TABLE II. *Change in E predicted by Eq. (2).*

$(H+H_p)$M H_2O	$-\frac{d \ln N}{d \sec \vartheta}-1$	Increase of E by Formula (2)
10.1	0.89	—
19.4	1.09	$\sim -20\%$
25.2	1.00	$\sim -15\%$

also been found by experiment. There were no other assumptions made to find formula (2), except for the constancy of c, τ_0, m. As we have sufficient proof that c and τ_0 are constants, our results may point to the existence of mesotron particles of different mass. The average mass has to be assumed to increase at least 30 percent, in order that formula (2) should yield the measured increase of energy when about 10 m absorbing mass is added.

I am indebted to Professor W. Kolhoerster for his interest in this work, part of which has been carried on at the Institut für Hoehenstrahlenforschung of the University of Berlin, Germany.

PAUL WEISZ

Cullman, Alabama,
May 7, 1939.

[1] P. Weisz, Naturwiss. **27**, 132 (1939).
[2] In the first publication (reference 1), H_f was falsely assumed as $0.9H$ instead of about $2.4H$ because of the pressure distribution in the earth's atmosphere. Then, L will be found as about 24 km (behind about 10mH$_2$O additional absorber).
[3] E. Brackertz, doctor's thesis, University of Berlin, Germany (1936).
[4] P. M. S. Blackett, Nature **142**, 992 (1938).

Collision Cross Sections of K Atoms and K_2 Molecules in Gases*

Measurements of effective collision cross sections are here reported for the neutral potassium atom, K, and for the neutral potassium molecule, K_2, scattered in hydrogen, in deuterium, in helium, in argon and in nitrogen. A molecular beam method has made it possible to measure the effective collision cross sections of the K atom and the K_2 molecule under identical conditions.

A beam of neutral potassium, the source of which is an oven at a temperature of approximately 500°K, is predominantly composed of K atoms, but is found to contain a small number of K_2 molecules. The molecules are sorted from the atoms by utilizing the fact that the K atom possesses a much larger magnetic moment than the K_2 molecule. The beam is passed through a strong magnetic field the gradient of which is sufficiently high to deflect the atoms completely out of the beam, while the K_2 molecules suffer no appreciable deflection.

The beam is scattered by a gas whose pressure and temperature (approximately 300°K) are measured. The scattering gas is confined to a region small compared to the total length of the beam. The mean free path is determined by measuring the intensity of that part of the beam which traverses the scattering region without being deflected by more than 45 seconds of arc. Thus the geometric resolution of the apparatus enables a collision between a beam particle and a particle of the scattering gas to be defined as any encounter which deviates the beam particle by more than 45 seconds of arc.

The collision cross sections are calculated from the mean free paths by using Tait's expression [1,2] for a mixture of two systems, modified to take account of the v^3 velocity distribution characteristic of effusion from a slit. The results are expressed in Table I as effective mutual collision cross sections, i.e., $\pi\sigma^2$.

TABLE I. *Cross sections of* K *and* K_2.

	Effective Collision Cross Section cm$^2\times10^{16}$	Percent Accuracy	Ratio of Cross Section of K_2 Molecule to K Atom
K in H_2	197.5	1.6	1.264
K_2 in H_2	249.6	2.5	
K in D_2	252.4	2.0	1.36
K_2 in D_2	343	5.9	
K in He	170.8	2.3	1.214
K_2 in He	207.3	3.9	
K in A	587.1	1.8	1.197
K_2 in A	702.7	2.5	
K in N_2	613	5.4	1.21
K_2 in N_2	741	5.5	

The intensity of the beam of K_2 molecules is 0.5 percent of the total intensity of the parent beam. This low intensity makes it difficult to measure the mean free paths of the K_2 molecule as accurately as the mean free paths of the K atom, as is reflected in the estimates of accuracy in Table I.

Values of the effective collision cross sections of the K atom in these gases have been reported by Mais[3] and by Rosin and Rabi.[4] In the present experiments the estimated accuracy of the results is much higher than in the experiments of Mais and of Rosin and Rabi, and the angular resolution has been increased.

The last column of Table I gives the ratio of the effective collision cross section of the K_2 molecule to the cross section of the K atom for each scattering gas. Perhaps the most interesting result in these experiments is the small difference in cross section between the K atom and K_2 molecule even though the internuclear distance in the K_2 molecule is large (3.91×10^{-8} cm from band spectra). The ratios in the last column of Table I are about 1.2 except for a ratio of 1.36 in the case of D_2. It is noteworthy that no two of these ratios differ from each other by a factor of more than 0.13 although the cross sections change by a factor of as much as 2.58 as we go from one scattering gas to another.

It also should be noted that both the K atom and the K_2 molecule have considerably larger cross sections in deuterium than in hydrogen.

A complete account of these experiments will be published in this journal.

PAUL ROSENBERG

Department of Physics,
Columbia University,
New York, New York,
May 31, 1939.

* Publication assisted by the Ernest Kempton Adams Fund for Physical Research of Columbia University.

[1] Tait, Trans. Roy. Soc. Edinburgh **33**, 65 (1886).
[2] J. H. Jeans, *The Dynamical Theory of Gases* (fourth edition, 1925), p. 254.
[3] W. H. Mais, Phys. Rev. **45**, 773 (1934).
[4] S. Rosin and I. I. Rabi, Phys. Rev. **48**, 373 (1935).