

# Liquid Characterization Using Visible Light Lasers

Colette M. Szabo-Long, Jacob D. Gayles, Can Sun, Jason W. Fleischer

Department of Electrical Engineering, Princeton, NJ 08544, U.S.A.

Email: [cszabo@princeton.edu](mailto:cszabo@princeton.edu)

Nonlinear optics is an important branch of modern optics that describes the properties of media when acted on by an intense light, such as a laser. Under these conditions, the optical properties of nonlinear mediums, unlike linear materials, become functions of the intensity of the lights. Nonlinear materials are important in many fields including electronics and communications. The motivation for this study was to provide information on a nonlinear liquid to be used in future experiments. In this study, a visible light laser was used to measure the nonlinear properties of a thermal liquid. The liquid characterized was a solution of iodine and ethyl alcohol where the iodine worked to absorb the green light, while the ethyl alcohol allowed the liquid to heat quickly. Characteristics of the liquid found were base refractive index, absorption, nonlinear change in index, nonlocal response and nonlinear diffraction.

A 532 nm solid state laser was used for this experiment. The nonlocal width of the beam was first found by measuring the spread of the beam as the liquid was heated by the laser over a period of time as seen in Fig. 1A. Green and red light lasers were also used to find the nonlocal width. The green light created a potential in the medium, and the red light was measured to find the width. Convection was also found by using a camera to monitor the liquid as it heated up. Fig. 1B shows the measured nonlinear diffraction that was created by the interference of a plane wave and a Gaussian beam. Green and red light lasers were used again to find the nonlinear change in index.

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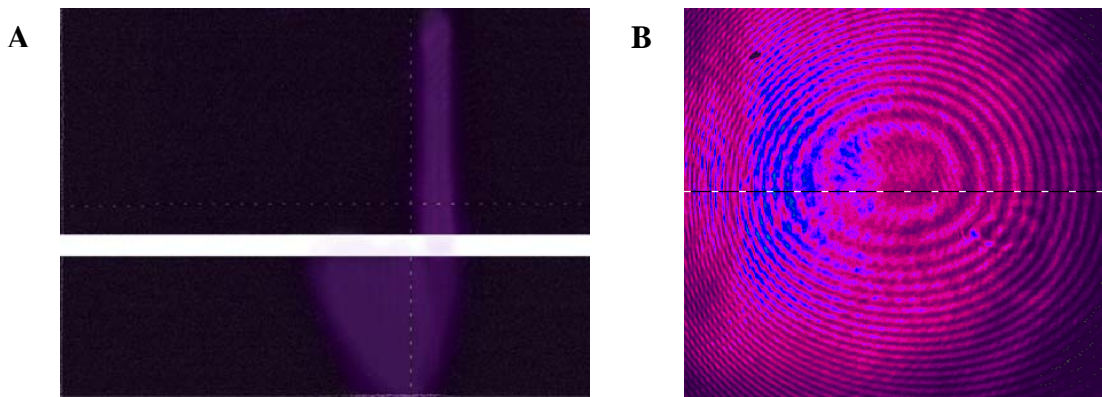


Fig. 1 (A) The spreading of a high intensity beam at .10 watts (top) and 2.2 watts (bottom) as it passes through the nonlinear liquid. (B) Nonlinear diffraction caused by the interference of high and low intensity beams in the nonlinear liquid.