

PHYSICS IS FOR YOU

An exciting introduction to physics and your world from the American Institute of Physics

WHAT IS PHYSICS?

PHYSICS IN EVERYDAY LIFE

PHYSICISTS AT WORK

WILL I NEED FURTHER EDUCATION?

PHYSICS IN CAREERS

CAREERS IN PHYSICS

WHERE DO I FIND ADDITIONAL INFORMATION?

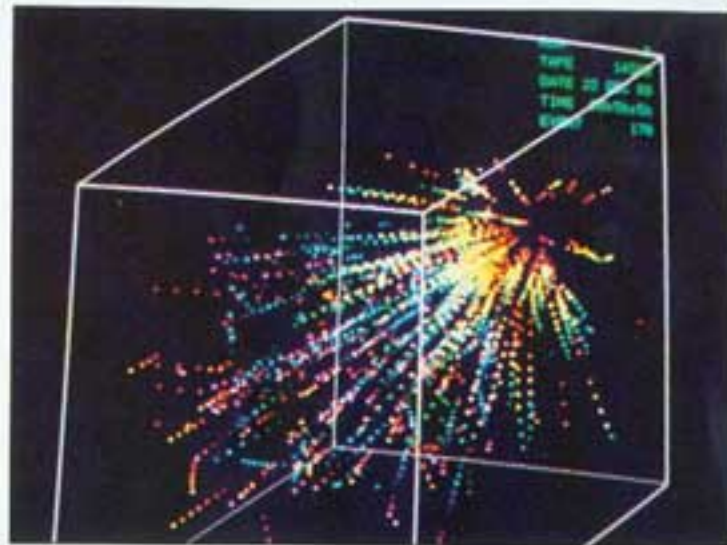
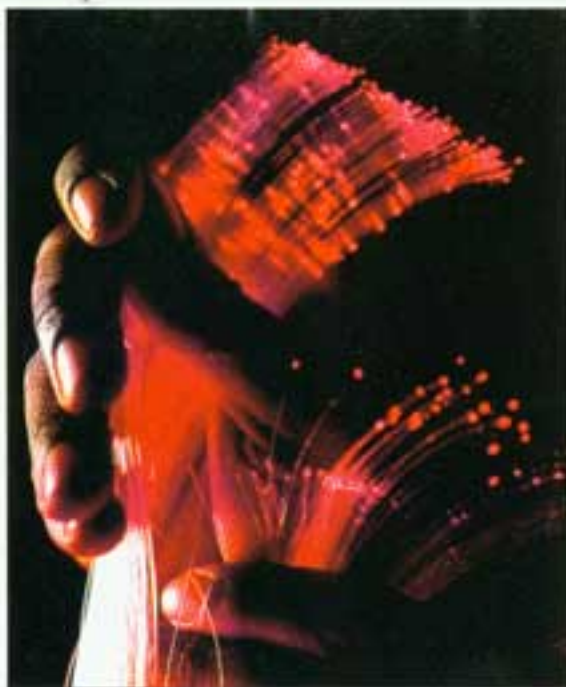
Physics is an organized way of conversing with nature. Physicists ask questions; nature responds. For many questions, the answers are almost predictable, but when the question is a particularly good one, the answer can be unexpected and give us new knowledge of the way the world works. These are the moments physicists live for.

DID YOU KNOW?

Did you know that an amusement park is a life-size physics lab? You can feel the physical forces in action. Concepts like acceleration, momentum, gravitational potential energy, and weightlessness become real as you experience the rollercoaster, the colliding bumper car, the swinging cages, or the fall-away floor. These are concepts explained in physics courses.



The fundamental ideas of physics underlie all basic science—astronomy, biology, chemistry, and geology. Physics also is essential to the applied science and engineering that has taken our world from



High energy collision between heavy nuclei at the Alternating Gradient Synchrotron at Brookhaven National Laboratory. (Photo courtesy Brookhaven National Laboratory.)

the horse and buggy to the supersonic jet, from the candle to the laser, from the pony express to the fax, from live smoke signals to live satellite transmission, from the beads of an abacus to the chips of a computer.

Today physics is as exciting as ever. The animated conversation between physicists and nature goes on and it shows no sign of stopping. ■

Fiber optics used in telecommunications.
Science Source

The most basic of the sciences, physics, is all around us every day. If you've ever wondered what makes lightning, why a boomerang returns, how ice skaters can spin so fast, how Michael Jordan can "fly," why waves crash on the beach, how that tiny computer can do complicated problems, or how long it takes light from a star to reach us, you have been thinking about some of the same things physicists study every day.

Physicists like to ask questions. They try to find answers for almost everything—from when the universe began to why soda fizzes. If you like to explore and figure out why things are the way they are, you might like physics.

DID YOU KNOW?

Did you know that a karate strike aimed slightly **BEHIND** the target achieves the most force? The idea of momentum is the key, a topic found in physics courses.



If you've had a back-row seat at a rock concert, and could still hear, you experienced physics at work! Physicists studying sound contribute to the design of concert halls and the amplification equipment. Knowing more about how things

move and interact can be used to manage the flow of traffic and help cities avoid gridlock.

Lasers and radioactive elements are tools in the war on cancer and other diseases. Geophysicists are developing methods to give advance warning of earthquakes.



Ford driver Robby Gordon competing in the ITT Automotive Detroit Grand Prix. Aerodynamic engineering helps reduce drag and increase traction. (Photo courtesy Ford Motor Company/Campbell and Co.)



Alf Rowls performs the "Ollie," the aerial maneuver on which all new skateboard tricks are based. The "Ollie" depends on a rapid compression and decompression of the skater's legs. (Photo courtesy Transworld Skateboarding Magazine.)

The work of physicists made possible the computer chips that are in your digital watch, CD player, electronic games, and hand-held calculator. ■

The laboratory of the physicist extends from the edge of the universe to inside the nucleus of an atom. A physicist may work in a laboratory designing materials for the computer chips of tomorrow, or smashing atomic particles against one another in a quest to understand how our universe began. Physicists have orbited the Earth as astronauts, and plumbed the oceans' depths. Individuals who have studied physics seek to make instruments that diagnose and cure disease; to develop safer and cleaner fuels for our cars and homes; to harness the power of the sea; to calculate

DID YOU KNOW?

A knuckleball can flutter up and down as much as a foot on its way to the batter. The erratic flow of air around the baseball's stitching causes this effect. Air turbulence is another subject covered in physics courses.



the movement of arctic glaciers; and to create smaller, faster electronic components and integrated circuits.

Research physicists work in industry and government, in laboratories and hospitals, and on university campuses. Some physicists serve in the military, teach in high schools and colleges,



NASA astronauts in weightless spaceflight conditions. The weightless conditions of spaceflight can be simulated by flying an airplane in a special arc. (Photo courtesy NASA.)

design science museum exhibits, write books and news articles about science, give advice to federal, state, local, and foreign governments, run businesses, even become artists. Students not interested in pursuing a science career can still benefit from courses in physics. The study of physics helps you acquire very special problem-solving skills and

teaches you to better observe and understand the world. We all employ physical concepts in everyday life.



AT&T Bell Laboratories researcher Janis Valdmanis makes equipment adjustments while measuring super-fast electrical pulses through a new electro-optic technique.

(Photo courtesy AT&T Bell Laboratories.)

Pole vaulters and drummers aren't research physicists, but they make use of physical concepts such as elasticity, momentum, conservation of energy, vibration, reverberation, and reflection to hone their skills. ■

A course in physics can be the beginning of a career in science or an important building block for another profession. The course will give you a powerful and beautiful way to look at and understand the world around you.

If you like mathematics and science, a physics career offers many opportunities. You should take algebra, geometry, trigonometry, and pre-calculus (if it's available) in high school. When you get to college, you'll take more mathematics. Studying mathematics will help you in physics—and physics will help you to understand and begin to appreciate many applications of mathematical concepts.

Other fields of science overlap physics. Many parts of biology, chemistry, geology, and engineering use physics. If you have taken both biology and chemistry, you may have used physics. In college, if you decide to major in physics, you'll take more science but concentrate in physics. After you have taken general physics, with laboratory work, you will study some of the fields within physics such as classical mechanics, thermodynamics, electromagnetism, relativity, astrophysics, optics, and geophysics.

Graduate students pursuing master's and doctoral degrees concentrate fully on physics. The master's program usually takes two years and may require a research project. An additional two to four years may be needed to earn a Ph.D. One of the most important parts of the Ph.D. program is a piece of original research (either theoretical or experimental) conducted with the guidance of a faculty advisor. You will write up the results for your thesis and perhaps publish it in a scientific journal.

As in other fields, computers are important tools for physicists. Computer programming classes will teach you the skills necessary for the modelling and analysis that are important in physics.

But don't plan on spending all of your time in the lab or in front of a computer screen! You'll need speaking and writing skills to communicate your discoveries, which means that English and composition are required. Scientists need to be able to write clear, concise reports about their research. The editors and reviewers at scientific journals won't re-write



During the training camp prior to the 1992 International Physics Olympiad, the U.S. team visited NASA's Goddard Space Flight Center where solar physicist Carol Jo Crannell detailed upcoming missions. (Photo courtesy NASA.)

your paper, and publishing your work may be very important to your career as a scientist.

You will also need to speak before different audiences: you may present a lecture on your research at professional meetings of physicists, explain your research to non-scientists, and even answer questions from reporters for newspapers and magazines. If you decide to teach, being able to explain technical material in understandable language is particularly important. Science is international. The study of foreign languages will help when you're invited to attend an international meeting, accept a fellowship for study and research in a foreign country, or when the latest research paper in your field hasn't been translated into English.

If you become a scientist, you can contribute not only through your research, but also by helping others to understand how scientific research is important to them. ■

DID YOU KNOW?

Did you know that shaking a ketchup bottle before opening it will produce a smoother flow? Ketchup is a plastic solid. It is thicker when resting than when agitated. Rheology—a field that uses physics—is the study of how matter flows.



ELEMENTARY OR

MIDDLE SCHOOL TEACHER

It has been said that children are born scientists. This is best illustrated by the questions they constantly ask. Teaching at the elementary or middle school level presents the challenge of keeping that curiosity alive while teaching new ideas. Why do you get electric shocks in cold, dry weather? Does a stick of dynamite contain force? What makes rainbows form? How cold can it get? Individuals who themselves appreciate science often have a special gift for teaching young children. Curiosity about the world around us is a common bond of children and scientists.

ATHLETE

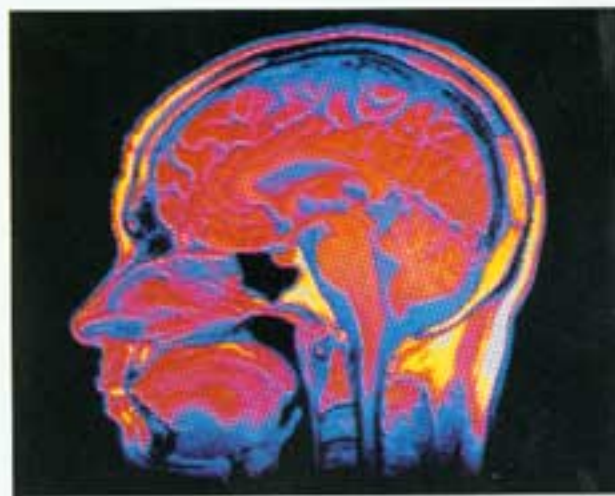
When you watch an athlete, you are seeing the principles of physics in motion. The bat hitting the baseball, the spiraling football, the bend in the vaulter's pole, and the tension of muscles as a weight is lifted illustrate some of the basic laws of physics, like momentum, equilibrium, velocity, kinetic energy, center of gravity, projectile motion, and friction. Knowing these principles of physics helps an athlete or coach improve performance.

IMAGING TECHNICIAN

Looking inside the body without surgery is one of medicine's most important tools. X rays, computed tomography, CT scans, and magnetic resonance imaging are used to determine bone damage, diagnose disease, and develop treatment for various illnesses. Technicians who use imaging equipment need to be familiar with the concepts of x rays and magnetic resonance, and be able to determine how much of this powerful technology to use. Imaging technicians work at hospitals, medical colleges, and clinics.

AUTO MECHANIC

Today's automobiles are a far cry from those put on the road by Henry Ford. Computers play a major role in how our cars operate. Computers are also used by mechanics to diagnose auto malfunctions. A basic understanding of computer technology is essential in almost every career.



Magnetic Resonance Imaging of the brain. Science Source

ENVIRONMENTALIST

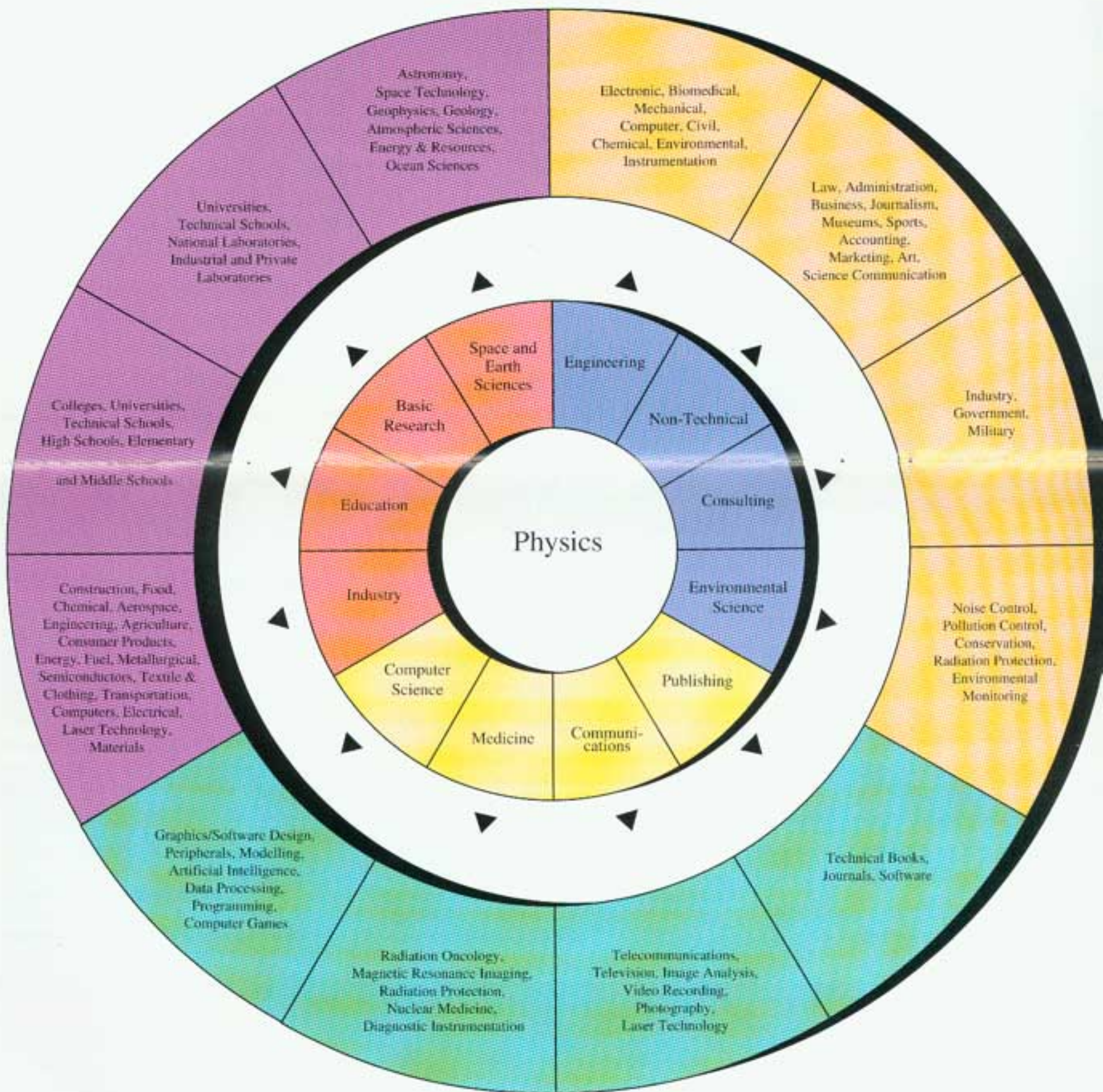
The 1990s have been called the "Decade of the Environment." Environmental physicists are studying ozone depletion and other problems involving the atmosphere. They use acoustics to try to reduce noise pollution. They search for cleaner forms of fuel, study how smog forms and how to reduce it, and devise ways in which to dispose of and store nuclear waste safely.

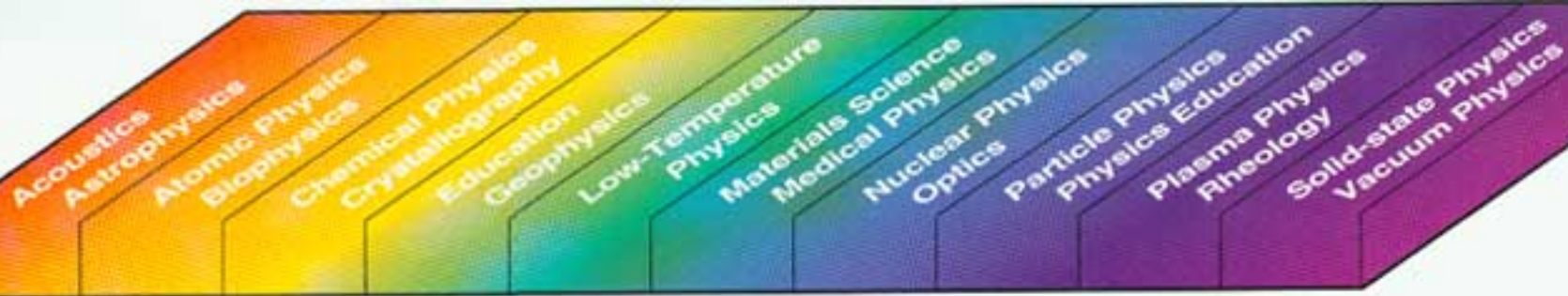
JOURNALIST

Science is one of the most exciting assignments a reporter can have. New discoveries, controversial findings, space research, medical breakthroughs, natural disasters, technological competitiveness, and the environment make up a big part of the news. Reporters who have a background in physics have an advantage in being able to grasp technical issues quickly and communicate easily with researchers. Many major daily newspapers in the country have science sections; in addition, science reporting is featured on radio and television. ■

Physics offers challenging, exciting, and productive careers. As a career, physics covers many specialized fields—from acoustics, astronomy, and astrophysics to medical physics, geophysics, and vacuum sciences.

Physics offers a variety of work activities—lab supervisor, researcher, technician, teacher, manager. Physics opens doors to employment opportunities throughout the world in government, industry, schools, and private organizations. ■





General Information - AIP and its Member Societies

To Find Additional Information
Write Directly To:

American Institute of Physics:

One Physics Ellipse, College Park, MD 20740
promotes the advancement and diffusion of the knowledge of physics and its application to human welfare through numerous programs of publishing, education, and information.

Acoustical Society of America:

500 Sunnyside Blvd., Woodbury, NY 11797
physical properties of sound—architectural, engineering, musical, noise, physical, psychological and physiological, shock and vibration, speech communication, and underwater acoustics.

American Association of Physicists in Medicine:

One Physics Ellipse, College Park, MD 20740
application of physics to medical practice—radiation oncology, diagnostic radiology, nuclear medicine, ultrasound, magnetic resonance imaging, and radiation protection.

American Association of Physics Teachers:

One Physics Ellipse, College Park, MD 20740
the teaching of physics at the high school and college levels, classroom experiments, methodology, computer technologies for teaching, public understanding of physics, and cultural and historical aspects of physics.

American Astronomical Society:

2000 Florida Ave. Ste. 400, NW, Washington, DC 20009
the physics of the cosmos—planetary sciences, solar physics, dynamical astronomy, high energy astrophysics (the extension of basic physics into the cosmos), and historical astronomy.

American Crystallographic Association:

P.O. Box 96, Ellicott Station, Buffalo, NY 14205-0096
study of the arrangement of the atoms in matter, its causes, its nature and its consequences, and the tools and methods used in such study.

American Geophysical Union:

2000 Florida Ave., NW, Washington, DC 20009
understanding of the earth and its environment in space, including seismology (the study of earthquakes), hydrology (the study of water on and below the surface), and volcanology (volcanoes).

American Physical Society:

One Physics Ellipse, College Park, MD 20740
largest society of physicists in the world includes many subunits—astrophysics, atomic, molecular and optical, physics of beams, biological, computational, chemical, condensed matter, fluid dynamics, high polymer, materials, nuclear, particles and fields, and plasma physics, and the forums on education, international, history, and physics and society.

American Vacuum Society:

120 Wall St., New York, NY 10005
electronic materials and processes, fusion technology, surface science, thin films, vacuum metallurgy, and vacuum technology.

Optical Society of America:

2010 Massachusetts Ave., NW, Washington, DC 20036
study of light (including invisible ultraviolet and infrared radiation)—laser technology, optical transmission of information via thin fibers, and the design of optical "circuits" for future computers.

Society of Rheology:

500 Sunnyside Ave., Woodbury, NY 11797-2999
study of the flow of viscous (thick, sticky) materials and mixtures of materials—interests include flow of blood in the body, materials such as plastic, metal, ceramics, rubber, and glass, and the movement of arctic glaciers.

Career Information and Resources

To Find Additional Information:

For Statistical & Salary Surveys contact:

American Institute of Physics
Education and Employment Statistics Division

For Physics News and physics posters contact:

American Institute of Physics
Public Information Division

For job listings for physicists contact:

American Institute of Physics
Career Services Division

Additional resource books and bulletins which may be found at your local public or university library:

America's Federal Jobs - 720 N. Park Drive, Indianapolis, IN 46202 - A comprehensive guide to new job openings each year in the federal government - JIST Works, Inc.

Careers in Chemistry - Questions and answers - American Chemical Society, Washington, DC

Chamber of Commerce Directories - Available in many cities, and restricted to the areas they serve.

Chronicle of Higher Education - Weekly newspaper - Washington, DC

Directory of American Research & Technology - Organizations Active in Product Development for Business - R.R. Bowker, New York, NY

Directory of Directories - Gale Research, Inc., Detroit, MI

Directory of Physics & Astronomy Staff - American Institute of Physics

Dun & Bradstreet Million Dollar Directory - Vol. I, Dun & Bradstreet Inc., New York, NY

Employment Guide for Engineers and Scientists - Institute of Electrical and Electronics Engineers, Inc., New York, NY

Encyclopedia of Associations - Vol. I - National Organizations of the U.S.

Graduate Programs in Physics, Astronomy & Related Fields - American Institute of Physics

Job Hunter's Source Book - Gale Research Inc., Detroit, MI

National Directory of Nonprofit Organizations - The Taft Group, Detroit, MI

Peterson's - Engineering, Science & Computer Jobs - Peterson's Guides, Princeton, NJ

Physics Today - A monthly professional scientific magazine - American Institute of Physics

Research Centers Directory - A guide to university-related and other nonprofit research organizations - Gale Research Inc., Detroit, MI

The Scientist - Biweekly newspaper for the science professional - The Scientist, Inc., Philadelphia, PA

Scientific and Engineering Societies: Resources for Career Planning - American Association for the Advancement of Science, Washington, DC

Standard & Poor's Register of Corporations, Directors and Executives - (3 Vol.) Standard & Poor's, New York, NY

Thomas' Register of American Manufacturers - (12 Vol.) Thomas Publishing Company, New York, NY

Value Line Investment Survey - Arnold Bernhard & Company, Inc.