characterize O_3, SO_2, and H_2O overtone spectra.[5]

Oscillator and rotor eigensolutions are obtained approximately using a novel graphical "color quantization" technique.[7] This is accomplished by plotting each trajectory using a color that varies through the chromatic spectrum with each revolution of a classical action phasor. When classical variables satisfy quantization conditions, the trajectory pattern will exhibit a superimposed coherent color pattern that is the Hamilton-Jacobi outline of a semiclassical eigenfunction. It is only necessary to tune initial conditions or energy values until the desired color wavefunction appears. Then animation of the computer's color palette causes the wavefronts to move like solutions to the time-dependent Schrodinger equation. This technique may also be applicable to solutions by the method of characteristics for optical wave cavities and guides.

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Nonlinear Chinese tea

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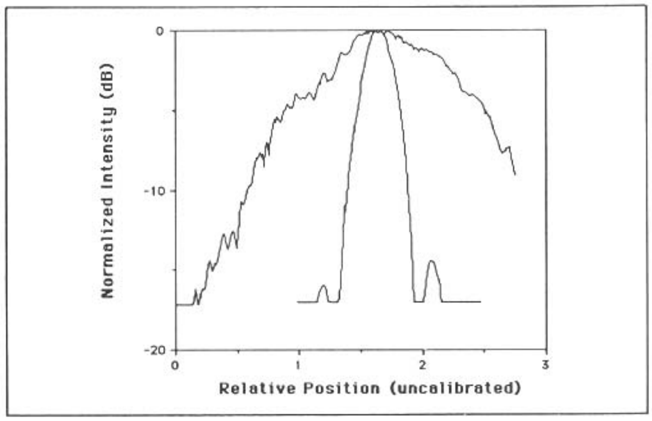
In a recent report,[1] Hong-Jun Zhang and co-workers from the Institute of Physics, Chinese Academy of Sciences, report on strong nonlinear Kerr effects in Chinese tea, herbal medicine, and solutions of chlorophyll. They describe observation of self-focusing and self-phase modulation at powers around 5 mw, using a He-Ne laser. Their observed time constant is of the order of 100 msec and they calculate a nonlinear Kerr coefficient of about 3×10^{-5} e.s.u. Their solution is contained in a sample cell of 10 mm length. Illumination is by means of a 2 mm laser beam focused by a 30 mm lens into the cell.

One of their most remarkable effects is the appearance of a ring pattern observed 100 mm from the focal point with the latter somewhere in the middle of the cell. When the focal point is moved to the far edge, they observe a small spot that they describe as a self-trapped beam. With the focal point moved to the near end of the cell, they find a very large spot explained as the result of defocusing by heating effects.



Because of the importance of studying nonlinear effects with low power lasers, we repeated the experiment and observed substantially the same phenomena. In our experiment, we used a He-Ne laser with a $1/e^2$ diameter of 0.82 mm focused by a 25 mm objective into a 10×10 mm polystyrene cuvette filled with a solution of chlorophyll in ethyl alcohol. As a base material, we used chlorophyll tablets from a local health food store. The solution was filtered and diluted until it had a pale green color and an absorption coefficient for the focused light of about 10 db/cm. We observed the resulting pattern in the far field approximately 2.14 m away from the cuvette.

Typical intensity traces are shown in the figure. The narrow curve with two rings visible refers to 4.5 mW of light focused in the cell, with the position of the focus adjusted for good ring visibility. The rings are separated by 2.4 cm. The broad curve refers to the same experiment with alcohol only. Attenuating the laser beam by 6 db prior to focusing into the chlorophyll solution resulted in a very large spot without rings, too weak to record, but visibly of about the same size and appearance as the one shown.

Our more recent preliminary experiments indicate that n_2, as measured with the Z-scan method,[2] is actually negative. We therefore suspected that the basic effect was due to heating and that perhaps any absorbing substance mixed with alcohol might work. Subsequently, we found that ink dissolved in alcohol works indeed as well as chlorophyll and that other solvents, such as acetone and water, appear to exhibit the effect in rough proportion to their thermal expansion coefficients. Moreover, patterns observed at various distances exhibit radial asymmetry and sometimes quite complex, bilateral symmetry (see cover). We suspect that this may be due to thermal gradients and/or convection currents.[3]

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