Physics Stimulates Industry

LASERS

- First built in 1958 with only $30,000 in federal research funding
- Key component in many medical, industrial, military, and consumer devices
- $23 billion US market depends on lasers and related components

FASTER COMMUNICATIONS

- Voice communication, Internet service, and video now reach private homes through laser-based fiber optics
- The $100 billion telecommunications industry relies on lasers carrying optical data

NSF, DOD, Office of Naval Research funded research from 1960 to the present


Sandia National Lab

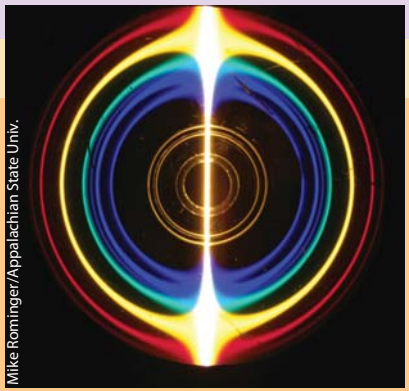

Corbis Photos

PAIN-FREE SURGERY

- Used in millions of medical procedures every year from eye surgery to skin-cancer removal
- $3.2 billion in revenue from LASIK alone
- Reduces the need for general anesthesia, and leads to less bleeding and infection

NSF, NIH, DOD funded research since 1980

1931-2006 AMERICAN INSTITUTE OF PHYSICS 75 Years of Service


Mike Rominger/Appalachian State Univ.

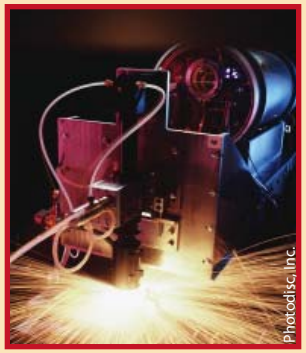
REVOLUTIONIZING ENTERTAINMENT

- CDs, DVDs, checkout scanners and printers are just a few of the consumer products that rely on lasers
- The global market for laser-based optical storage products exceeds $3.5 billion

NSF, DOD, Office of Naval Research funded laser research from the mid-1950s to the present

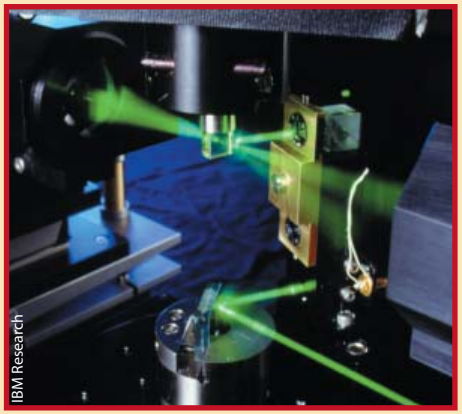
R&D Pays Off – Support Physics Research

Lasers — From Physics R&D to Widespread Use



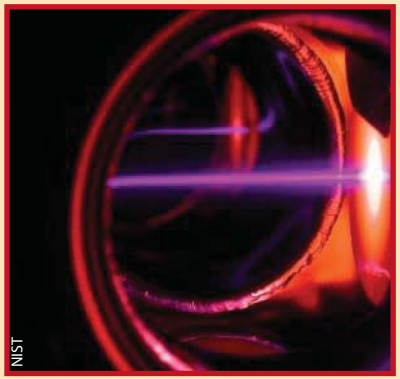
Laser Tools in Industry

Lasers cut, drill and weld materials ranging from paper and cloth to diamonds and exotic alloys. Lasers are more precise, never dull, and rarely wear out.



Holograms

Security features on credit cards and labels are often made with laser-created holograms. Laser holograms may also lead to high-density data storage.

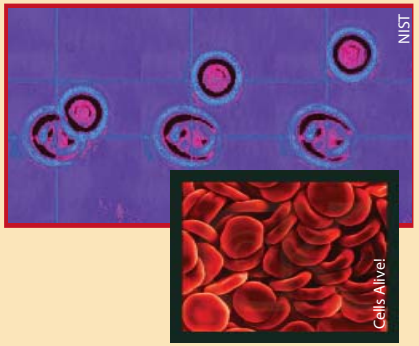


Laser Cooling

In the last 10 years alone, five US researchers have shared Nobel Prizes for using lasers to cool and trap atoms and to create a new state of matter, known as the Bose-Einstein condensate.

Optical Tweezers

Focused laser beams can trap tiny objects, and can manipulate biological samples such as red blood cells and microorganisms.



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Reaping the Rewards: A Century of R&D

LASERS TIMELINE

"A splendid light has dawned on me." (Albert Einstein, on the discovery of the lasing mechanism)

1917 – Albert Einstein performs fundamental studies on the nature of light, discovering the principles of spontaneous and stimulated emission.

1953 – Charles Townes builds the first maser while trying to create a source of microwaves for communications. Work was funded by the ONR and the Air Force (Nobel Prize, 1964).

1958 – Townes and Arthur Schawlow attempt to build a maser for visible light.

1959 – Gordon Gould, a doctoral student at Columbia University, introduces the term laser in a seminal paper, "The LASER: Light Amplification by Stimulated Emission of Radiation."

1960 – Theodore Maiman builds a working laser with a ruby crystal.

1961-65 – Schawlow and Nicolaas Bloembergen share the Nobel Prize in 1981 for work in laser spectroscopy, which later permits identification of chemical species, such as airborne pollutants. Ali Javan, William Bennett, and Donald Herriott first use laser for telecommunication. GE, IBM, and the federally funded Lincoln Labs all announce the development of semiconductor lasers. Kumar Patel develops the carbon-dioxide laser now used in welding, cutting, and drilling.

1968-69 – NASA launches the first satellite equipped with a laser beam. Earth-based lasers transmit information to orbiting satellites. Astronauts place laser reflectors on the moon.

1982 – Visa begins putting laser holograms on credit cards to discourage forgery.

1997 – MIT researchers create the first atom laser (ONR, NSF).

2001 – ONR, NIST and NSF-funded physicists earn the Nobel Prize for creating a new state of matter called a Bose-Einstein condensate, using laser cooling (Nobel Prize, 1997).

2005 – US researchers share Nobel Prize for seminal insights into the nature of laser light and for dramatically improving laser-based measurements for such applications as better optical clocks.

From Today's Investment to Tomorrow's Rewards

Funding and Initial Research:
NIH, DOE, NSF, DOD, NIST, NASA and DARPA since the 1950s