmicRay/CosmicRaySites.html This site is a 10-page listing of links regarding cosmic rays, high-energy particles, etc.

http://www.aps.org/resources/particle.html
A great list of sources for the study of particle physics.

http://quarknet.fnal.gov/run2/biblio.html
Another great place to start looking for resources.

http://sln.fi.edu/tfi/hotlists/physical.html Created by Franklin Institute Science Museum with numerous physics links.

THE HIGH SCHOOL PROJECTS

ALTA Alberta Large Area Time coincidence Array
http://csr.phys.ualberta.ca/~alta/Pages/Sitemap.html

CHICOS California High School Cosmic Ray Observatory
http://www.chicos.caltech.edu

CROP Cosmic Ray Observatory Project
http://physics.unl.edu/~gsnow/crop/crop.html

NALTA North American Large Area Time Coincidence Arrays
http://csr.phys.ualberta.ca/nalta/

NYSCPT New York Schools Cosmic Particle Telescope
http://www.physics.nyu.edu/NYSCPT

SALTA Snowmass-Area Large Time Coincidence Array
http://faculty.washington.edu/~wilkes/salta/salta-science.html

WALTA Washington Large Area Time Coincidence Array
http://www.phys.washington.edu/~walta

PITT-UMST The CosRay High School Project
http://www.phyast.pitt.edu/~jth/scied/quarknet/qnet.html

Preston College. A UK college, which has some detectors at a couple high schools
http://www.prestoncoll.ac.uk/cosmic
SEASA Stockholm Educational Air Shower Array
http://gluon.particle.kth.se/SEASA/

SCROD School Cosmic Ray Outreach Program
http://www.hep.physics.neu.edu/scrod

SKY VIEW University of Wuppertal (Germany)
http://skyview.uni-wuppertal.de
(Note: this may involve high schools)

INDIANA UNIVERSITY QUARKNET
http://www.physics.indiana.edu/~quarknet
This is an excellent site from a summer workshop where the high school students helped from day one in the project. Teams were established for Theory, Web, Electrical and Mechanical development. Nice notes and images

PAPERS FROM HIGH SCHOOL STUDENTS

*The Effect of Foil Wrapping on Scintillator Efficiency*
Carney, Fendrick, Greer, Marian High School, Omaha
April 4, 2001
http://marian.creighton.edu/~tfendric/foil.html

*Correlation between Barometric Pressure and Cosmic Ray Intensity*
Batten, Karr, Marian High School, Omaha
March 23, 2001
http://marian.creighton.edu/~besser/physics/barometer.html

*JavaScript Distance Calculator*
Greer, Sedlacek, Marian High School, Omaha
April 9, 2001
http://marian.creighton.edu/~besser/physics/crop/distance.html

SIMULATIONS BASED ON EXTENSIVE AIR SHOWERS (EAS)

Milagro Animations
http://scipp.ucsc.edu/milagro/Animations/Pages/MilAnimIndex.html

Milagro Animations EAS
http://scipp.ucsc.edu/milagro/Animations/Pages/EASIndex.html

CORSIKA or Cosmic Ray Simulations for Kascade
http://www-ik3.fzk.de/~heck/corsika/
OTHER SIMULATIONS

http://www.bun.falkenberg.se/gymnasium/amnen/fysik/millikaneng.html  A simulation of the Millikan Oil Drop Experiment

http://physics.nad.ru/start.htm  An amazing site with numerous simulations of physical phenomena. Downloads of some animations are available as is a CD Rom.

28th INTERNATIONAL COSMIC RAY CONFERENCE  (Tokyo, Japan)
The papers listed are not yet available as of the time of this writing (7/15/03) from the Conference site. However, they should be available relatively soon.
http://www-rccn.icrr.u-tokyo.ac.jp/icrc2003/

SEASA: The Stockholm Educational Air Shower Array, Mark Pearce, et al.
http://www-rccn.icrr.u-tokyo.ac.jp/icrc2003/proceedings_pdf.html

SCROD: School Cosmic Ray Outreach Program, John David Swain, et al.

CHICOS Detector Stations, Robert D McKeown
http://www-rccn.icrr.u-tokyo.ac.jp/icrc2003/proceedings_pdf.html

WALTA Progress Report, Gichard Gran, et al.
http://www-rccn.icrr.u-tokyo.ac.jp/icrc2003/proceedings_pdf.html

FERMI LAB BOARD SITE (this might be important someday
http://www.phys.washington.edu/~berns/WALTA/Qnet2/

MOVIES
http://www-star.stanford.edu/~vlf/optical/fly/
http://www-star.stanford.edu/~vlf/optical/fly  A short 1MB movie of an “elf flash” as would be seen by the Fly Eye detector.

http://www.lalanet.gr.jp/nsm/E-radiation.html  A very interesting site from a Japanese University, which includes video clips of produced tracks in an elaborate cloud chamber.

The Cosmic Connection by Tim Middleton, a teacher from Austin, Texas. From what I read the video describes cosmic rays and shows how they are detected. It is “suitable for grades 6-12.”
http://www.shsu.edu/~chm_tgc/sounds/pushmovies/pmt.html  A flash animation movie of the operation of a PMT. Simple but effective.

http://microcosm.web.cern.ch/Microcosm/RF_cavity/ex.html  An interactive video where you must flip batteries to move a proton through accelerator magnets.

EDUCATIONAL BACKGROUND MATERIAL (books and URLs)

Dave and I agree that the most logically presented material is found at the CHICOS Workshop site. It should provide an outline and the material for an explanation of not only cosmic rays but the use of Scintillator/PMT detectors.

http://www.chicos.caltech.edu/collaboration/workshop.html

An absolutely must read: (it should be required for all physics teachers)
Trefil, James. From Atoms to Quarks. (Press, 19 )

Another absolutely must read: (this is meant for a general audience)

Schwarz, Cindy, A Tour of the Subatomic Zoo, (AIP Press, 2nd ed, 1997) A truly great intro to the standard model with great diagrams and tables explaining the nature of subatomic particles. The book is the basis of a six week course taught at Vassar by the author.

http://archive.ncsa.uiuc.edu/Cyberia/Expo/information-pavilion.html  University of Illinois site focuses on astronomy, astrophysics and virtual environments with well-designed deep content.

Others:

A reference book to help you understand the electronics:

Gaisser, Tom, Cosmic Rays and Particle Physics. (Cambridge Univ. Press, 1991)


Popular Magazine Articles

Cronin, Gaisser and Swordly, “Cosmic Rays at the Energy Frontier” Scientific American, January 1997. This article gives an overview of the study of cosmic rays.


See The Cosmic and Heliospheric Learning Center, which provides links to recent articles. http://helios.gsfc.nasa.gov

LESSON PLANS and DEMOS (you don’t need to invent the wheel)

http://outreach.physics.utah.edu/javalabs/java102/hess/index.htm This the index page for the Astrophysics Science Project Integrating Research and Education (wow!). At this time it contains 5 “Activities” which are virtual labs. They include Hess’ Balloon Ride, Particle Direction, Angle of Particle Arrival, Average Velocity and Maximizing Recorded Events.
There is a Teacher Page in addition to the Student Lab. There was a mention on one site that these at times do not work.

http://www.chicos.caltech.edu/classroom/shower/reconstruct1.html A lab from CHICOS involving the reconstruction of an EAS from ground level directional data. It is a paper and pencil lab but does demonstrate the means to determine the direction of the primary particle.

http://quarknet.fnal.gov/projects/summer00/index.shtml Eight virtual activities from Quarknet. I had time to review one, “Recognizing Particle Signatures”. It actually contained seven “Challenges” involving the identification and measuring of particles. The diagrams are very nice.

http://imagine.gsfc.nasa.gov/docs/ask_astro/ask_an_astronomer.html Not lesson plans but a resource to use, Ask a High Energy Astronomer service. There are some lesson plans under the “teacher” link. They deal with gamma rays, but might be usable.

Breden, Thomas and Weber, Photo Multiplier Demonstration, Scintillator Demonstration, Positioning Arrays and Finding Your Exact Location from CosRay students. You should have a copy of this.

http://www.lns.cornell.edu/public/outreach This is the main link that contained the previous referred to lesson plan. It has many other activities that are worth investigating including lesson plans in particle physics.

http://onlineclassroom.bnl.gov/teachers/solar_neutrinos/lesson_plans/high/Dippin_Dot_Neutrinos.doc This appears to be a great lab from Brookhaven National Labs involving the use of three flavors of 'Dippin’ Dot Ice Cream to represent electron neutrinos, muons, and tau neutrinos.

http://onlineclassroom.bnl.gov/teachers/cosmic_rays/index.html A powerpoint presentation of the construction and use, including data, of “The Muon in the Bottle” lab. This involves the use of PMT and water bottles to detect muons using Cherenkov light. Interesting comments on the Berkeley board.

http://www.cybermeme.net/muon1.html An interesting detector system using two Geiger counters connected with a coincidence counter. It includes directions, data and data evaluation with photos.

http://pdg.web.cern.ch/pdg/particleadventure/index.html Website from Berkeley including seven activities under the Educational link.

http://www.deepspace.ucsb.edu/rot.htm Not really a particle site but a site that allows students to operate a telescope remotely, download images and a 180 page curriculum manual is available.

http://physicsweb.org/resources/Education/Exercises Physics Around the World’s Educational Section. Some useful links to physics exercises and experiments although not many on particle physics.

http://jersey.uoregon.edu/vlab/index.html Physics applets by U of Oregon Physics dept. Experiments provide conceptual interface to the equations and simulate real physics experiments. No specific cosmic ray experiment however.

**ON LINE PARTICLE PHYSICS COURSES** (with notes)


http://www.quark.lu.se/~eerola/fys225.html Particle course with nice notes for nearly all chapters. Some of the notes could be used as overheads during lectures.

http://www.cabrillo.cc.ca.us/divisions/mse/phys/joes_tesis/ Not really a complete course but a group of web pages with nice explanations of the development of a cosmic-ray induced EAS and the lateral and temporal distribution of EAS.
http://www.phys.washington.edu/~jeff/courses teaches numerous particle physics courses at the University of Washington, for example, Ultra High Energy Cosmic Rays and Experimental Particle Astrophysics. He includes notes and slides for his courses.

http://faculty.washington.edu/~wilkes/salta/talks/D-Claes_SALTA_Charged_Interactions_files/frame.htm An introductory power point presentation by D. Claes regarding the interaction of charged particles with matter. It was presented at a SALTA workshop.

VIRTUAL OSCILLOSCOPES

http://www.virtual-oscilloscope.com Still a work in progress, but a useful shockwave based oscilloscope program for teaching the basic of using a scope.

PEOPLE DIRECTORY

http://www.slac.stanford.edu/spires/hepnames/ A database of 37,000 e-mail addresses of people associated with particle physics and related fields.