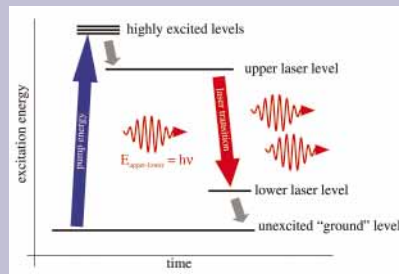


# Lasers

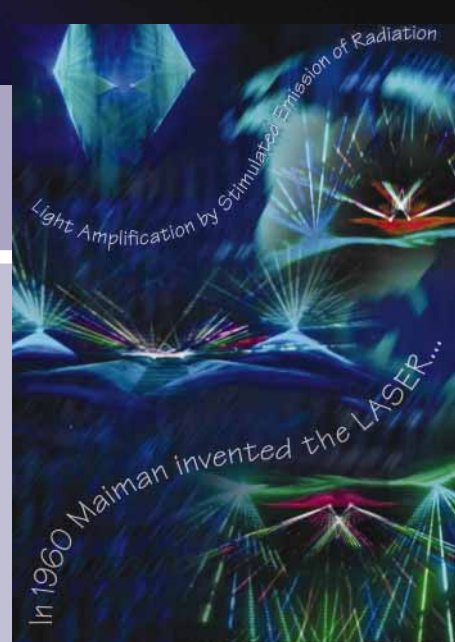


The invention, and increasing application, of new lasers will continue into the 21st century. Lasers inundate modern society spanning applications in fundamental scientific research (above) to entertaining laser light shows (far right).

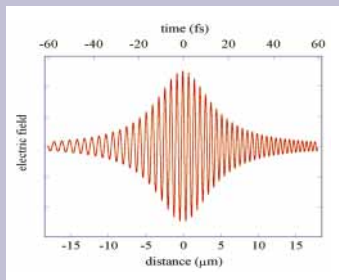
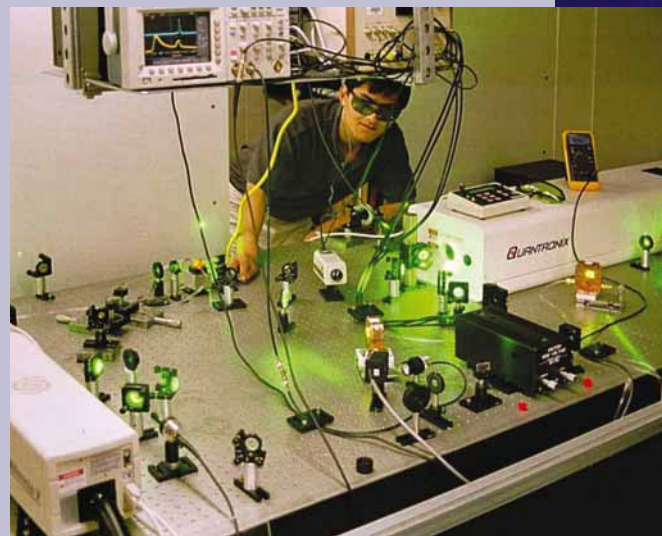
When the gain medium of a laser is excited, it may be stimulated by a photon to release its stored energy and emit another, identical photon. This is the basis of a **LASER: Light Amplification by Stimulated Emission of Radiation Lasers**



Pump energy, e.g. an electrical discharge, excites the atoms in the laser gain medium to high-energy levels. These decay into the upper laser level and the lasing action converts this energy into photons. Finally the atom decays to the low energy state where it may be re-excited.



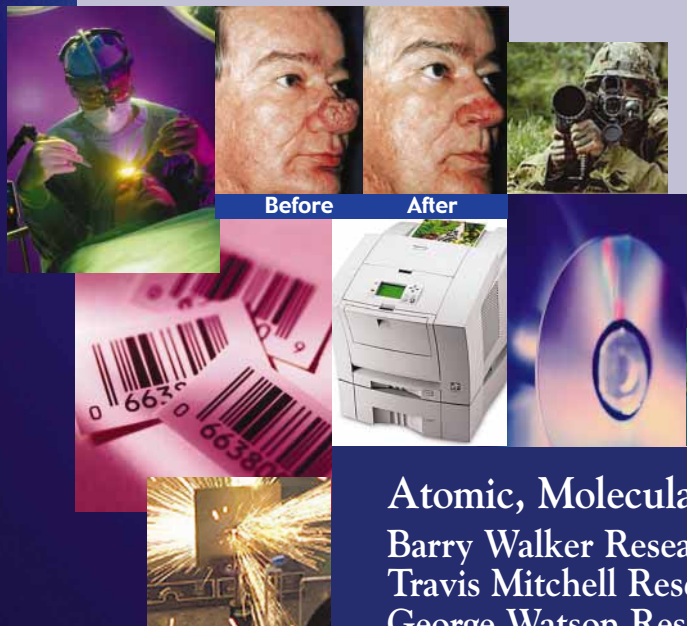
A high power laser developed by Joe Yang (MS '01) at the University of Delaware is shown to the right. Laser mirrors reflect light through the gain medium eighteen times. The laser amplifies weak light pulses 10 million times until they contain 23,000 trillion photons.



The electromagnetic light wave from a laser can be either continuous, with billions of oscillations, or pulsed with as few as two oscillations. Laser light ranges in color from the far infrared to the deep ultraviolet.

Pulses of laser light as short as 20 femtoseconds (femto =  $10^{-15}$ ) are generated at the University of Delaware. The graph shows the electric field of a pulse that is only a few millions of a meter ( $10^{-5}$  meters) long.

Lasers are used to perform delicate eye surgery, transmit information in fiber optic cables, stencil greeting cards, make holograms, read prices at the supermarket, excite and probe samples in scientific research, remotely sense and range, to name only a few.



The collage of applications shown include the lasers used to read compact disks, print on paper, guide weapons, scan UPC bar codes, perform surgery, or cut through steel.

Atomic, Molecular, Optical Physics  
 Barry Walker Research Group  
 Travis Mitchell Research Group  
 George Watson Research Group

