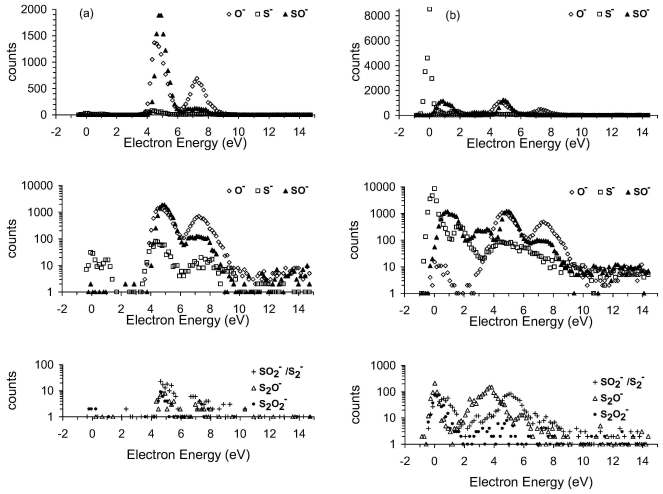
Electron interaction with radicals; experimental observation of dissociative electron attachment to S_2O and S_2O_2

T A Field, A E Slattery, D J Adams, and D D Morrison
Department of Physics and Astronomy, Queen's University, Belfast, BT7 1NN, U.K.



I. INTRODUCTION

Dissociative electron attachment (DEA) is a fundamental molecular fragmentation process and a major process in plasmas, electrical breakdown phenomena, combustion, the upper atmosphere and many other situations where there is a high density of free electrons. These are all environments where unstable free radicals have a crucial impact on the overall chemistry, but few studies of electron attachment to unstable molecules have been reported although many studies of stable molecules and clusters have been reported, *see e.g.* [1, 2]. It appears that DEA has only been observed experimentally to stable free radicals, such as NO [3], or partially stable ones, such as OClO [4, 5]. The experimental results for OClO are in agreement with theoretical calculations [6]. Theory has also been used to calculate the scattering of low energy electrons by free radicals such as ClO, CF, CF_2 and CF_3 [7–10] for which there are no experimental data. Electron attachment to excited states, such as SO_2 in the $\tilde{B}\ ^1B_1$ state [11, 12], and some exotic species, such as S_2 [13] and Na_2 [14], has been observed experimentally. In this work a new spectrometer has been developed to study DEA to unstable molecular species such as free radicals; first results have been presented for S_2O and S_2O_2 [15].

II. RESULTS

The figure shows DEA spectra gathered for a mixture of He and SO_2 with the microwave discharge off, (a), and on, (b), with linear and logarithmic vertical scales. The results with the discharge off are consistent with previous measurements of dissociative electron attachment to sulphur dioxide, see *e.g.* [12, 16–18]. Several new resonances are observed with the discharge on, which have been assigned to the radicals S_2O and S_2O_2 [15].

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