Introduction

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Physics as a whole boomed in the middle of the twentieth century, but optics remained a seemingly sleepy backwater compared with hot fields such as nuclear physics, electronics, and astronautics. Yet the seeds of two technological revolutions were growing quietly, fertilized by the generous government research funding that had fueled the rapid expansion of physics. One was the development of space optics for surveillance satellites, which in time would stabilize the uneasy balance of nuclear power. The other was the birth of the laser, which brought new excitement and ideas to optics.

The development of spy satellites was among the deepest of military secrets in 1960. The effort had begun quietly in 1955, as military and intelligence officials realized that satellites might offer a new window on the Soviet Union's nuclear activities. That priority grew more important with the Soviet Sputnik launch in 1957, which both showed that spaceflight was possible and established the precedent that satellites above the atmosphere could fly over countries without violating their airspace. Advanced optics were as crucial to the effort as rockets; without good optics, the satellites could not record images of the ground clearly enough for intelligence analysts to interpret them. Just weeks after Sputnik, the U.S. started a crash optics program called CORONA, described in this section by Kevin Thompson, which eventually succeeded in filming Soviet nuclear activity from space, helping to ease nuclear tensions. The Hexagon program that followed, described by Phil Pressel, built on CORONA's success.

The laser was an outgrowth of a military program seeking higher-frequency microwave sources that led Charles Townes to develop the maser, then to think of how to extend the principle of amplifying stimulated emission to even higher frequencies. Laser light brought dramatic new possibilities to optics—monochromatic and coherent light that could be concentrated into a beam of energy.

Irnee D'Haenens, who assisted Ted Maiman in making the first laser, may have been the first to call the laser "a solution looking for a problem," and it was a cute joke in the early 1960s. But in reality the laser opened the door to solving a host of previously intractable problems. One series of articles in this section tells of the development of new varieties of lasers, made from gases, new types of solids, semiconductors, and organic dyes in solution. Another article tells how companies began manufacturing lasers for others to use.

The laser also opened up whole new fields of endeavor, covered in other articles in this section. The intensity of laser light revealed nonlinear effects that had previously been impossible to observe. The coherence of laser light made practical a radically new form of truly three-dimensional imaging called holography. Lasers offered precise new ways of measurement, from remote sensing to ultra-precise metrology. Laser beams could cut or drill materials, print words on paper or record data on optical disks, or read printed patterns to automate checkout at stores.

Lasers soon launched whole new government programs, described in other articles in this section. Concern about nuclear attack led to efforts to develop laser weapons that could destroy targets at the speed of light, a program that would wax and wane with the arms race and progress (or lack of it) in building high-power lasers until the present day. The laser's ability to focus intense energy onto pinpoint spots led to research on laser fusion, both as a way to generate energy and to simulate nuclear weapons. The laser's narrow linewidth and tunability led to efforts to enrich isotopes, both for nuclear reactors and to make bombs.

And the echoes of laser ideas, stimulated in the early years of the laser revolution, also resonate through the remaining sections of this history.