

### 1.9 On the temperature dependence of dissociative attachment in O<sub>2</sub>

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#### *Abstract*

The temperature dependence of dissociative attachment of electrons on oxygen molecules is studied in the framework of the theory of Dubrovski, Janev and Ob'edkov for such processes. Using the recent experimental results of Henderson, Fite and Brackmann the real part of the complex potential curve of the quasistationary  $^2\Pi_u$  state of O<sub>2</sub> ion is obtained. This curve is quite different in respect to that obtained by O'Malley, using another formulation of the dissociative attachment theory. The cross sections of the studied process are calculated for temperatures of 300 K, 1030 K and 1940 K. The agreement with the experimental data is good.

### 1.10 High resolution studies of electron excitation functions in helium

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A hemispherical electron energy monochromator has been used for the measurement of some excitation functions in helium in the vicinity of the threshold. An electron beam of variable energy spread, from 35 meV to 15 meV, and current  $(5 - 1) \times 10^{-8}$  A was directed through the gas at a pressure of  $2 \times 10^{-3}$  torr. The resultant radiation is viewed at right angles to the electron beam with a Hilger E612 Raman Spectrograph and is detected with an E. M. I. 6256S photomultiplier cooled to  $-30^\circ\text{C}$ . A Victoreen P. I. P. 400 multi-channel analyser is used in the multi scale mode to collect the photomultiplier signal in the channel appropriate to the collision chamber potential and to drive the potential on the collision chamber.

In all the results presented the voltage step height is 10 mV and the energy range is either 1 or 2 eV. The duration of an experiment varies from fifteen hours to seventy two hours, the dwell time per channel being in most cases one second. As the duration of an experiment is considerable there was some concern over the stability of the energy scale; this was checked by monitoring a particular point on an excitation function at five minute intervals over a period of twenty four hours. The experiment could detect a drift of less than 2 mV in five minutes.

The accompanying figures show the  $4^1\text{S}$ ,  $4^3\text{S}$ ,  $4^1\text{D}$ ,  $4^3\text{D}$ ,  $3^3\text{D}$  and  $3^3\text{S}$  excitation functions in He uncorrected for polarization, on what we consider to be an absolute energy scale correct to  $\pm 10$  meV. The applied energy resolution is 20 meV and the beam current  $2 \times 10^{-8}$  A.

The  $4^1\text{S}$  and  $4^3\text{S}$  channels show complete correlation in their resonant structure, the energies of the feature marked 1–6 in  $4^3\text{S}$  and 1–5 in  $4^1\text{S}$  being computed from six separate runs of each function, the quoted error is the r. m. s. deviation. There is strong correlation between structure observed in the  $4^1\text{D}$ ,  $4^3\text{D}$  and  $3^3\text{D}$  channels, but much weaker correlation between D and S channels; the feature at 23.915 eV being common to all.