PHYSICS

New Laser Uses Liquid

➤ A NEW WAY of producing the very intense light beam of lasers, which are promising for use in space and earth communications, was reported to the American Physical Society in New York.

Organic liquid lasers give off light at wavelengths not previously available and are predicted to become important in the fundamental understanding of matter. The new kind of laser, or optical maser, operates on a principle never used before—stimulated "Raman" scattering.

Although the Raman effect is well known to physicists it has not been involved in laser action. In the ordinary Raman effect, light is scattered from molecules. The outgoing, or scattered, light has different energy and wavelength than the incoming light, the energy difference having been converted to molecular vibrations.

All previous lasers make use of fluorescence from a long-lived upper energy level of an atom or molecule. In the new laser materials, there is no upper energy level. However, very strong incoming, or "pumping," light is required to initiate laser action, so the liquid organic lasers are "pumped" with the well-known ruby laser.

The liquid lasers were developed by scientists at Hughes Aircraft Company, working at the research laboratories in Malibu, Calif. Drs. Eric J. Woodbury of the Culver City, Calif., plant, Gisela Eckhardt, R. W. Hellwarth, Fred J. McClung, S. E. Schwarz and D. Wiener reported details of their research to fellow physicists in the Physical Review Letters, 9:455, 1962.

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Hughes Aircraft

LIQUID LASER—Dr. Fred J. McClung of Hughes Aircraft Company pours nitrobenzene from a beaker into the laser's glass sample holder.

METEOROLOGY

Weather Photo System

➤ MAJOR WEATHER stations all over the world will be able to get cloud cover pictures of their regions directly from weather satellites under a new photographic system.

The experimental system for sending direct cloud pictures from meteorological satellites to inexpensive ground stations has passed initial ground-based checkout tests.

Called the Automatic Picture Transmission Subsystem (APT), it will require relatively simple ground station equipment costing about $30,000.

The new system is expected to have wide application in weather analysis and forecasting internationally when it is perfected and put into orbit operationally. Although it is designed for the Nimbus meteorological satellite system whose first launch is scheduled for the fall of 1963, a preliminary flight test on the Tiros satellite may be conducted in mid-1963.

The APT subsystem in Nimbus will enable meteorologists to obtain a few immediate local area cloud pattern photographs of high quality when the satellite is within a 1,700-mile range of a receiving station. This will normally occur twice a day about noon locally at any receiving station in the world.

The transmission of pictures from the satellite will be by a technique similar in principle to the method now used to send radio news photographs. These pictures will be received and reproduced immediately on an especially adapted facsimile machine.

This is accomplished by sending a "narrow-band" TV signal from the satellite to the ground station's antenna and receiver, which feeds it directly to the facsimile machine. The signal is electronically converted, building up a picture line by line. As a result, a cloud cover picture is immediately available for use in weather analysis and forecasting.

Dr. Morris Tepper, director of meteorological systems, NASA headquarters, is in overall charge of NASA's weather satellite program.

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ASTROPHYSICS

Sunspot Cycle Influences Far Atmospheric Density

➤ THE EARTH'S outer atmosphere at heights of about 400 miles changes density in tune with the sun's 11-year cycle of activity.

A large decrease in the density at this far level since 1958 has been found from information sent back to earth by radio from two satellites—Vanguard I and Explorer IX. The year 1958, when Vanguard was launched, was the time of highest sunspot activity in the 11-year cycle. Explorer IX was launched in 1961, at a time approaching the low point in solar spottedness.

Explorer IX is a rigid sphere 12 feet in diameter and weighing only 14.6 pounds. Because of this light weight and large size, its motion in orbit is extremely sensitive to the slight resistance of the very sparse atmosphere at high levels. Its surface is highly reflective, so this satellite is very easy to track and about 70 photographs are made of it each week.

When air density was calculated from changes in its orbital motion, scientists at the National Aeronautics and Space Administration found that the density was only about one-tenth that measured at 400 miles with Vanguard.

The study, reported in Sky and Telescope, 24:335, 1962, was made by Drs. William J. O'Sullivan Jr., Claude W. Coffee Jr. and Gerald M. Keating of NASA's Langley Research Center, Langley Field, Va. They believe, because of this sharp drop in density, that the upper atmosphere cools and shrinks closer to the earth when solar activity is diminishing.

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ASTRONOMY

New Measurement to Closest Neighbor Galaxy

➤ THE MOST accurate measurement so far for the distance to Andromeda Galaxy is 2.2 million light years obtained by astronomers at Mount Wilson and Palomar Observatories. That is about 13,000,000,000,000,000,000 miles.

Andromeda is the immense island of stars that is the closest galaxy to our own Milky Way. Its distance has been estimated variously at 700,000 to three million light years.

The new figure was calibrated by Miss Henrietta Swope, research fellow in astronomy at the observatories, operated by California Institute of Technology and Carnegie Institution of Washington.

Her yardstick was a group of pulsating stars called Cepheid variables, which she and other astronomers have spent many years developing into the most penetrating of all celestial measuring rods for distances out to about five million light years. That is about as far away as these bright, blinking beacons show up in photographs taken through powerful telescopes.

A Cepheid is a very bright, comparatively young star that grows brighter and dimmer in a rhythmic cycle, called a period. Some Cepheids have short periods of about one day and some, long ones of more than 50 days. Significantly, there is a precise relationship between the length of their period and their intrinsic brightness. The longer the period the brighter the star.

This relationship allows Cepheids to be used to measure distances. If two Cepheids have the same blink period and one appears to be four times brighter than the other, it is because it is only half as far away, according to the law of physics that light varies inversely with the square of the distance.

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