Radioactive Substances and their Radiations. By E. RUTHER-
    FORD, D.Sc., Ph.D., LL.D., F.R.S. Cambridge University
    Press, 1913. viii+699 pp.

THIS book contains a very interesting treatment of a
fascinating subject by a writer who speaks with the authority
of a leading investigator. Dealing effectively as it does with
one of the most remarkable developments of modern physics,
a science which has sprung anew into the most rapid growth in
the present generation, it is assured of a wide range of readers
and of a valuable place in the development of science. For
the most part it deals with experimental researches and results
and makes but a small use of mathematics in their interpre-
tation. For this reason only a brief notice of it should be
given here, although it appears to be a book of more than
usual value.

The investigations of radioactivity are too new for the sub-
ject yet to have taken on a mathematical form. Mathematics
is the dress in which a physical science is best expounded and
developed after it has come to maturity and the fundamental
laws involved in it have been determined with precision; but
it ill becomes a subject while yet in the infancy of early
experimental stages.

But in spite of this newness of the subject there is one mathe-
matical investigation connected with it and of considerable
interest owing to the differential equation to which it gives
rise. This seems not to be mentioned by Rutherford. It was
initiated by J. J. Thomson (see Encyclopaedia Britannica,
11th edition, volume 6, page 371) and further developed by
Mie (*Annalen der Physik* (4) 13 (1904): 857–889) and others.
In investigating the distribution of electric force when a
current is passing through an ionized gas Thomson obtained a
differential equation which Mie has transformed to

$$\frac{1 - k^2}{2\lambda} z \frac{d^2z}{d\xi^2} - \frac{1 - k^2}{4\lambda^2} \left(\frac{dz}{d\xi} \right)^2 + \frac{k}{\lambda} \frac{dz}{d\xi} - z + 1 = 0,$$

where k and λ are constants. In developing the theory of this
equation considerable difficulty has arisen. A reading of the
papers which have been devoted to it leaves one with the con-
viction that they do not satisfactorily dispose either of the
mathematical question involved in the solution of the equation
or of the electrical question of which this equation is in part
the mathematical expression.

                                        R. D. CARMICHAEL.