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Cross sections for the formation of H(2p) atom via doubly excited states in photoexcitation of para-H_2

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1 Introduction

Formation and decay of doubly excited states of H_2 has been theoretically and experimentally investigated [1,2]. Recently, it was found that the non-adiabatic transition would play a role in the dissociation of the $Q_2\,^1\Pi_u$ doubly excited states of H_2 and D_2 [3,4]. In the present study, we measured cross sections for the formation of H(2p) atom in photoexcitation of para-H_2 in the lowest rotational level, $J'' = 0$, for obtaining detailed information against the non-adiabatic transition. Only the $^1\Pi_u^+$ states as well as the $^1\Sigma_u^+$ states can be populated in photoexcitation from the $J'' = 0$ rotational level, while all the dipole allowed states ($^1\Pi_u^\pm$ and $^1\Sigma_u^+$) can be formed in photoexcitation of ordinary-H_2 at room temperature. It is thus expected that the cross section for the rotationally cold H_2 could be different from those for ordinary-H_2 since the $^1\Pi_u^\pm$ states interact with the $^1\Sigma_u^+$ states differently due to the Kronig's selection rule [5].

2 Experiment

Linearly polarized light from BL20A beam line was introduced into the gas cell filled with H_2. A gas of H_2 in the lowest rotational level was obtained by a cryogenic ortho-para hydrogen converter. The gas cell was kept at approximately -186℃ by using liquid-N_2 during the measurement. The rotational distribution in the sample was checked through measuring high-resolution photo-ion yield spectra. The Lyman-α photon emitted from the H(2p) atom produced through photoexcitation of H_2 were detected.

3 Results and Discussion

Figure 1 shows the cross sections for the formation of H(2p) atom for para-H_2 in the lowest rotational level, $J'' = 0$. The shape of the cross section curve agrees with that for ordinary-H_2 at room temperature within the statistical uncertainty.

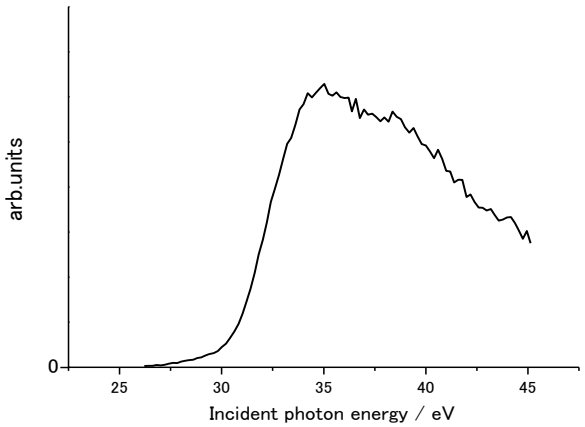

Figure 1. Cross sections for the formation of H(2p) atom in photoexcitation of H_2 in the lowest rotational level

References

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