Self –Focusing and Self- Trapping of Continuous Wave Light in Neutral Red

ISSN –1817 –2695

C. A. Emshary and H.A. Badran

Physics department, Education College, Basrah University, Basrah, Iraq

((Received 25/1/2010 , Accepted 23/3/2010))

Abstract :

We demonstrate experimentally that optical beam using CW low power (7)mWatt 6328 A^0 laser beam is self-focused upon passing through organic dye cells (Neutral Red (3- amino-7-dimethylamino-2-methyl phenazine))

Keywords: Neutral red ; self- focusing ; self- trapping

Introduction:

The nonlinear interaction of laser light with different and enormous media has been of intense interest since the advent of laser from theoretical and experimental points of view [1,2] .One of the simplest nonlinear effects that can occur for a laser beam with transverse variation is the self focusing or filamentation instability .The self focusing of light in matter has long been studied , as it was one of the earliest nonlinear optical effects to be observed [3] and studied theoretically [4] since then it has been investigated in connection with the interaction of laser light with many types of solids[5] liquids [6] and gases[7] .Self –focusing is still under continuous considerations [8].

In this paper, we present the results of our observation of CW self –focusing and self trapping of a laser beam in the organic chromophore, neutral red (NR) under CW 6328A^0 laser beam produced by a solid state laser. NR (3- amino-7-dimethylamino-2-methyl phenazine); molecular structure shown in Figure (1) is a low – cost organic dye which finds many applications in biology [9] .

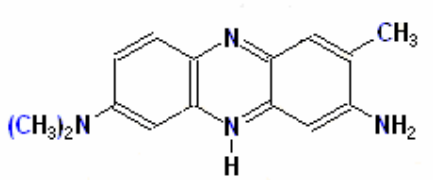

Figure (1) Molecular structure of neutral red dye molecule

The Self Focusing Process:

The details of the self –focusing effect due to an intensity dependent increase in index of refraction have been treated long ago by Kelley [10] .In the following we will give the nice picture of self focusing process given by Javan and Kelley [11] : An increase in the index of refraction with the intensity of light beam produces a decrease in phase velocity in the regions where the beam is most intense .Thus as the beam propagates the equiphase surface becomes more and more concave in the intense regions .From Huggens principle ,therefore ,the rays should move toward the region of light intensity and the intensity of the center should increase .This of course is just the opposite of what occurs in normal light diffraction .

It was predicted [10] that a light beam may be first self- trapped at any diameter and thus will not be spread. This self trapping occurs at a critical