

# PHYSICS

2009

Physics is the study of the laws that govern natural phenomena, from the infinitely small (the atomic and subatomic worlds) to the infinitely large (the universe). The discoveries made thanks to research in physics have applications in unexpected places—among them biology, finance, and artificial intelligence, to name just a few. Current research in physics extends to applied as well as basic research. The many applications of the basic laws of energy and matter have revolutionized our life since the early 19th century. Consider, for example, the steam engine, electricity, the telephone, television, and the computer. Technological progress continues to depend on the pioneering work of physicists in theory, experimentation, and, now, digital methods. What engages physicists today will occupy engineers tomorrow.

By virtue of their multidisciplinary training—in physics, mathematics, computer science, physical chemistry, new materials, and more), graduate physicists have their choice of a wide range of careers. In addition to research and teaching in a university setting, they may choose to work in computer science, corporate research and development, health care, or financial modeling

#### Subfields

Electronics, nanotechnologies, optics, solid-state physics, general physics, nuclear physics, biophysics, hydrodynamics, signal imaging.

Also see the following subject profiles: Mathematics, Biology, Chemistry, Computer science, Environment and earth sciences, New materials

#### Sectors of activity

research, engineering, technology, teaching, industry, telecommunications, aeronautics and space, medical imaging, research and development, computer science, manufacturing.

## ORGANIZATION OF STUDIES

Students enrolled in a university climb the harmonized European academic ladder: licence, master, doctorate. University programs are renowned for their teaching and research, but career-oriented programs leading to the licence professionnelle also open doors to the business world. Many students continue on for a master. At the master level they focus on a specific field of study and then earn a doctorate or accept a position in industry.

Several of France's schools of engineering specialize in physics—among them ESPCI (École Supérieure de Physique et Chimie Industrielles) in Paris, ENSPS (École Nationale Supérieure de Physique) in Strasbourg and Grenoble, and ENSPCB (École Nationale Supérieure de Chimie et de Physique) in Bordeaux. In other schools physics may be offered as a specialization, even though it may not be the school's primary mission. Schools specializing in optics, acoustics, and energy, for example, offer programs in physics.

Engineering programs require a minimum of 5 years of postsecondary study. Students are admitted based on their performance on an entrance examination administered either following 2 years of preparatory postsecondary study or directly upon leaving secondary school (for schools that offer the preparatory curriculum internally). In some cases, students may begin or transfer into engineering programs based on the grades they earned while working toward a DUT (diplôme universitaire de technologie), BTS (brevet de technicien supérieur), licence, or 1-year master (M1).

Engineering schools train students for positions in computer science, manufacturing, and technical business fields, where competence in several subjects is valued.

## RESEARCH THEMES

Physics research in France is carried out by the universities and major research bodies such as the CNRS, CEA, ONERA, and INSERM. France has a long and exemplary record of imaginative physics research. The nation's physicists have made and continue to make major contributions to progress in various fields of the discipline.

Research is done on both basic and applied topics. In fact, the fine balance between the two forms of research is a strength of the French system, because tomorrow's technological progress is based on today's basic research. "To abandon basic research would be to sterilize practical applications," said Albert Fert, professor at Université de Paris-Sud 11, who shared the 2007 Nobel Prize in physics.

Research is ongoing in the following broad fields: physics and nanotechnology, elementary particle physics, and astrophysics. The CNRS, France's preeminent research organization, is reorganizing its research program in physics around new national institutes in each of these fields. Physics also overlaps other basic and applied disciplines—among them biology, chemistry, electronics, and medicine

## INTERNATIONAL STANDING

France's scientists have won 10 Nobel Prizes since 1903. The first was shared by Antoine-Henri Becquerel and Pierre and Marie Curie for their discovery of radioactivity and the isolation of two radioactive elements: radium and polonium. Other French names on the Nobel roster are Lippmann, Perrin, Broglie, Kastler, Néel, Gennes (1991), Charpak (1992), Cohen-Tannoudji (1997), and Fert (2007). Albert Fert shared the prize with Peter Grünberg (Germany) for their simultaneous discovery of the giant magnetoresistance effect, the technology behind the steady reduction in the size of hard disks and the improvement of their performance. The fruits of the work of Fert's team are found not only in magnetic memory but also in the sensors used in defense and automotive systems and in super-high-frequency telecommunication systems.

## Websites

- Centre national d'études spatiales (CNES, national center for space studies)  
<http://www.cnes.fr>
- Centre national de la recherche scientifique (CNRS, national center for scientific research)  
<http://www.cnrs.fr>
- Commissariat à l'énergie atomique (CEA, atomic energy commission)  
<http://www.cea.fr>
- Conférence des directeurs des écoles françaises d'ingénieurs (CDEFI, conference of directors of French engineering schools)  
<http://www.cdefi.fr/>
- École normale supérieure (ENS)  
<http://www.phys.ens.fr/>
- École normale supérieure Lyon (ENS-Lyon)  
<http://www.ens-lyon.fr/PHYSIQUE/>
- Ecoles d'ingénieurs ParisTech  
<http://www.paristech.org/>
- Écoles d'ingénieurs Polytech  
<http://www.polytech-reseau.org/>
- n+i network of engineering schools  
<http://www.nplusi.com/>
- Institut national de la santé et de la recherche médicale (INSERM, national institute of health and medical research)  
<http://www.inserm.fr/>
- Laboratoire central des industries électriques (central laboratory for the electrical industry)  
<http://www.lcie.fr>
- Métiers de la Physique (careers in physics)  
<http://physi.curieux.free.fr/IMG/pdf/metiersDeLaPhysique.pdf>
- Métrologie française (French standards office)  
<http://www.metrologiefrancaise.fr>
- Ministry of Ecology, Energy, Sustainable Development, and Regional Planning  
<http://www.developpement-durable.gouv.fr/>
- Ministry of Higher Education and Research  
<http://www.enseignementsup-recherche.gouv.fr/>
- Office National d'Études et de Recherches Aéronautiques (ONERA, national office for aeronautical research and plans)  
<http://www.onera.fr/>
- Organisation européenne pour la recherche nucléaire (CERN, European organization for nuclear research)  
<http://public.web.cern.ch>
- Société Française de Physique (French physical society)  
<http://www.sfpnet.fr>

## Keywords

aeronautics – analogique – archéosciences – architecture – armement – astronomie – astroparticules – astrophysique – atmosphère – atomique – automatique – automobile – aviation – biologie – chimie – climat – communication – conception – cosmologie – culturel – curie – développement – domotique – droit – eau – écologie – économie – électrique – électromagnétisme – électronique – énergie – entreprise – environnement – fiabilité – génie – géophysique – gestion – hydraulique – hyperfréquence – imagerie – industrie – informatique – ingénierie – laser – management – matériaux – mathématiques – mécanique – métrologie – micro-technologies – moléculaire – nanotechnologies – nucléaire – numérique – observatoire – océanographie – ondes – optique – optronique – patrimoine – photonique – physique – plasmas – radiochimie – radiofréquence – radioprotection – rayonnements – recherche – réseaux – robotique – santé – science – subatomique – système – technologie – télécommunication