Revised May 2002 by P. Kreitz (SLAC).

This list describes a broad set of online resources that are of value to the particle physics community. It is prescreened and highly selective. It describes the scope, size, and organization of the resources so that efficient choices can be made amongst many sites which may appear similar. A resource is excluded if it provides information primarily of interest to only one institution. Because this list must be fixed in print, it is important to consult the updated version of this compilation which includes newly added resources and hypertext links to more complete information at:

`http://www.slac.stanford.edu/library/pdg/`

Databases and resources focusing primarily on accelerator physics have been excluded in deference to the excellent compilation at the World Wide Web Virtual Library of Beam Physics and Accelerator Technology:

`http://home.earthlink.net/ whittum/vl/`

My thanks to Betty Armstrong, Particle Data Group, the SLAC Library staff, and the many particle physics Web site and database maintainers who have all given me their generous assistance. Please send comments and corrections by e-mail to `pkreitz@slac.stanford.edu`.

1. Particles & Properties Data:

- REVIEW OF PARTICLE PHYSICS (RPP): A biennial comprehensive review summarizing much of the known data about the field of particle physics produced by the international Particle Data Group (PDG). Includes a compilation/evaluation of data on particle properties, summary tables with best values and limits for particle properties, extensive summaries of searches for hypothetical particles, and a long section of reviews, tables, and plots on a wide variety of theoretical and experimental topics of interest to particle and astrophysicists. The linked table of contents provides access to particle listings, reviews, summary tables, errata, indices, *etc.* The current printed version is K. Hagiwara, *et al.*, Physical Review **D66** 010001. Maintained at:

  `http://pdg.lbl.gov/`

- PARTICLE PHYSICS BOOKLET: A pocket-sized booklet containing the Summary Tables and abbreviated versions of some of the other sections of the full *Review of Particle Physics.* This is extracted from the most recent edition of the full RPP. Contains images in an easy-to-read print useful for classroom studies. The next edition will be August 2002. Until the new edition is published and available via the Web, students, teachers, and researchers should use the full RPP:

  `http://pdg.lbl.gov/`

- COMPUTER-READABLE FILES: Currently available from the PDG: Tables of masses, widths, and PDG Monte Carlo particle numbers and cross-section data, including hadronic total and elastic cross sections vs laboratory momenta, and total center-of-mass energy. Check out the Palm Pilot version of the table of masses, widths, and PDG Monte Carlo particle numbers. This version will be updated in the Summer of even-numbered years coinciding with the production of the *Review of Particle Properties*:

`http://pdg.lbl.gov/computer_read.html`

- PARTICLE PHYSICS DATA SYSTEM: This site contains an indexed bibliography of particle physics (1895–1995), a database of computerized numerical data extracted from experimental publications, and an index of papers (1895–present) that contain experimental data or data analyses. The Web interface permits simple searching for numerical data on observables in reactions and for compilations of integrated cross-section data. Maintained by the COMPAS group at IHEP:

  `http://wwwppds.ihep.su:8001/ppds.html`

- HEPDATA: Reaction Data Database: A part of the HEPDATA databases at University of Durham/RAL, this database is compiled by the Durham Database Group (UK) with help from the COMPAS Group (Russia) for the PDG. Contains numerical values of HEP reaction data such as total and differential cross sections, fragmentation functions, structure functions, and polarization measurements from a wide range of experiments. Updated at regular intervals and contains links to precompiled reviewed data such as 'Structure Functions in DIS', 'Single Photon Production in Hadronic Interactions', and 'Drell-Yan Cross Sections':

  `http://durpdg.dur.ac.uk/HEPDATA/REAC`

- NIST Physics Laboratory: This unit of the National Institute of Standards and Technology provides measurement services and research for electronic, optical, and radiation technologies. Three sub-pages, on Physical Reference Data, on Constants, Units & Uncertainty, and on Measurements & Calibrations, are extremely useful. Additional links to other physical properties and data of tangential interest to particle physics are also available from this page:

  `http://physics.nist.gov/`

2. Collaborations & Experiments:

- CURRENT EXPERIMENTS IN PARTICLE PHYSICS: Lists 586+ active experiments abstracted from the EXPERIMENTS Database. Includes both accelerator-based and non-accelerator based experiments with links back to the Experiments Database for more complete information. Accelerator experiments are organized by institution, machine, and experiment name. Non-accelerator experiments are alphabetical by name:

  `http://www.slac.stanford.edu/spires/`
  `experiments/online_exp.shtml`

- EXPERIMENTS Database: Contains more than 2,161 past, present, and future experiments in elementary particle physics. Includes official experiment name and number, location, spokespersons and collaboration lists. Simple searches by: participant; title; experiment number; institution; date approved; accelerator; or detector; return a result that fully describes the experiment, including a complete list of authors, title, description of the experiment's goals and methods, a list of resulting journal articles, instrumentation papers, theses, and a link to the experiment's Web page if available:

`http://www.slac.stanford.edu/spires/experiments/`

- HIGH ENERGY PHYSICS EXPERIMENTS: A HEPiC page of links to experimental collaboration Web pages. Experiments are arranged alphabetically by name or number under 18 major laboratories or in a catch-all group labeled 'Other':

  `http://www.hep.net/experiments/`
  `all_sites.html_sites.html`

3. Conferences:

- CONFERENCES: Database of 11,000 past, present and future conferences, schools, and meetings of interest to high-energy physics and related fields. Covers 1973 to 2004+. The current year includes 450+ events. Search or browse by title, acronym, date, location. Includes information about published proceedings, links to submitted papers from the SPIRES-HEP database, and links to the conference website when available. Provides a form at:

  `http://www.slac.stanford.edu/spires/conferences/`
  `add_conference.shtml` to submit a new conference. Can also search for any conferences occurring by day, month, quarter, or year:

  `http://www.slac.stanford.edu/spires/conferences.html`

- CONFERENCES AND CONFERENCES: Lists 150+ 2002 and 2003 meetings in many fields of physics. Browse through an ASCII list of all conferences or specialized lists arranged by topic: particles/nuclei, quantum, condensed matter, mathematical, interdisciplinary physics, and related fields. Includes links to the conference Web page and the contact. From this page, you can submit an event for inclusion in this list or sign up for email alerts of new events:

  `http://www.physics.umd.edu/robot/confer/confmenu.html`

- PHYSICSWEB Events: Part of the Institute of Physics (IOP) website, this site contains approximately a hundred entries for meetings, workshops, exhibitions and schools occurring in 2002 and 2003. Searchable by free text words. Provides a Web form and email address for adding a conference and for signing up to receive email notices of new events added:

  `http://physicsweb.org/events/`

- EUROPHYSICS MEETINGS LIST: Maintained by the European Physical Society, this lists in chronological order all the 2002 meetings, workshops, schools, etc.

organized or sponsored by EPS or organized in conjunction with an EPS-sponsored group. Provides a PDF form you can use to electronically submit notice of a new conference or can print and mail to EPS:

`http://www.eps.org/ephconf.html`

- CERN Events: A list of current and upcoming conferences, schools, workshops, etc., of interest to high-energy physicists. Organized by year and then by date. For 2002, it includes about a hundred events. Send an email to Web.Communications@cern.ch to submit your event to this list:

  `http://user.web.cern.ch/user/events.html`

4. Current Notices & Announcement Services:

- See the conference and event sites above for links to email notification services or event submission forms.

- E-PRINT ARCHIVES LISTSERV NOTICES: The Cornell-based E-Print Archives provides daily notices of preprints in the fields of physics, mathematics, nonlinear sciences, and computer sciences which have been submitted to the archives as full text electronic documents. Use the Web-accessible listings:

  `http://arXiv.org/`

  or subscribe:

  `http://arXiv.org/help/subscribe`

- NEW EXPERIMENT ANNOUNCEMENT: Submit information about a new particle physics experiment to the SPIRES EXPERIMENTS Database or modify an older entry using the form at:

  `http://www.slac.stanford.edu/spires/exp/`
  `exp_info.shtml`

Note: Use the library pages in Section 5.3 below to find additional announcement lists for recently received preprints, books, and proceedings. Use the online journal links in Section 7 below for journal table of contents.

5. Directories:

5.1. *Directories—Research Institutions:*

- HEP INSTITUTIONS ONLINE: Active links to the home pages of more than 800 HEP-related institutions with Web servers. Maintained by SLAC. Listed by country, and then alphabetically by institution:

  `http://www.slac.stanford.edu/spires/institutions/`
  `online_institutions.html`

- INSTITUTIONS: Database of over 6,234 high-energy physics institutes, laboratories, and university departments in which some research on particle physics is performed. Covers six continents and over a hundred countries. Provides an alphabetical list by country or an interface that is searchable by name, acronym, location, *etc.* Provides address, phone and fax numbers, e-mail address, and Web links where available. Has pointers to the recent HEP papers from each institution. Maintained by SLAC and DESY libraries:

+The web page for searching is:

`http://www.slac.stanford.edu/spires/inst/`

+The web page that is alphabetical by country is:

`http://www.slac.stanford.edu/spires/inst/online_institutions.shtml`

- HEP INSTITUTES: Contains almost a thousand institutional addresses used in the CERN Library catalog. Includes, where available, the following: phone and fax numbers; e-mail addresses; and Web links. Provides free text searching and result sorting by organization, country, or town:

  `http://weblib.cern.ch//Home/HEP_Institutes/index.php`

- HIGH ENERGY PHYSICS WEB SITES: An alphabetical listing of approximately 200 particle physics web sites with links to the institutions' Web pages. Maintained by the CERN Web group for the WWW Virtual Library. Somewhat difficult to use because entries are listed by institutional acronym or by short name:

  `http://physics.web.cern.ch/Physics/HEP.html`

- PHYSICSWEB WEB LINKS: An Institute of Physics database of web links to the home pages of physics departments worldwide. Searchable by field of research, country, keyword, or a combination. Results vary since information is in the process of being fully coded:

  `http://physicsweb.org/resources/dsearch.phtml`

5.2. *Directories—People:*

- HEPNAMES: Searchable worldwide database of 41,869 e-mail addresses of people associated with particle physics, synchrotron radiation, and related fields. Provides simple searches for Nobel Laureates, country statistics, Lab Directors, etc.:

  `http://www.slac.stanford.edu/spires/hepnames/`

- HEP VIRTUAL PHONEBOOK: A list of links to phonebooks and directories of high-energy physics sites and collaborations around the world. Very useful if you know the place or group and are trying to find a particular individual. Some phonebooks may require passwords or other authentication to access. Maintained by HEPiC:

  `http://www.hep.net/sites/directories.html`

- US-HEPFOLK: A searchable directory and census of U.S. particle physicists. Provides a database of almost 3,500 physicists from 155 U.S. institutions based on data collected annually. Searchable by first or last name, by affiliation, and/or by email address. Also provides some interesting demographic plots of the survey data:

  `http://pdg.lbl.gov/us-hepfolk/index.html`

5.3. *Directories—Libraries:*

- Argonne National Lab Library:

  `http://www.library.anl.gov/library/index.html`

- Berkeley Lab (LBNL) Library:

  `http://www-library.lbl.gov/teid/`
  `tmLib/aboutus/LibDefault.htm`

- Brookhaven National Lab Library:

  `http://inform.bnl.gov/RESLIB/reslib.html`

- (CERN) European Organization for Nuclear Research Library:

  `http://library.cern.ch/`

- Deutsches Elektronen-Synchrotron (DESY) Library:

  `http://www-library.desy.de/`

- Fermilab Library:

  `http://fnalpubs.fnal.gov/`

- Jefferson Lab Library:

  `http://www.jlab.org/IR/library/index.html`

- (KEK) National Laboratory for High Energy Physics Library:

  `http://www-lib.kek.jp/publib.html`

- Lawrence Livermore National Laboratory Library:

  `http://www.llnl.gov/tid/Library.html`

- Los Alamos National Laboratory Library:

  `http://lib-www.lanl.gov/`

- Oak Ridge National Laboratory Library:

  `http://www.ornl.gov/Library/library-home.html`

- Sandia National Laboratory Library:

  `http://www.sandia.gov/library.htm`

- Stanford Linear Accelerator Center Library:

  `http://www.slac.stanford.edu/library`

5.4. *Directories—Publishers:*

- DIRECTORY OF PUBLISHERS AND VENDORS: Outstanding and comprehensive directory of web links to publishers. Additional lists include publishers' email addresses, out-of-print sources, new title notifications, etc. Publisher and vendor lists are searchable alphabetically or by subject areas: Science, Mathematics, and Technology Publishers; Biomedical Publishers; Computer Publishers; Engineering Publishers; General Publishers; Natural History Publishers, and University Presses:

  `http://www.library.vanderbilt.edu/law/acqs/pubr.html`

5.5. *Directories—Scholarly Societies:*

- American Association for the Advancement of Science:

  `http://www.aaas.org/`

- American Association of Physics Teachers:

  `http://www.aapt.org/`

- American Astronomical Society:

  `http://www.aas.org`

- American Institute of Physics:

  `http://www.aip.org/`

- American Mathematical Society:

  `http://www.ams.org/`

- American Physical Society:

  `http://www.aps.org`

- American Physical Society: Scholarly Societies: Use this list to find national international scientific and professional societies:

  `http://www.aps.org/resources/#societies`

- European Physical Society:

  `http://epswww.epfl.ch/`

- IEEE Nuclear and Plasma Sciences Society:

  `http://ewh.ieee.org/soc/nps/aboutnpss.htm`

- Institute of Physics:

  `http://www.iop.org/`

- SCHOLARLY SOCIETIES PROJECT: Directory of 2,500+ scholarly and technical societies with links to their websites. Permits searching by subject, country, language, founding dates, etc. Includes acronyms and indicates when a website contains both its native language and an English-language version and when it has a permanent URL. Maintained by the University of Waterloo:

`http://www.scholarly-societies.org/`

6. E-Prints/Pre-Prints, Papers, & Reports:

- CERN ARTICLES & PREPRINTS: The CERN Library's database which contains records of more than 400,000 (CERN and non-CERN) articles, preprints, theses, CERN Yellow reports, technical notes, and official committee documents in particle physics. Provides access to full text of the documents for about 50and to the references when available:

  `http://weblib.cern.ch/Home/Library_Catalogue/Articles_and_Preprints/`

- HEP DATABASE (SPIRES): Contains over 491,900 bibliographic summaries for particle physics e-prints, journal articles, preprints, reports, conferences papers, and theses, *etc.* Covers 1974 to the present with substantial older materials added. Updated daily with links to electronic texts, Durham Reaction Data, *Review of Particle Properties*, *etc.* Searchable by citation, by all authors and authors' affiliations, title, topic, report number, citation (footnotes), e-print archive number, date, journal, *etc.* A joint project of the SLAC and DESY libraries with the collaboration of Fermilab, Durham (UK), KEK, Kyoto, and many other research institutions and scholarly societies such as the APS:

  `http://www.slac.stanford.edu/spires/hep/`

- KISS (KEK Information Service System) for Preprints: KEK Library preprint and technical report database. Contains bibliographic records of preprints and technical reports held in the KEK library with links to the full text images of more than 100,000 papers scanned from their worldwide collection of preprints:

  `http://www-lib.kek.jp/KISS/kiss_prepri.html`

- arXive.org E-PRINT ARCHIVE: An automated electronic repository of physics, mathematics, computer, and nonlinear science preprints. Used heavily by the subdisciplines of high-energy physics. Began with a core set of archives in 1991. Provides access to the full text of the electronic versions of these preprints. Permits searching by author, title, and keyword in abstract. Allows limiting by subfield archive or by date. Has mirror sites around the world. Papers are sent electronically to the archives by authors:

  `http://arXiv.org`

- PARTICLE PHYSICS DATA SYSTEM—PPDS: A search interface to the bibliography of the print publication *A Guide to Experimental Elementary Particle Physics Literature* (LBL-90). This bibliography covers the published literature of theoretical and experimental particle physics from 1895 to 1995:

`http://wwwppds.ihep.su:8001/ppds.html`

- PPF: PREPRINTS IN PARTICLES AND FIELDS: A weekly listing averaging 250 new preprints in particle physics and related fields. Contains bibliographic listings for and, in the Web version, full text links to, the new preprints received by and cataloged into the SPIRES High-Energy Physics (HEP) database. Includes that week's titles from the e-print archives as well as preprints and articles received from other sources. Directions for subscribing to an email version can be found on the page listing the most recent week's preprints:

  `http://www.slac.stanford.edu/library/`
  `documents/newppf.html`

7. Particle Physics Journals & Reviews:

7.1. *Online Journals and Tables of Contents:*

Please note, some of these journals, publishers, and reviews may limit access to subscribers. If you encounter access problems, check with your institution's library.

- Advances in Theoretical and Mathematical Physics: Bimonthly electronic and hard copy publication. Table of contents has links to arXiv.org E-Print Archives where papers for this journal are submitted:

  `http://www.intlpress.com/journals/ATMP/`

- American Journal of Physics: A monthly publication of the American Association of Physics Teachers on instructional and cultural aspects of physical science:

  `http://ojps.aip.org/ajp`

- Applied Physics Letters: Weekly publication of short (3 pages maximum) articles:

  `http://ojps.aip.org/aplo/`

- Astrophysical Journal: Published three times a month by the American Astronomical Society. See also AAS entry under Journal Publishers (below):

  `http://www.journals.uchicago.edu/ApJ/`

- Classical and Quantum Gravity: Published 24 times a year by IOP:

  `http://www.iop.org/Journals/cq`

- European Physical Journal A: Hadrons and Nuclei: This monthly journal merges Il Nuovo Cimento A and Zeitschrift fur Physik A:

  `http://link.springer.de/link/service/journals/`
  `10050/index.htm`

- European Physical Journal C: Particles and Fields: This twice monthly journal is the successor to Zeitschrift fur Physik C:

  `http://link.springer.de/link/service/journals/10052/index.htm`

- Journal of High Energy Physics: Electronic and print available. Like *ATMP*, this is an electronically-run journal. It accepts email submission notices and 'fetches' the submitted paper from the arXiv.org E-print archives:

  `http://jhep.sissa.it/`

- Journal of Physics G: Nuclear and Particle Physics: Monthly, published by IOP:

  `http://www.iop.org/Journals/jg`

- Journal of the Physical Society of Japan: JPSJ Online: Monthly, online since 1993:

  `http://jpsj.jps.or.jp/`

- Modern Physics Letters A: Published 40 times a year, this contains research papers in gravitation, cosmology, nuclear physics, and particles and fields. *Brief Review* section for short reports on new findings and developments:

  `http://www.wspc.com.sg/journals/mpla/mpla.html`

- Modern Physics Letters B: Published 40 times a year, this contains research papers in condensed matter physics, statistical physics, applied physics and High Tc Superconductivity. *Brief Review* section for short reports on new findings and developments:

  `http://www.wspc.com.sg/journals/mplb/mplb.html`

- New Journal of Physics: Funded by article charges from authors of published papers and by scholarly societies, *NJP* is available in a free, electronic form:

  `http://www.njp.org/`

- Nuclear Instruments and Methods in Physics Research A: Accelerators, Spectrometers, Detectors, and Associated Equipment: Published approximately 36 times per year, this journal focuses on instrumentation and large scale facilities:

  `http://www.elsevier.nl/locate/nima`

- Nuclear Physics A: Nuclear and Hadronic Physics:

  `http://www.elsevier.nl/inca/publications/store/5/0/5/7/1/5/`

- Nuclear Physics B: Particle Physics, Field Theory, Statistical Systems, and Mathematical Physics:

  `http://www.elsevier.nl/inca/publications/store/5/0/5/7/1/6/`

- Nuclear Physics B: Proceedings Supplements: Publishes proceedings of international conferences and topical meetings in high-energy physics and related areas:

  `http://www.elsevier.nl/inca/publications/`
  `store/5/0/5/7/1/7/`

- Physical Review D: Particles, Fields, Gravitation, and Cosmology: Published 24 times a year:

  `http://prd.aps.org/`

- Physical Review Special Topics – Accelerators and Beams: A peer-reviewed electronic journal freely available from the APS:

  `http://prst-ab.aps.org/`

- Physics Letters B: Nuclear and Particle Physics: Published weekly:

  `http://www.elsevier.nl/locate/plb`

- Physics—Uspekhi: English edition of Uspekhi Fizicheskikh Nauk:

  `http://ufn.ioc.ac.ru/`

- Progress in Particle and Nuclear Physics: Published four times a year. Many, but not all, articles are at a level suitable for the general nuclear and particle physicist:

  `http://www.elsevier.nl/locate/ppartnuclphys`

7.2. *Journals – Directories:*

- DESY Library Electronic Journals: Use this Web page for up-to-date links to electronic journals of interest to particle physics. Contains a broader list than is included in this compilation:

  `http://www-library.desy.de/eljnl.html`

- Electronic Journals: A directory of over 900 science, technology, and engineering journals online compiled by the University of Buffalo's Science and Engineering Library. Includes a list of full text journals:

  `http://ublib.buffalo.edu/libraries/units/sel/`
  `collections/ejournal2.html`

7.3. *Journals – Publishers & Repositories:*

- NASA ASTROPHYSICS DATA SYSTEM: Provides free electronic access to back issues of the *Astrophysical Journal*, *Astrophysical Journal Letters*, and the *Astrophysical Journal Supplement Series*. The NASA ADS is in the process of scanning more back issues and will eventually make the complete *ApJ* available:

  `http://adswww.harvard.edu/`

- AIP JOURNAL CENTER: The American Institute of Physics' top-level page for their electronic journals may be found at:

  `http://www.aip.org/ojs/service.html`

- AMERICAN PHYSICAL SOCIETY: The top-level page for the APS research journals is:

  `http://publish.aps.org/`

- ELSEVIER SCIENCE: This website enables browsing Elsevier-published journals by subject field. First select 'physics and astronomy' and then on the next page you must select either physics or astronomy (no longer both) and then also select publication type 'journals' returns an intermediate page with links organized by the first letter of the name of the journal. Thus one must select "A" to retrieve a list of all of Elsevier's physics-related journals beginning with that letter. A somewhat inefficient way to search what Elsevier offers:

  `http://www.elsevier.nl/homepage/`

- EUROPEAN PHYSICAL SOCIETY: Their journals are handled by various publishers but may be reached from this top-level page:

  `http://www.eps.org/publications.html`

- INSTITUTE OF PHYSICS: Journals: Information: A list of the IOP journals organized by subject. A page organized by title is also available linked to this page:

  `http://www.iop.org/EJ/S/3/418/main/-list=subject`

- SPRINGER PUBLISHING: Physics: This link provides a list of Springer journals by subject. On subsequent pages, the small bullets containing the letter 'E' beside each title indicate which journals are electronic:

  `http://www.springer.de/phys/journals/index.html`

7.4. *Review Publications:*

- Net Advance of Physics: A free electronic service providing review articles and tutorials in an encyclopedic format. Covers all areas of physics. Includes e-prints, book announcements, full text of electronic books, and other resources with hypertext links when available. Welcomes contributions of original review articles:

  `http://web.mit.edu/redingtn/www/netadv/welcome.html`

- Physics Reports: A review section for *Physics Letters A* and *Physics Letters B*. Each report deals with one subject. The reviews are specialized in nature, more extensive than a literature survey but normally less than book length:

  `http://www.elsevier.nl/locate/physrep`

- Reviews of Modern Physics: Published quarterly. Includes traditional scholarly reviews and shorter colloquium papers intended to describe recent research of interest to a broad audience of physicists:

  `http://rmp.aps.org/`

8. Particle Physics Education Sites:

8.1. *Particle Physics Education: General Sites:*

- Argonne National Laboratory Gee Whiz!: Includes links fun and informative sub-sites such as the The ArithmAttack, the Rube Goldberg Machine Contest; Arts in Science; and the parts of the movie 'Chain Reaction' that were filmed at Argonne:

  `http://www.anl.gov/OPA/geewhiz.htm`

- Contemporary Physics Education Project (CPEP): Provides charts, brochures, Web links, and classroom activities. Online interactive courses include: Fundamental Particles and Interactions; Plasma Physics and Fusion; and Nuclear Science:

  `http://www.cpepweb.org/`

- Center for Particle Astrophysics in Berkeley: Excellent source for online demos aimed at middle school students (modifiable for other levels). Online demonstrations include: Air-Powered Rockets; Desktop Stars; Lunar Topography, Ping Pong Ball Launcher; Potato Power; Solar System; and more to come. Each includes an introduction, teacher and student worksheets, and a list of materials needed:

  `http://cfpa.berkeley.edu/Education/DEMOS/DEMOS.html`

- EDUCATIONAL INFORMATION: This Particle Data Group site provides links to three subsites each filled with well-designed and visually attractive information: The Particle Adventure; Contemporary Physics Education Projects' Educational Materials; and then a set of links to Physics Education Sites:

  `http://pdg.lbl.gov/outreach.html`

- Fermilab Education Office: Outstanding collection of resources from the 'grandmother' of all physics lab educational programs. Sections are organized for students and educators by grade level and for general visitors. See in particular the Phriendly Physics Bibliography:

  `http://www-ed.fnal.gov/trc/phys`

- Physics4Kids: While this site is still under construction and has mostly white text on a black background, it has excellent explanations of physics principles and analytical concepts and tools. Diagrams are clear and easy to understand. Sections cover Motion, Thermodynamics, Light, Modern Physics, and Electricity and Magnetism:

  `http://www.physics4kids.com/`

- Physical Science: Educational Hotlists: Created by the outstanding Franklin Institute Science Museum, these hotlists contain a prescreened list of resources for science educators, students, and enthusiasts. The criteria for inclusion is that a site stimulates creative thinking and learning about science. The excellent Physical Science list contains useful links for physics, physicists, optics, material science, applied design and engineering, sites for museums, 'doing science,' and inventors and engineers:

  `http://sln.fi.edu/tfi/hotlists/hotlists.html`

- PhysLink.com: Education: This site provides sub-lists of online resources in the following areas: History of Physics and Astronomy; Essays on the interface between science, art, religion and philosophy; Astronomy; Graduate School and Student Advice; Software (reviews); References and Learning Sites for Educators; Youth Science; and New Theories:

  `http://www.physlink.com/Education/Index.cfm`

- QuarkNet: QuarkNet brings the excitement of particle physics research to high school teachers and their students. Teachers join research groups at 60 universities and labs across the country that are associated with particle physics experiments at CERN, Fermilab, or SLAC. Students learn fundamental physics as they participate in inquiry-oriented investigations and analyze live, online data. QuarkNet is supported in part by the National Science Foundation and the U.S. Department of Energy.

  `http://QuarkNet.fnal.gov`

- Stanford Linear Accelerator Center: This Virtual Visitor's Center website explains basic particle physics, linear and synchrotron accelerators, electron gamma showers, cosmic rays, and the experiments conducted at SLAC. Interesting section includes real-world applications. Aimed at the general public, as well as at students and teachers: `http://www2.slac.stanford.edu/vvc/home.html`

8.2. *Particle Physics Education: Ask-a-Scientist Sites:*

- Ask A Scientist: Questions are answered by volunteer scientists throughout the world. Service provided by the Newton BBS through Argonne National Lab. Submission form permits very specific age information to be included with the question so that the answer can be targeted to the questioner's level of knowledge:

  `http://newton.dep.anl.gov/aasquest.htm`

- Ask the Expert: Submit questions via a form to PhysLink.com. Questions are answered for free. Submission form warns that they won't answer questions from homework assignments or help design something for a science fair or competition:

  `http://www.physlink.com/Education/`
  `AskExperts/Index.cfm`

- How Things Work: The author of the popular *How Things Work: the Physics of Everyday Life* has created a site that functions as a virtual 'radio call-in program'. Submit questions about how something works or consult the 60 pages of most recent questions which are searchable by date, topic, or keyword:

  `http://howthingswork.virginia.edu`

- Mad Scientist's Network: Ask A Question: Responds to hundreds of questions a week. Be sure to check out their extensive archive of answered questions and use their Science Fair Links for ideas for projects:

  `http://www.madsci.org/submit.html`

- The Science Club: An excellent compilation of places to ask science questions. Organized by 'general' sites and then by sites that specialize in specific subjects or professions:

  `http://www.halcyon.com/sciclub/kidquest.html`

8.3. *Particle Physics Education: Experiments, Demos,* & *Fun*

- Albert Einstein Online: A meta-Einstein site with links to dozens of resources by and about this scientist. Organized into Overviews; Moments (recollections of Einstein by others); Physics; Writings; Quotes; Pictures; and Miscellaneous:

  `http://www.westegg.com/einstein/`

- All About Light: From Fermi National Accelerator Laboratory, a delightful collection of pages explaining classical, relativistic and quantum descriptions of light at the advanced placement high school level or above:

  `http://www.fnal.gov/pub/`
  `inquiring/more/light/index.html`

- Deep Space: Remote Access Astronomy Project: This project (RAAP) was developed as a supplement for high school, college or advanced placement physics courses to enable students to combine theory with observation by working with satellite imaging data and a Remotely Operated Telescope. The labs are available as PostScript and .doc files. Classes should also obtain the 180 page curriculum and image processing manual available for $15.00 plus shipping:

  `http://www.deepspace.ucsb.edu/rot.htm`

- The Edible/Inedible Experiments Archive of the Mad Scientist Network: Astronomy, Mathematics, and Physics are included in the scientific fields covered. Each experiment uses common materials and identifies whether the experiment is edible, inedible, or 'partially drinkable', or 'not all that edible' (!?) categories:

  `http://www.madsci.org/experiments/`

- The Particle Adventure: An interactive tour of particle physics and the inner workings of the atom for the general public, students and teachers. Available in five languages:

  `http://ParticleAdventure.org/`

- A Century of Physics: Timeline from the American Physical Society provides great browsing, searching and images:

  `http://timeline.aps.org/APS/home_HighRes.html`

- Helping Your Child Learn Science: A wonderful introduction and set of tools for parents of elemenatary-age children compiled by the U.S. Department of Education. Provides ideas, home experiments, community-based science activities, and more:

  `http://www.ed.gov/pubs/parents/Science/index.html`

- Insultingly Stupid Movie Physics: An entertaining and educational site to learn how many movie special effects violate the laws of physics. Includes a rating system for movie reviews:

  `http://www.intuitor.com/moviephysics/`

- Life, the Universe, and the Electron: A wonderful exhibit to celebrate the centenary of the discovery of the electron sponsored by IOP and the Science Museum, London:

  `http://www.iop.org/Physics/Electron/Exhibition/`

- QuarkDance.org: Not only are quarks the basis of matter, they can dance! See adorable, cute, quarks shake their bottoms as they bounce around to some fun, mind-numbingly cool music. It is also a gateway to many exciting physics websites.

  `http://QuarkDance.org`

- The Virtual Laboratory: Physics Applets: Maintained by the University of Oregon's Physics Department. A series of experiments using Java applets that are targeted to non-majors physics classes which have no physical lab sections. The experiments provide conceptual interfaces to the equations of physics and represent interaction with data that simulates a real physics experiment. Includes: Astrophysics applets; Energy and Environment applets; Mechanics applets; Thermodynamics applets; and the beginnings of some general tools such as a whiteboard to create a gif image of a particular applet's output for submitting as a homework assignment:

  `http://jersey.uoregon.edu/vlab/index.html`

- The World of Beams: A site to visit if you know a little or a lot. Sponsored by the Center for Beam Physics at Lawrence Berkeley National Laboratory:

  `http://cbp-1.lbl.gov/`

9. Software Directories:

- CERNLIB: CERN PROGRAM LIBRARY: A large collection of general purpose libraries and modules offered in both source code and object code forms from the CERN central computing division. Provides programs applicable to a wide range of physics research problems such as general mathematics, data analysis, detectors simulation, data-handling, *etc.* Also includes links to commercial, free, and other software:

  `http://wwwinfo.cern.ch/asd/index.html`

- FREEHEP: A collection of software and information about software useful in high-energy physics. Searching can be done by title, subject, date acquired, date updated, or by browsing an alphabetical list of all packages:

  `http://www.slac.stanford.edu/find/fhmain.html`

- FERMILAB Software Tools Program: Software repository of Fermilab-developed software packages of value to the HEP community. Permits searching for packages by title or subject category:

  `http://www.fnal.gov/fermitools/`

- HEPIC: Software & Tools Used in HEP Research: A meta-level site with links to other sites of HEP-related software and computing tools:

  `http://www.hep.net/resources/software.html`

10. Specialized Subject Pages:

10.1. *Subject Pages*

- Nanotechnology: A selective set of links providing recent news, introductory-level explanations, web videos, bibliographies of books and articles, conferences, events, and an excellent list of links to other sites:

  `http://www.zyvex.com/nano/`

- Neutrino Website: John Bahcall has compiled links to: technical and popular articles books; Hubble Space Telescope and other images; models; viewgraphs; cross-section data; software; and more. The place to begin researching neutrinos at a graduate student level and beyond:

  `http://www.sns.ias.edu/~jnb/`

- The Official String Theory Web Site: Outstanding compilation of information about string theory includes: an introductory section on theory; cosmology; links to other sites; experiments testing string theory; black holes; a directory of people working on string theory; and a discussion forum. Many of the explanations are very accessible to an advanced high school level:

  `http://superstringtheory.com/`

- Relativity: Bookmarks: Presents an almost overwhelming number of worldwide links. Topical divisions include: university sites; experimental gravitation projects; relativity-related journals and databases; historical relativity; popular relativity; visualization; relativistic raytracing; elementary, intermediate, and advanced relativity; workshops; courses and seminars; astrophysical and black hole relativity; computational; symbolic; quantum; applied; and philosophical:

  `http://physics.syr.edu/research/relativity/RELATIVITY.html`

- Relativity on the World Wide Web: An excellent set of pages offering links and written information about relativity. Organized into: popular science sites; visualization sites; web tutorials; observational and experimental evidence and rebuttals; course work (divided into undergraduate and graduate levels); software; research frontiers; and further reading:

  `http://www.math.washington.edu/~hillman/relativity.html`

- Sean Morgan's Nanotechnology Pages: A large compilation that must be browsed to discover all it's gems. Includes News; Molecular Nanotechnology, Scanning Probe Microscopy; Molecular Modeling; Nanoelectronics and Micromachining; Nanotechnology Mailing Lists; Electronic Magazines and Journals on MNT; and a Nanotechnology Timeline. Each list includes articles, books, conferences, and more:

  `http://www.lucifer.com/~sean/Nano.html`

- Superstrings!: An online introduction to superstring theory for the advanced student. Includes further links:

  `http://www.sukidog.com/jpierre/strings/`