LASER SPECTROSCOPIC STUDY OF CaH IN THE $B^2\Sigma^+$ AND $D^2\Sigma^+$ STATES

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Calcium hydride is one of the abundant molecules in the stellar environment, and is considered as a probe of stellar analysis[a]. Ab initio calculations have shown that the electronic excited states of CaH have complex potential curves. It is suggested that the $B^2\Sigma^+$ state has an interesting double minimum potential due to the avoided crossing[b]. Such a potential leads to drastic change of the rotational constants when the vibrational energy level goes across the potential barrier. Spectroscopic studies on CaH began in the 1920's[c], and many studies have been carried out since then. Bell et al. extensively assigned the $D^2\Sigma^+-X^2\Sigma^+$ bands in the UV region[d]. Bernath's group has observed transitions in the IR and visible regions and identified their upper states as the $A^2\Sigma^+$, $B^2\Sigma^+$ and $E^2\Sigma^+$ states[efgh]. We have carried out a laser induced fluorescence (LIF) study in the UV region between 360 and 430 nm. We have produced CaH by using laser ablation of a calcium target in a hydrogen gas environment, then molecules have been excited by a second harmonic pulse of dye laser and the fluorescence from molecules have been detected through a monochromator. Detection of the $D^2\Sigma^+$-$X^2\Sigma^+$ bands already identified by Bell et al. indicates the production of CaH. In addition, many other bands have been also found and a few bands have been assigned by using the combination differences, the lower state of these bands have been confirmed to the vibrational ground state of $X^2\Sigma^+$ state. We have tentatively assigned these bands as the $B^2\Sigma^+-X^2\Sigma^+$ transition. We will discuss the assignment of these bands, together with the rotational constants comparing with those calculated from the ab initio potential.

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