TITLE: Two - Photon Microscopy

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The two photon absorption transition of the dipolar molecules Dandy (a fluorescence ten level molecule), Rhodamine B and Rhodamine 6g were explored in its application to microscopy. Expressions for the excited state population, the excitation rate and the cross sections of these molecules have been evaluated using second-order time-dependent perturbation theory. The simultaneous absorption of two photons takes place via the use of a linearly circular polarized femtosecond mode-locked Ti^{3+}:Al_2O_3 sapphire laser. The two excitation mechanisms involved in the process are the permanent dipole and the virtual state mechanism. Perturbation-theory expressions for the cross sections were used to demonstrate these mechanisms. The two mechanisms together with the laser-molecule, interaction time and laser intensity have been analyzed for the enhancement of absorption. The results are significant to the present application of two photon microscopy and to the study of future multi-photon applications in biological, chemical and scientific fields.