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NASA TECH BRIEF

Thermal Tuning of Organic Dye Laser

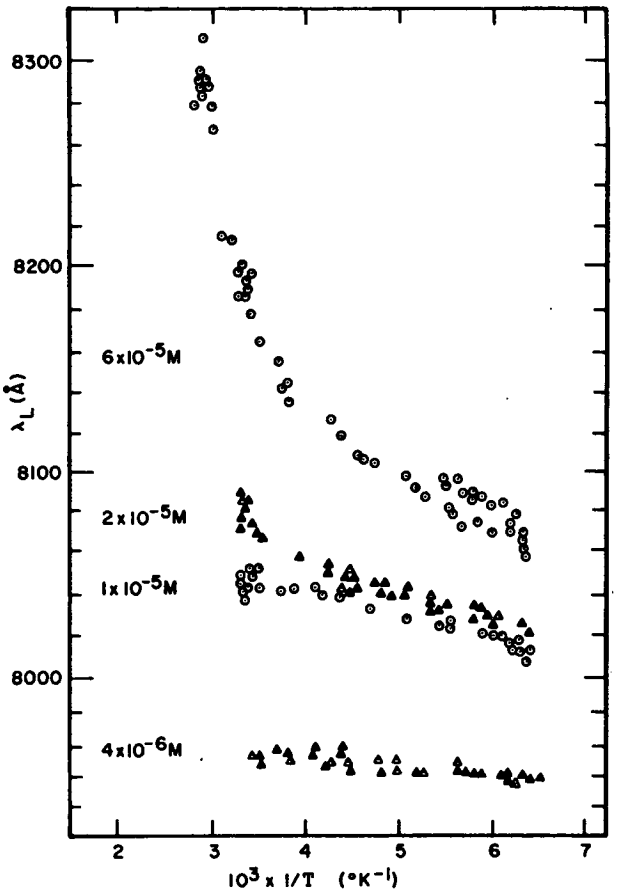

Figure 1. Center Lasing Frequency as a Function of Temperature for Four Dye Concentrations

A new, non-mechanical method for tuning liquid laser wavelengths replaces previous mechanical procedures such as varying the cavity Q or the nature or concentration of the lasing medium. The new method electrically varies the temperature of the lasing medium.

The wavelength spectrum of an organic-dye laser (3,3'-diethylthiatricarbocyanine at various concentrations in ethanol), contained in a liquid nitrogen cooled dewar and longitudinally pumped by a Q-switched ruby laser, was measured as a function

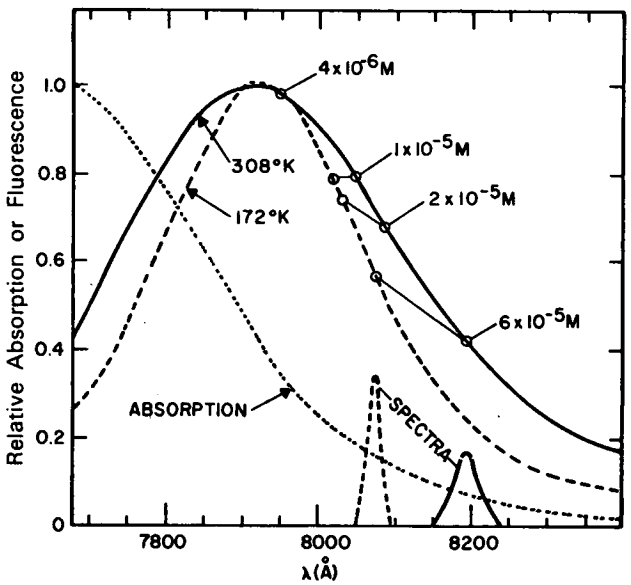

Figure 2. Measured Absorption and Fluorescence Spectra. The circles indicate lasing wavelengths at different concentrations. Below two such points are shown typical spectra recorded for a 6 × 10^{-6}M solution and plotted on an identical intensity scale for the temperatures 172° and 308°K.

of temperature between −117° and 78°C (Fig. 1). The results were in qualitative agreement with the model of a vibrationally broadened two-level system, each level being separately thermalized. The absorp-

(continued overleaf)

tion and fluorescence spectra appear in Figure 2.

The conversion efficiency (the ratio of output power to pump power) of this dye laser can be increased by lowering the temperature. For example, an increase by a factor of 3 can be produced by a temperature change of from +20° to −60°C.

The method may be used for investigating the behavior of laser dyes, and may lead to a broad, tunable, light source for spectroscopic applications, especially for measurements of long-path absorption.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Headquarters
National Aeronautics
and Space Administration
Washington, DC. 20546
Reference: TSP70-10480

Patent status:

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