High resolution non-linear laser spectroscopy of CH4 and H2CO in an external cell configuration

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Abstrak

The basic principles for the development of laser, an acronym for: light amplification by stimulated emission of radiation, can be traced back to the paper written by Einstein in 1916 when he considered interaction of radiation and matter. In this paper Einstein predicted the existence of stimulated emission and' calculated the probability of its occurence. However, at thermal equilibrium the probability of absorption is larger than stimulated emission therefore the net effect is that light is always absorbed. The stimulated emission can be observed when some population inversion is generated in the material. In order to induce inverted population, one needs to have a proper understanding of the energy level scheme of the material. As a number of atomic or molecular spectra were successfully elucidated by workers in microwave spcectroscopy, the possibility of microwave amplification using stimulated emission from a system of inverted population became a subject of serious investigation. Experimentally the first operation of this amplifier was demonstrated by Townes et.al using amonia molecular beam. The name laser, acronym for: microwave amplification by stimulated emission of radiation, was proposed by this group.
In 1958, Schawlow and Townes considered the feasibility of maser action at optical frequencies. In 1960, Maiman succeeded in operating a pulse ruby laser, while Sorokin et.al,demonstrated the infrared pulsed oscilla-Lion using a CaF2 crystal. The first continuous wave laser announced in 1961 by Javan et. Al. Since then, the development of laser progressed rapidly. At present laser oscillation can be obtained in a number of materials such as gas, solid state, semi-conductor, liquid (organic dye) and others. The oscillation wave length of these lasers covers the range from vacuum ultraviolet to far-infrared radiation. Table 1.1. shows the historical sketch of laser developments.
The application of lasers covers a wide area of scientific and technological activities and taking advantages of laser a number of novel techniques have been developed in modern science and engineering. The application of laser may be divided into four categories as shown in Table 1.2 T based on the characteristics of laser radiation. The first is the use of energy density with typical examples in material processing and heating. The second is in the use of spatial characteristics of laser which is highly directional. Interferometric measurement and holography are examples in this category.