Inelastic squared form factors of the valence-shell excitations of molecular deuterium studied by high-energy electron scattering

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Synopsis Utilizing the high-energy electron scattering technique at 1500 eV with an energy resolution of 60 meV and relative flow technique, absolute inelastic squared form factors of four vibronic series belonging to the $B^1\Sigma_u^+$, $C^1\Pi_u$, $EF^1\Sigma_g^+$ and $B'^1\Sigma_u^+$ electronic states of molecular deuterium have been determined experimentally.

As an isotope of hydrogen, the dynamic parameters such as the photoabsorption cross sections, inelastic squared form factors (ISFFs) and integral cross sections of the valence-shell excitations of molecular deuterium are of great importance and have wide applications in diverse fields such as astrophysics and plasmas physics. Since ISFF is directly related to the wave functions of the ground and excited states in the momentum space, it can reveal the electronic structure of atoms and molecules.

Recently the ISFFs of D_2 have been measured by high energy electron energy loss spectroscopy (EELS) at an incident electron energy of 1500 eV and an energy resolution of 60 meV. The relative flow technique have been used to absolutize the ISFFs of D_2 by referencing to the ISFF of the 2^1P state of He. A typical spectrum of D_2 at a scattering angle of 1.5° is shown in Fig.1, and the experimental ISFFs of some vibronic excitations of $B^1\Sigma_u^+$ of D_2 are shown in Fig.2. To the best of our knowledge, there is no other investigation for comparison.

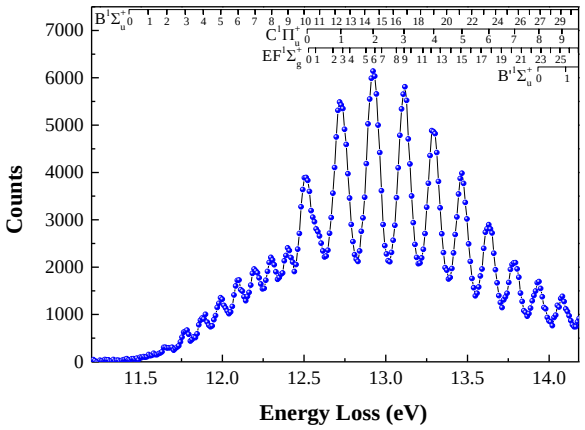

Figure 1. A typical electron energy loss spectrum of D_2 at the scattering angle of 1.5°.

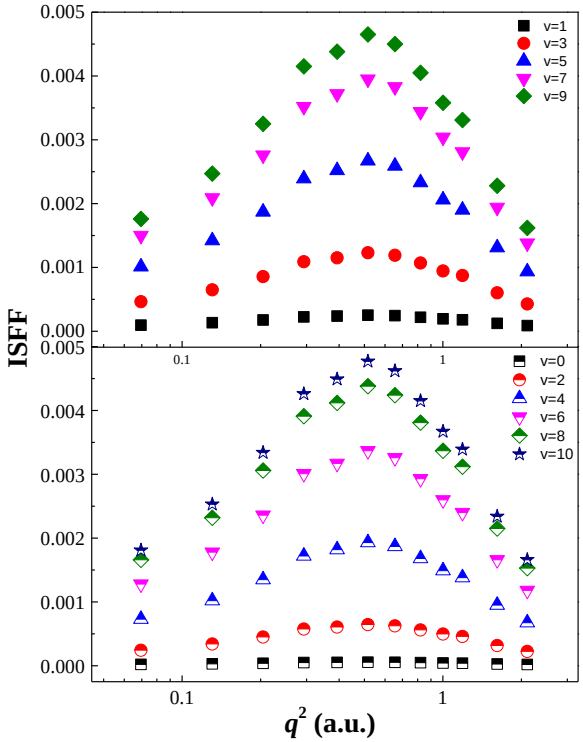

Figure 2. The ISFFs of some vibronic excitations of $B^1\Sigma_u^+$ of D_2.

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