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NEW LASER-PUMPED MASER MAY CLOSE GAP IN SPECTRUM

Hughes Develops Tool for Space Communications, Probing Secrets of Matter

MALIBU, Cal., June 19 -- Discovery of a new way to invade the vast unprobed gap in the electromagnetic radiation spectrum between radio frequencies at 50 billion cycles and light at 50,000 billion cycles, laying open broad areas of communication previously unassailable, was claimed today by scientists of Hughes Aircraft Company.

Described as vital to accomplishing the feat is a laser-pumped maser which, while still in the experimental stage, has been successfully demonstrated in the Hughes Research Laboratories here, the company announced. (The word maser is an acronym for Microwave Amplification by Stimulated Emission of Radiation.)

The announcement recalled that man's first source of "coherent light," called a laser (for Light Amplification by Stimulated Emission of Radiation), was initially developed by the Hughes Research Laboratories and was announced on July 7, 1960. This breakthrough opened up the spectrum above 50,000 billion cycles but constituted a tremendous jump rather than a continuous progression from the previously useful communication limit in the microwave region.

The present discovery can now close the unexplored gap in the available spectrum, the scientists said.

(more)

Uses Two Ruby Gems

The accomplishment of the laser-pumped maser is described in the June 1 issue of Physical Review Letters in a paper entitled "Microwave Generation in Ruby Due to Population Inversion Produced by Optical Absorption," by Donald P. Devor, Irnee J. D'Haenens and Charles K. Asawa, scientists at the Hughes Lab who performed their experiments under a $100,000 one-year contract with the U. S. Army Signal Corps, Fort Monmouth, N. J. In this work, the scientists used the intense red light from a synthetic ruby laser to generate radiation at lower frequencies in a second ruby gem.

"The new 'laser-maser' technique promises to become the heart of future outer-space communications systems and to provide a new scientific tool for enabling man to investigate the secrets of matter," Dr. George F. Smith, manager of the laboratories' quantum physics department, said.

To Invade Gap

"Success in application to the expanding communications field now awaits only discovery of new materials or new combinations of old materials, which may now be confidently expected," Dr. Smith explained. "This development means that in principle there no longer are any fundamental limitations to invading the broad 8 or 10 octave gap, never before accessible, between microwaves and the infrared. The highest microwave frequency which can be generated coherently now, using klystrons, is about 200 Gc (1.5 millimeters), while the lowest laser frequency in the infrared is about 30,000 Gc (0.01 millimeters). The gap between has no coherent technology.

"The gap is still there, but with the laser-maser, man now has the technique that could help close the gap. Research can now go a little way into the millimeter wave regions with present materials like ruby, while at the same time the search continues for new materials which show the proper resonances and contain the proper spectroscopy,

or energy level structure, to bridge the entire spectrum gap," he said.

Has Space Uses

Dr. Smith listed the possible applications of a laser-maser operating in the microwave-infrared gap:

> 1. Space Communications. "A system in this frequency band would be ideal for communications in outer space where there is no atmosphere. It could enable the U. S. to get the maximum advantages out of its space communications for the money. Operating in the sub-millimeter wave regions, such a system could provide excellent communications between space probes and satellites, and provide high data rate communications between communications satellites. Highly directive antennas can be very compact at these frequencies, in contrast with mammoth dishes required at microwave frequencies."
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> 2. Scientific Investigations. "It could be a valuable new tool for learning more about matter. It is hard to predict what knowledge could accrue from such explorations; before we had microwave technology, we couldn't even dream of radar, for example."
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> 3. Military. "It has possible military application to communication and detection systems."

Follows Laser Breakthrough

"It is an interesting sidelight," Dr. Smith said, "that this optically-pumped maser represents a technique which the Hughes laboratory was seeking more than two years ago when its scientists achieved laser action and coherent light. When the efficiency of ruby in generating light was discovered to be 100 times better than anyone's estimates, the scientific effort here went full speed ahead on lasers. Now we have backtracked to find the optically-pumped maser which was one of our prime objectives in the first place."

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