$f(x)$ was plotted against $x$ around each half value, to an open scale. The correct abscissæ were read from these plots at a value of $f(x)$ equal to half the peak ordinate already determined.

Repeating for various $h$ values, chosen to cover the required field of broadening, a calibration was plotted of peak deviation against half-width of the sum curve. This calibration tended asymptotically towards deviation values of zero and of one third of the $K\alpha_1 - K\alpha_2$ peak separation. The accompanying figure shows a curve family for equation (1) for values of the constant $h$ from 0·85 to 3·0.

The correction method can be modified to overcome the practical uncertainty of true film background level. Thus the practical background-level can be drawn to intersect the skirts of the doublet at some arbitrary distance on either side of the peak value. The correction curve is modified to a corresponding zero-ordinate level, which will vary with the degree of resolution of the doublet. The doublet width thus measured will not be the conventional half-width.

An error of about 15 per cent may be allowed in the correction method, as this compares favourably with the error in the peak estimation of diffuse doublets.

Applied to individual results, the method would prove tedious; but in cases where a large number of readings are to be analysed, or the use of a monochromator is impracticable, it will be found to provide rapidly an improved figure for lattice parameter.

Peak deviations found in recent experiments with steel tensile bars have amounted to the equivalent of 0·04 per cent in lattice parameter, of great significance in residual strain or similar determinations.

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## Plotting Electron Trajectories

A NEW method of tracing electron trajectories in electron optical systems has been developed in this Laboratory. The method consists essentially in the use of a differential analyser to integrate the equations of motion of an electron, the components of acceleration of which are continuously determined by automatic measurements in an electrolytic tank.

The present tank is of the type using half-section models of the electrode system under investigation, with the surface of the electrolyte corresponding to a plane of symmetry. The longitudinal and radial components of electric field are measured by the voltages between three suitably placed probes mounted on a movable carriage. These voltages have to be converted into proportional rotations to be suitable for feeding the differential analyser, and this is done by means of self-balancing linear potentiometers, embodying conventional follow-up servomechanisms. A third similar potentiometer is used to keep the probes at approximately earth potential.

The rotations are each fed into a pair of integrators of the differential analyser in cascade, the outputs from the first integrators of each pair representing velocities, and those from the second, displacements. The displacements are coupled back to the probe carriage so that the system continuously integrates the equations of motion of an electron and the probes move along an electron path.

Tests have been carried out on an electrostatic two-cylinder lens, and the results agree adequately with the theoretical ones available. The lens used had a gap-width of 0·8 radii. Numerical integration has been done by Goddard[1] for the case of zero and unity gap-widths, while calculations of the spherical aberration coefficient $C$ are available for zero gap-width only[2]. For an acceleration lens of voltage ratio 4·9 we find:

| Gap | $f/R$ | $C$ | |
|---|---|---|---|
| 0·8 $R$ | 7·95 | 105 | measured |
| 0 | 7·85[1] | 120[2] | calculated |
| $R$ | 8·25[1] | — | calculated |

The accuracy is estimated at 1 per cent for $f$ and rather worse for $C$.

In addition to simple ray tracing, including skew paths, the machine appears to be suitable for solving more complicated problems, including the effect of space charge, both by exact and approximate methods, and tracing trajectories in time-varying fields. It is possible to allow exactly for relativity effects.

The differential analyser has already been described[3], and our thanks are due to the Director of the Cambridge University Mathematical Laboratory for making it available to us.

It is hoped to publish a detailed description of the apparatus at an early date.

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## Absolute Power Measurement at Microwave Frequencies

Nichols and Hull[1] have verified the Maxwell–Bartoli theory of radiation pressure experimentally to within 1–2 per cent by a torsion balance method, with a light beam carrying a power of about 0·1 watt.

Experiments are being made in the application of a similar technique to the absolute measurement of power at microwave frequencies. The power $P$ to be measured is fed through a compensated wave-guide $T$-junction[2] to a matched load. The third leg of the $T$-junction (preferably a circular guide supporting the $H_{01}$-mode) contains a movable short-circuiting plate so placed that no reflexion occurs at the junction. It can be shown that the force on the plate is $\frac{P}{2c} \cdot \frac{\lambda}{\lambda_g}$, where $c$ is the velocity of light, $\lambda$ the free space wave-length, and $\lambda_g$ the guide wave-length in the third leg.

Measurement of this force is sufficient to determine $P$, knowing $\lambda$ and $\lambda_g$.

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[1] *Proc. Amer. Acad. Arts and Sci.*, 559 (1902–3).
[2] Huxley, L. G. H., "Wave Guides", 170 (Camb. Univ. Press).