Uranium Optical Maser
Source: *The Science News-Letter*, Vol. 78, No. 27 (Dec. 31, 1960), p. 434
Published by: Society for Science & the Public
Stable URL: http://www.jstor.org/stable/3942288
Accessed: 09/04/2010 16:18

PHYSICS

Uranium Optical Maser

➤ A NEW OPTICAL MASER, a device for greatly amplifying light, has been made from uranium to give the first continuous generation of coherent light waves.

Optical masers are expected to have important applications in sending and receiving signals from satellites and other objects in space, in projecting television pictures, in photographing astronomical bodies, and in medical diagnosis by X-rays or fluoroscopy. By using optical masers, super-sharp pictures heretofore unobtainable can be made.

The uranium optical maser—previous devices were made of ruby—was discovered by Drs. Peter P. Sorokin and Mirek J. Stevenson of International Business Machines Corporation. Their report on how the uranium optical maser works is reported in the Physical Review Letters, 5: 557, 1960.

By using uranium, they found it possible for the first time, to generate continuous and coherent light waves in the infrared portion of the electromagnetic spectrum.

The scientists also developed a second optical maser device, made from samarium. Operation of this device, which operates in the visible light spectrum, will be reported in the IBM Journal of Research, Jan., 1961.

Ruby optical masers, light from one of which was recently sent 25 miles, transmit light in pulses and require a fair amount of power to operate.

Power requirements of the uranium optical maser are only a five-hundredth that of the ruby.

Efficiency of the uranium optical maser can be increased by refining the optical design of apparatus in which it is used. Both the uranium and samarium devices are cylinder-shaped crystals, silvered at each end.

The optical maser system of communication is expected to be especially useful for space communications as there are few dust particles and no moisture to scatter the light as they do in the earth's atmosphere.

Development of optical masers was suggested early in 1959 by Dr. C. H. Townes, now a consultant for the Institute for Defense Analyses, Washington, and Dr. A. L. Schawlow of Bell Telephone Laboratories. They received a patent on the optical maser this year.

Maser is a coined word that stands for Microwave Amplification by Stimulated Emission of Radiation. The first masers operated in the radio wave range.

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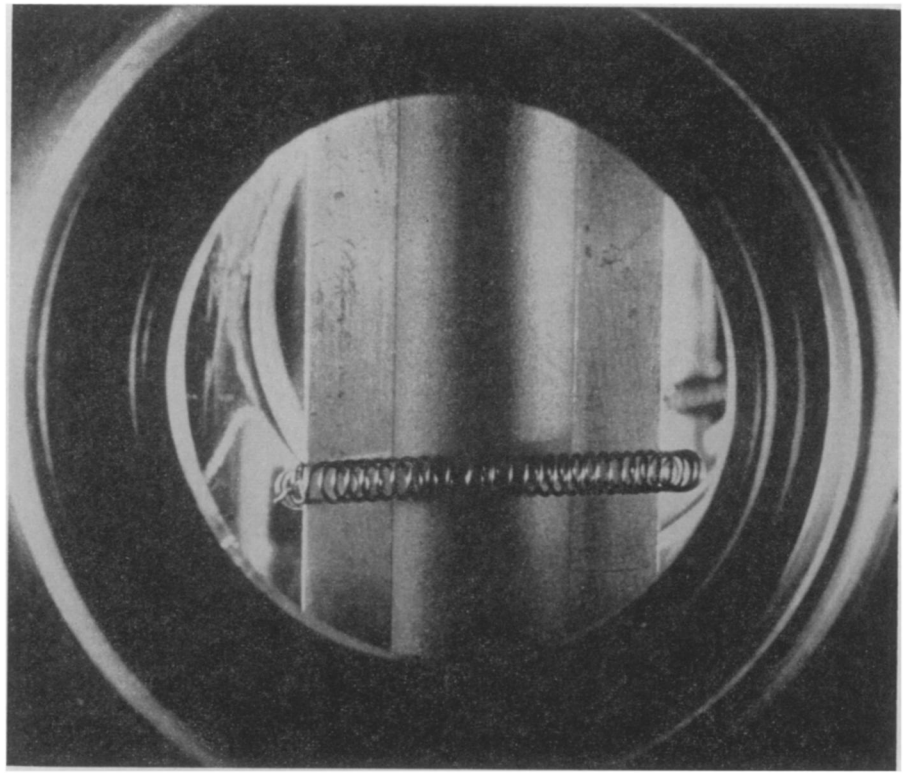

CLOSE UP VIEW OF URANIUM MASER—through window of liquid helium dewar flask.

ENGINEERING

Meets Space Challenge

See Front Cover

➤ TWENTY-ONE of the nation's 25 top priority space and weapons systems have been tested at the Arnold Engineering Development Center of the Air Research and Development Command in Tullahoma, Tenn.

The Center is a $325,000,000 complex of stainless steel pipes, tunnels and platforms. Items coming through the Center are space, ballistic and atmospheric flight weapons, and vehicles of the future. Ninety percent of the work done here is classified.

In the unclassified area, however, general knowledge of aerodynamics, propulsion and rocket technology, valuable both to industry and civilian agencies of government, are made available.

The Arnold Center can test equipment ranging in size from full-scale vehicles to small-scale models, under conditions ranging from altitudes at sea level to more than 200,000 feet, and from subsonic velocities to those in the hypersonic range at Mach 20. (Mach 1 equals the speed of sound, which is 763 miles per hour at sea level.)

The success in the reentry and recovery of the Air Force's Discoverer satellite capsule was due to the Center's tests on parachutes designed to return the capsule safely through the earth's atmosphere.

Its wind tunnel facilities permitted testing the parachute alone with no risk to the satellite or its payload at altitudes and speeds to which it would be subjected in space. At 55,000 feet and at winds eight times the speed of sound, the type of parachute used in earlier Discoverer shots that failed in re-entry was ripped to shreds in one or two seconds.

Arnold Center engineers studied the cause of failure and designed the two-stage chute that passed the wind tunnel tests.

The vast wind tunnels of the Center have movable walls so that air pressures, winds and speeds can be stepped up by narrowing the "throat" through which the air must go before it reaches the weapon or vehicle being tested.

The ducting in the supersonic circuit of the propulsion wind tunnel, seen on the cover of this week's SCIENCE NEWS LETTER, ranges in diameter from 27 to 62 feet.

The inner wall is lined with square, stainless steel panels, stuffed with fiberglass pillows. This provides insulation to maintain heat in the tunnel when high temperatures are needed for certain tests.

Temperature, which ranges up to 650 degrees Fahrenheit, is controlled by 100,000 gallons per minute capacity air-to-water heat exchangers.

The tunnel has an altitude simulation capacity of 200,000 feet and can operate between Mach 1.5 and 4.5.

The flexible nozzle wall in the circuit is made of a special steel alloy of high yield and tensile strength. It is 1½ inches thick, 100 feet long and 16 feet high and took two years to build.

"It is the most advanced facility of its kind in the world," Gen. Homer Boushey, AEDC Commander, said.

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