

negative probabilities, expression (4) must be regarded as unilateral and integrable only between the limits 0 to  $\pi/2$ . If the other half of the spherical aperture surrounding the origin is to be considered, the ray must be reversed. Everything would then be symmetrical about the plane  $\theta = \pi/2$ , there would be no justification in drawing any other conclusions with regard to  $\theta$ , or to the average forward momentum. Of course, if equation (4) is integrated as in (2) and (3) it will yield results which are obviously fictitious.

That longitudinal asymmetry exists has been abundantly shown by experiment. It is introduced in the Compton effect, and it is apparent that the probability of the interaction between a photon and an electron must depend on some mutual directional relationship existing between the two during the period of interaction. LEWIS SIMONS.

Birkbeck College, London, E.C.4,  
Dec. 1.

<sup>1</sup> Sommerfeld; "Wave Mechanics", p. 187, 1930. G. Schur; *Ann. d. Physik*, 4, p. 441; 1930. See also Carrelli, *NATURE*, June 1, 1929, and E. J. Williams, *NATURE*, April 13, 1929.

### Part-Absorption Phenomena of X-Rays.

In connexion with the partly absorbed lines observed by Ray (*NATURE*, May 17, p. 746; June 7, p. 856; Sept. 13, 1930, p. 399), I have observed the following lines, using similar arrangements:

Incident Radiation.	Absorbing Substance.	Modified Lines.	Origin.
FeK $\alpha_{1,2}$ (471.0)	C	2022 X.U. (450.6)	FeK $\alpha_{1,2}$ - CK $\alpha$ (20.4)
"	N	2053 X.U. (443.8)	FeK $\alpha_{1,2}$ - NK $\alpha$ (27.2)
"	Al	1975 X.U. (461.4)	FeK $\alpha_{1,2}$ - AL $L_1$ (9.6)
FeK $\beta_1$ (519.9)	"	1784 X.U. (510.8)	FeK $\beta_1$ - ALL $L_1$ (9.1)
NiK $\alpha_{1,2}$ (550.0)	"	1688 X.U. (540.0)	NiK $\alpha_{1,2}$ - AL $L_1$ (10.0)

The figures in the bracket indicate the values of  $\nu/R$ .

A current of 7 ma. was passed through the X-ray tube at a peak voltage of 24 kv. The transmitted beam was analysed by a calcite crystal.

The appearance of the lines with aluminium as the absorbing substance is rather interesting. Though the actual value of AL $L_1$  is not known, the theoretical value obtained by Mukherjee and Ray (*Zeit. f. Phys.*, vol. 57) is 9.2 ( $\nu/R$ ). As yet I have not observed any line having K $\alpha_{1,2}$  - AL $L_2$  as origin. This seems to be in accordance with the observations of Robinson, who found that if the energy of the incident quanta is large when compared with those of L-levels, the L $_1$  absorption edge has a much greater intensity than that of L $_2$ .

The partly absorbed lines are diffuse and have a definite breadth, and as such they can be selected from known faint lines. The breadth of the lines, when measured in volts, approximates to the ionisation potential of the atom in question, and thus points to the fact that the electron, which is lifted from the original level to the periphery or to any other optical level by the part-absorption of the radiation, is not removed from the atom completely.

In this connexion it may be pointed out that as the partly absorbed lines are very weak and diffuse, great precautions were taken to reduce the blackening of the plate from the general radiations, especially from higher orders, as much as possible, by decreasing the voltage and increasing the current through the X-ray tube. Further, by varying the thickness of

the absorbing layer and the time of exposure, a condition was found where the best photographs were obtained in about 8 hours. Agfa-Röntgen films are more suitable for this type of work than ordinary plates.

R. C. MAJUMDAR.

Department of Physics,  
University College of Science,  
Calcutta, Nov. 19.

### The Equivalence of the Valencies of Carbon.

I POINTED out some time ago,<sup>1</sup> that despite Pasteur's original statement, or at all events, the text-book version of it, optical enantiomers were possibly not completely identical. I followed this up with an investigation of the rotatory powers of the mandelic acids,<sup>2</sup> in which at least preliminary evidence of non-identity was obtained. I am about to publish an account of a lengthy investigation of the camphoric acids, in which differences of the same kind have been observed.

In the paper to the Faraday Society (loc. cit.) I pointed out that a probable consequence of the non-identity of enantiomers would be that, in the language of the tetrahedral conception, the carbon valencies were not symmetrically distributed in space, and that, therefore, numerous unsuspected isomers, differing only slightly in physical properties, should exist. It therefore behoved us to investigate anew the properties of such bodies as methylene chloride, bromide, and iodide, the supposed non-existence of isomers of which was formerly adduced as evidence in favour of the tetrahedral, as opposed to the plane, distribution of the carbon valencies. I am, of course, not contending for a plane distribution of valencies. It is of interest that my suggestion of alternative orbits for an electron in the same atom has been brought forward independently as an explanation of the existence of 'electro-isomers'.

As a preliminary to commencing work upon the methylene halides, I read through the literature on the subject, or at least such of it as is accessible to me here, and I was surprised to find that two crystalline modifications of methylene iodide are already known to exist.<sup>3</sup> Polymorphism is not considered as evidence of chemical difference, but merely of difference in crystal lattice; but one may be permitted to ask, why should alternative lattices be possible, if the molecules themselves are identical in size, configuration, and fields of force? The obvious method of attack here is to investigate the melts obtained from each form, after the manner in which the keto-enol transformation has been investigated, and this I shall proceed to do. In my opinion, two modifications of methylene bromide and of methylene chloride would also have been observed, had not these bodies been liquid at and below room temperature.

A. N. CAMPBELL.

Department of Chemistry,  
University of Manitoba,  
Winnipeg, Canada.

<sup>1</sup> *NATURE*, Nov. 23, 1929.

<sup>2</sup> Campbell and Garrow, *Trans. Faraday Soc.*, 26, 560; 1930.

<sup>3</sup> Beckmann, *Zeit. physik. Chem.*, 46, 853; Bruni and Callegari, *Atti Accad. Lincei*, (5) 13, 1, 485 (this from Beilstein).

### Relation of the Liquid to the Crystalline State.

IN a recent note E. Gross has found that the Debye elastic heat waves also give rise to modified scattering in liquids.<sup>1</sup> The fact that electromagnetic waves are modified by the elastic heat waves shows that the origin of the latter in liquids is also electrical and akin to lattice oscillations in crystals. In order to explain facts connected with X-ray diffraction in liquids, it