

# PHOTON

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## PHOTON CAREERS OVERVIEW

Photonics is a rapidly growing industry that offers many opportunities to students who choose to study optics. An optics professional can be an engineer, scientist, researcher, technician or educator that uses photonics to design, research, develop, assemble or teach. The jobs available to these students cover a range of disciplines and require a variety of skills. Take a look at some of the exciting opportunities photonics has to offer!

Students should be aware that there are two major areas in the field of optics: *optical engineering* and *optical science*.

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### **Optical Engineering**

Optical engineering involves the *application* of optics to the design and building of instruments or equipment.

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### **Optical Science**

Optical science involves the *researching* of light energy and its interaction with different materials and components.

We are all excited about the growing number of opportunities in optics; however, this field can be very unfamiliar, making it difficult to pinpoint the actual jobs that are available. Students often ask the question: "*What can I do with my education in optics?*" The following information should help counselors answer this question and provide students with some real examples of optics-related careers. Whether you are interested in cars, volcanoes, diamonds or cows, the photonics industry has a place for you!

## **WHAT CAN BE DONE WITH OPTICS?**

This list contains examples of what professionals in the Photonics industry actually do! As you can see, this field enables people to create, design, correct and scrutinize the multi-faceted earth in which we live.

### **AEROSPACE**

- Examines all safety and flight-critical hardware supplied to NASA
- Design minisatellites
- Study atmospheric composition in order to understand the distribution of the ozone
- Testing and flight-certifying NASA engines for space shuttle

### **AGRICULTURE/ ANIMAL HUSBANDRY**

- Examine how cows use food energy
- Perform reflectance measurements on swimming fish to determine what colors they are able to see
- Measure the fluorescence of plant leaves
- Improve crops by examining the gene structure of the plants
- Develop an inspection system for herring eggs to improve the quality of sushi
- Assess the health of coral reefs

### **ARCHEOLOGY/ HISTORIC PRESERVATION**

- Design 3-D computer models of dinosaurs
- Digitally restore ancient documents
- Conserve the American flag that hangs in the National Museum of American History
- Preserve the Alamo by locating moisture problems on its walls
- Clean facades and historical buildings with lasers

## **ART/ MUSIC**

- Create greener lawns year-round by manipulating genes in grass.
- Control color in motion picture lighting
- Improve quality and reliability of laser light shows
- Create holograms
- Improve acoustic sound systems with low-power lasers

## **ASTRONOMY**

- Replace glass telescope mirrors with nickel-coated aluminum
- Study quarks in outer space
- Use fiber-optic technology to create "hyper-realistic views of star fields, the sun and planets" in planetariums.
- Track asteroids that could collide with the earth
- Search for planets not yet discovered

## **AUTOMOTIVE INDUSTRY**

- Enable paint to be evenly coated on new cars
- Develop high-intensity discharge headlamps
- Matching plastic trim color to painted metal when produced in different locations
- Design heat-resistant coating for headlamp lenses
- Reduce defects by using line-scan cameras for inspection of automobile parts

## **CONSTRUCTION**

- Make three-dimensional models of buildings using a laser scanning system
- Monitor the structure of a bridge to detect deterioration
- Eliminate human error in structure-building by implementing laser precision

## **CRIME PREVENTION/ INVESTIGATION**

- Measure intoxication by monitoring slight changes in the eyes
- Protect documents from forgery

- Build infrared surveillance devices to place in taxicabs
- Improve toll collection facilities by capturing license plate images of cars passing through
- Replace password security systems with fingerprint security systems
- Use infrared thermology to measure temperature of bodies in graves

## **EARTH SCIENCE**

- Detect crustal deformation in the earth
- Map wildfires
- Create mudslides in order to measure their progression and allow for prevention of real mudslides
- Monitor volcanic activity and lava flow

## **ELECTRONICS**

- Produce diamond thin films for electronic applications
- Improve the variability of flatbed scanners
- Use lasers to drill holes smaller than a mechanical drill
- Build more efficient lasers

## **GEMOLOGY**

- Identify the origins of gemstones
- Value a diamond by its cut using an imaging spectrophotometer
- Value a diamond by its color using a microspectrometer

## **IMAGING/ PHOTOGRAPHY/ PRINTING**

- Improve quality of barcode's scanner windows
- Capture catastrophic events on film with an extremely high-speed camera
- Build more efficient electronic printing equipment
- Improve the efficiency of combustion engines
- Create high-speed verification systems for credit cards, bar codes and lottery tickets

## **LIGHTING**

- Create volumetric displays used in high-tech video games, air traffic

control and medical imaging

- Increase reliability of emergency power systems through backup generators
- Improve quality of laser displays

## **MANUFACTURING**

- Design web inspection systems to locate defects in rolled products (plastic film, paper, aluminum)
- Develop automated systems for more accurately cutting lumber
- Engrave trophies and award plates using CO<sub>2</sub> lasers
- Ensure that chemical being shipped internationally are free of impurities
- Monitor temperature and pressure in oil wells
- Create optimal lighting conditions for retail stores
- Use 3-D Imagers to measure golfer's hands and create custom-fit golf gloves

## **MEDICINE/ BIOMEDICINE**

- Explore insulin-secreting cells using fluorescent zinc dye
- Create mobile multimedia systems for use by new motorcycle paramedics
- Improve detection of breast cancer with a compact gamma camera
- Develop imaging software to assist in brain research
- Use video network technology to record surgical procedures and show them to students, patients and doctors.
- Improve quality and efficiency of radiation therapy to cancer patients

## **MILITARY**

- Use high-power lasers to destroy missiles
- Monitor target locations, navigation and weapons systems through virtual imagery in military aircraft
- Enable soldiers to quickly identify organisms during a biological attack with handheld biodetectors
- Use laser technology and 3-D diagnostic techniques to evaluate aircraft combustion flow

## **MOLECULAR/ PARTICULATE MEASUREMENT**

- Detect chemicals and atmospheric constituents using remote sensing systems
- Speed the detection of leaks in gas pipelines
- Monitor the presence of water among methane
- More efficiently measure the composition of aerosoles
- Study air pollution with laser-based systems

## **NUCLEAR SCIENCE**

- Perform situ, quasi-nondestructive analysis inside hostile industrial environments
- Initiate fusion using high-powered laser energy

## **TELECOMMUNICATIONS**

- Create lightweight miniprojectors for travel use
- Design computer programs to increase the efficiency of software programmers
- Improve quality of optical amplifiers
- Manufacture a pen which enables users to access email
- Develop the SUPERVision pitch-tracking system which enables broadcasters of baseball games to see the trajectory of every pitch

## **TRANSPORTATION**

- Monitor traffic in waterways with high-quality video compression systems
- Strengthen jet engine fan blades
- Map defects in the hulls of boats to aid in repair
- Stamp rail parts with identification numbers
- Decrease noise vibration near major highway systems