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INELASTIC ELECTRON SCATTERING BY H_2S*

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Utilising the crossed electron-beam molecular-beam scattering technique electron energy-loss spectra covering the energy region from 5 eV to 11 eV were obtained. Incident electrons of 20 eV energy were used. The energy resolution of the system was about 50 meV. Typical spectra are shown in Figs. 1 and 2, for 5° and 31.5° scattering angles, respectively.

We compare our data with photon absorption spectra[1,2,3,4] where several Rydberg series were assembled. Theoretical predictions[5] for transitions to singlet and triplet excited electronic states of the hydrogen sulphide molecule have been used as a guide for the interpretation of our results. On Table 1 the states from the figures are listed and their assignment proposed.
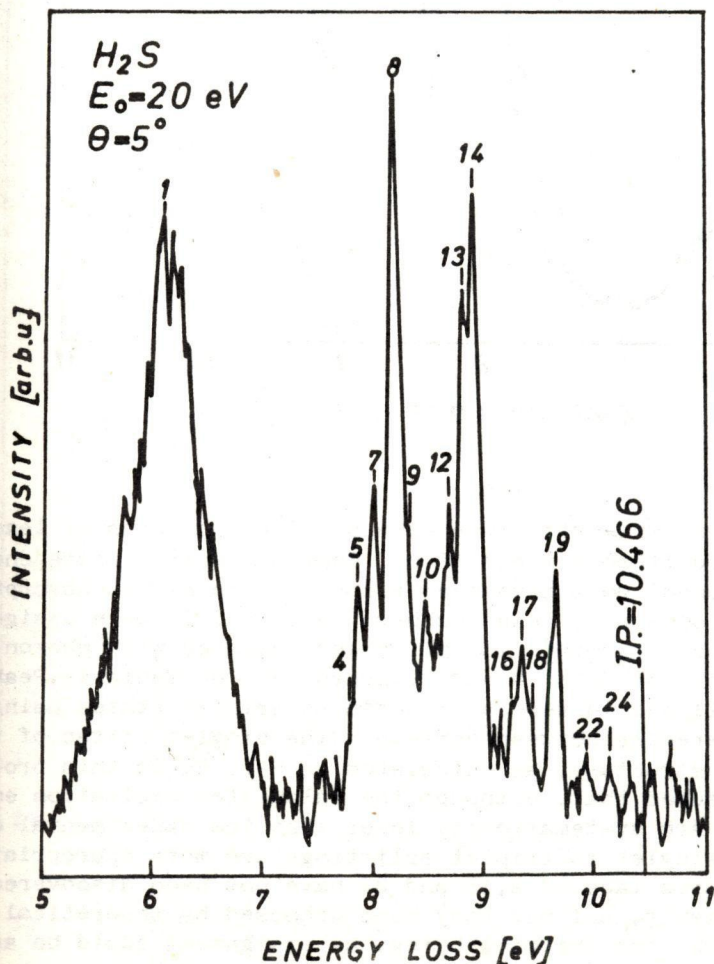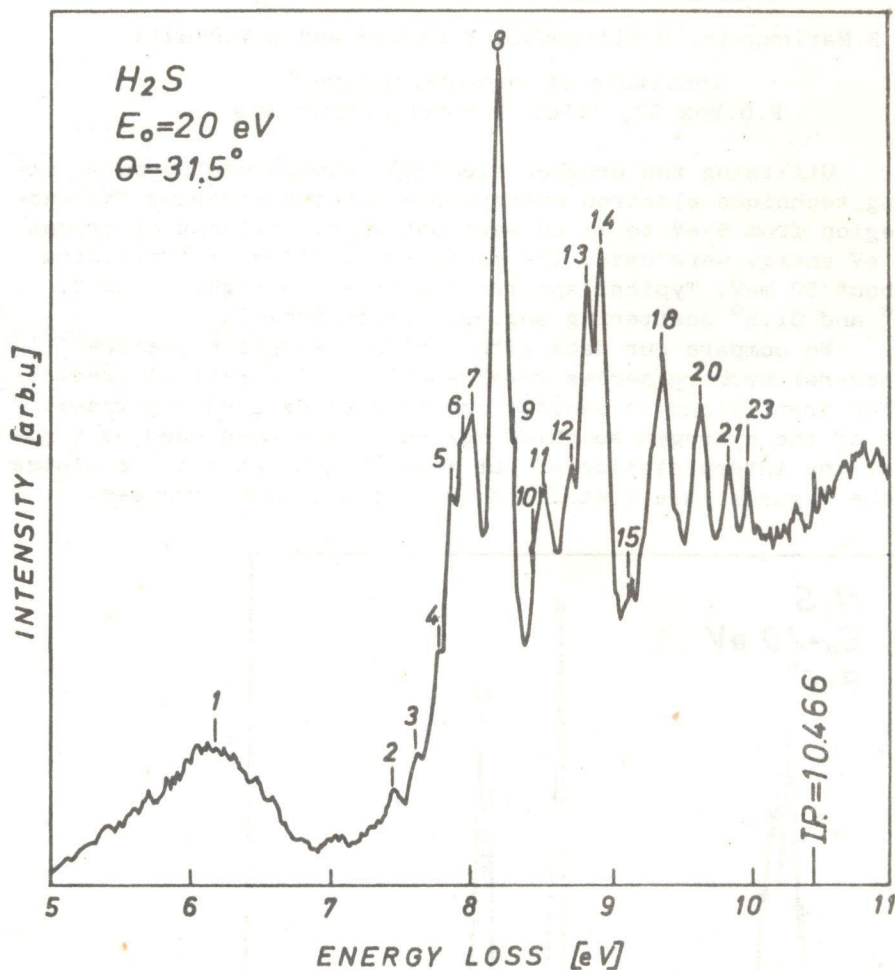

Fig. 1

Fig. 2

The first wide structure around 6.2 eV contains at least five unresolved different transitions. Most of excited state energies of the present work have been associated to photon absorption data, mainly of Ref.3. Peaks number 7,9,12 and 14 were assigned by theoretical arguments in Ref. 5 and compared with photon absorption spectra of Refs. 1 and 2(marked by + on Table 1).Peaks number 3,4,6,7,11 and 14 were attributed to triplet states using the energy differences between corresponding singlet states of the same electronic structure, as calculated in Ref. 5. In this procedure it is assumed that, although the calculated excitation energies of states are systematically lower than the experimental ones, the calculated singlet to triplet splittings are more appropriate.

Structures labeled 2,15 and 23 have not been discovered in previous experiments, neither they been proposed by theoretical calculation. Thus, for the time being, no assignment could be associated with these states.

Table 1

Line number	Excited state energy [eV]		Tentative assignment	
	Present work	Apsorption data	State	Description
1	6.2	6.045 6.184 6.326 6.471 6.616 }	$^1B_1$	$2b_1 \rightarrow 4sa_1$
2	7.46			
3	7.63		$^3B_1$	$2b_1 \rightarrow 3da_1 + h + 4s$
4	7.80**		$^3A_1$	$2b_1 \rightarrow 4px$
5	7.87	7.851	$^1A_2$	$2b_1 \rightarrow 4pb_2$
6	7.96**		$^3B_1$	$2b_1 \rightarrow 4pz$
7	8.02	8.026	$^1A_1$	$2b_1 \rightarrow 4pb_1$
		8.02 +	$^1B_1$	$2b_1 \rightarrow 4pz$
			$^3A_1$	$2b_1 \rightarrow 4py$
8	8.20	8.181	$^1A_1$	$2b_1 \rightarrow 4py$
		8.193 8.217 }	$^1A_1$	$2b_1 \rightarrow 4p$
9	8.30**	8.26 +	$^1B_1$	$2b_1 \rightarrow 3da_1 + h + 4s$
		8.272 8.284 8.324 }	$^1B_1$	$2b_1 \rightarrow 4pa_1$
10	8.44	8.464	$^1A_2$	$2b_1 \rightarrow 3db_2$
11	8.50		$^3B_{1,2}$	$2b_1 \rightarrow 4d$
			$^3A_{1,2}$	$2b_1 \rightarrow 4d$
12	8.68	8.66 +	$^1B_{1,2}$	$2b_1 \rightarrow 4d$
			$^1A_{1,2}$	$2b_1 \rightarrow 4d$

13	8.82	8.800	$^1B_2$	$2b_1 \rightarrow 3da_2$
		8.810	$^1A_1$	$2b_1 \rightarrow 3db_1$
14	8.92	8.91 +	$^{3,1}B_1$	$2b_1 \rightarrow 5s$
		8.914 $\Big\}$	$^1B_1$	$2b_1 \rightarrow 3d$
		8.926		
15	9.14			
16	9.27	9.275	$^1A_1$	$2b_1 \rightarrow 5pb_1$
17	9.32	9.303 $\Big\}$		
		9.315	$^1B_1$	$2b_1 \rightarrow 5pa_1$
		9.326		
18	9.37	9.361	$^1A_2$	$2b_1 \rightarrow 4db_2$
19	9.57	9.548	$^1A_1$	$2b_1 \rightarrow 4db_1$
20	9.64	9.614	$^1B_1$	$2b_1 \rightarrow 4d$
21	9.84	9.846	$^1B_1$	$2b_1 \rightarrow 4da_2$
22	9.92	9.919	$^1B_1$	$2b_1 \rightarrow 5d$
23	9.97			
24	10.08	10.087	$^1B_1$	$2b_1 \rightarrow 6d$

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