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# NONLINEARITIES OF A BRAKE FLUID USING LOW VISIBLE LASER BEAM

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**Abstract**

A number of diffraction rings were observed when a continuous wave laser light beam from a solid laser passed through the brake fluid. The effect of incident intensity on number and size of diffraction rings are reported. The nonlinear refractive index at the wavelength of 473 nm by diffraction rings and Z-scan techniques are determined. The results obtained from self-diffraction rings and Z-scan method are compared. The results showed that the brake fluid has large nonlinear refractive index. The optical limiting properties of the brake fluid were investigated. The optical limiting mechanism for sample is given.

*Key words*: Spatial self-phase modulation, Diffraction ring pattern, Z-scan, Nonlinear refractive index.
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## 1. Introduction

The search for obtaining new materials to be used in different applications viz., all optical switches, optical computing, optical data storage, optical communications, optical phase conjugation, optical limiting, all optical processing, etc. [1-28] is an going matter. These materials have to have high nonlinear refractive indexes and responds in short times. The present authors have published recently series of papers studying the nonlinearities of vegetable oils [29,30] and metal oils [31,32]. The most simple and accurate methods used to evaluate the change in refractive index and nonlinear refractive indexes of different materials are the diffraction ring patterns [33-,34] and the Z-scan [35,36]. In this work the results of experiments conducted on a brake fluid concerning the evaluation of the change in refractive index of this material and its nonlinear refractive index using the diffraction ring pattern technique and the Z-scan's using visible low power single transvers, $TEM_{00}$, mode laser beam at 473 nm. The transmission technique was used to measure the optical limiting response at the same wavelength.

## 2. Experimental

### 2.1 UV-visible spectroscopy to measure absorption coefficient,α

To obtain the linear absorption coefficient,α, of the brake fluid type Dexron-VI obtained from ACDelco at room temperature the absorbance, A, of the brake fluid in a quartz 1 mm thickness cell using a Jenway-England-6800 UV- visible spectrophotometer is measured. The result of the variation of absorbance, A, against wavelength in the 350- 900 nm range is shown in Fig.(1). With the aid of Fig.(1) and the following relation [37]