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NEWEST HUGHES LASERS COVER WIDE SPECTRUM

Noble Gases Produce Laser Action At More Than 60 Wavelengths In Pulsed and CW Modes

MALIBU, Cal., May 12 -- Laser action at more than 60 new wavelengths has been observed in a new class of gas ion laser discovered by scientists of Hughes Aircraft Company.

Four gaseous elements -- argon, krypton, xenon and neon -- were used to achieve the laser action. The action occurred in both the singly and doubly-ionized state of these inert, or "noble," gases.

The laser oscillations were achieved in both pulsed and continuous-wave operation. Several of the new wavelengths had very high gain, and higher CW power was achieved with tubes that are more compact than previous types of gas lasers.

The new ion lasers cover a wide range of frequencies up to ultraviolet, thus opening up the entire visible portion of the spectrum to laser action. A majority of the newly-discovered color lines are in the blue-green portion of the spectrum.

The new lasers were reported by Dr. William B. Bridges, of Hughes Research Laboratories, who conducts gaseous laser research in the electron dynamics laboratory.

Dr. Malcolm R. Currie, associate director of the Research Laboratories, said that the discovery of the new lasers was an outgrowth of a broad-based program of

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both basic and applied research in gas lasers being conducted by Hughes. He noted that the company has been doing extensive research into the properties of laser-type gas discharges, including studies of electron energy distribution, as well as research into new applications for lasers.

In addition to the compactness of the laser tube, Dr. Currie noted that the chemical stability of the "noble" gases makes them highly practical as there is no reaction with the elements of the laser tube.

Peak power of the pulsed discharges was the order of 10 watts, limited only by the capability of the pulser used in the experiments, Dr. Currie said. Maximum repetition rate of the pulser was 2 KC. The laser output was steady during the entire span of the exciting pulse, which was variable from 0.5 to 7 μsec, with the exception of a short delay from the leading edge of the pulse on the weaker lines.

In the continuous-wave mode, the new lasers achieved a maximum output of 160 milliwatts, with a tube length of 10 inches. Measured gain was as high as 13 db/meter at 4880 angstroms.

As possible applications of the new laser, Dr. Currie cited underwater probing, communications, color displays and use as a laboratory instrument offering a new degree of wavelength freedom for research.

Dr. Bridges noted that the new lasers have an advantage over red lasers in their use with photoemissive devices. He pointed out that, for example, most currently used photomultipliers achieve their peak response in the blue-green portion of the spectrum and are relatively inefficient at red wavelengths.

In the case of each of the elements, oscillations at all of its wavelengths noted above could be achieved simultaneously. Dr. Bridges also noted that, by mixing two or three gases, he could observe the laser lines of all the gases present. He pointed out

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that this fact emphasizes the ability to use one laser tube to cover the entire spectrum.

First indications of the new laser action were revealed in a paper published by Dr. Bridges last month in Applied Physics Letters. The paper reported on the observation of pulsed discharges in argon, and at that time the possibilities of continuous wave operation were established. Further work by Dr. Bridges revealed laser action in singly-ionized krypton, xenon and neon.

Achievement of CW operations in argon, krypton and xenon is disclosed in a paper being published in the May 15 issue of Applied Physics Letters, co-authored by Dr. Bridges and E. I. Gordon and E. F. Labuda of Bell Telephone Laboratories, Inc.

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