Laser spectroscopic study of the B/B' $^2\sum^+$ v=9, 10, 11 and 18 levels of CaH

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Spectroscopic studies on Calcium monohydride (CaH) have been carried out for long time. It was 1908 that electric transitions of CaH were observed for the first time through solar observations [1]. The first laboratory spectroscopy is the $C^2\Sigma^+$ - $X^2\Sigma^+$ transitions in near-UV region in 1925 [2]. Despite the long history of study of this molecule, the discrepancy exists between the experimental and theoretical analysis in higher vibrational levels of the second excited the B/B'$^2\sum^+$ state. The B/B'$^2\sum^+$ state is formed by the avoided crossing with the D state, resulting in a double minimum potential energy function[3]. Then there are strong perturbations between the B/B'$^2\sum^+$ and the $D^2\Sigma^+$ states. We have observed electric rotationa-vibrational transition of the B/B'$^2\Sigma^+$ - $X^2\Sigma^+$ above the double-minimum potential energy for experimentally elucidating the perturbation between the B/B'$^2\sum^+$ and the $D^2\Sigma^+$, for the general knowledge of molecule structure.

We observed four vibrational levels and attributed them to the B/B' $^2\Sigma^+$ (v=12, 13, 14 and 16) - $X^2\Sigma^+$ transitions, and five levels which had been previously miss assigned to the D state reassigned to the B/B' state [4]. In additional to this, we recently observed the B/B' (v=9, 10, 11, 18) levels. Then we observed unusual behaviors of vibrational structure, rotational structure and line intensity as follows;

- The vibrational spacing energy have oscillation pattern for higher vibraional levels.
- O－C value for some rotational line are much larger than RMS value
- Line intensity: Low J rotational transition lines even vibrational states in the B/B' state is weak and especially the J=0→1 transition lines are completely missing

We consider that there should be perturbation with some other electric states. In this talk, we report assignments of new four vibrational levels and discuss the perturbation.

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