which is Langevin's result, R being the distance from (x, y, z) to the point which the electron would reach at time t if its acceleration were zero; that is, a force directed towards this point and a force in the direction of the acceleration. Moreover

$$H = \frac{e}{4\pi\{r - (Vr)\}^2} [r\bar{j}] - \frac{e}{4\pi\{r - (Vr)\}^3} (r\bar{j}) [Vr],$$

that is, a force perpendicular to $\bar{r}$ and $\bar{j}$ and a force perpendicular to $\bar{r}$ and $\bar{V}$. It is easily verified from (27) that E is equal to H and that r, E, H are mutually perpendicular.

CORNELL UNIVERSITY,
        January, 1908.

SHORTER NOTICES.

On the Resolution of Higher Singularities of Algebraic Curves into Ordinary Nodes. By B. M. WALKER. Doctor Dissertation, University of Chicago, 1906. 8vo. 52 pp. + Vita.

As stated in the introduction, this dissertation completes in detail a procedure proposed by Clebsch for resolving the higher singularities of algebraic plane curves. The method is this: To relate the points of the plane, one to one, to points of a general cubic surface in such a way that one point of multiplicity higher than 2, with tangents all distinct, is distributed into ordinary points of a curve on the cubic. Then by projecting back upon the plane from a center on the cubic surface, no new singularities are introduced except ordinary double points.

The first half of the work (26 pages) is devoted to the relation of plane and cubic surface by means of a three-parameter linear system of plane cubics with six common base points. The restriction that these six points shall not lie on a conic suffices to insure that there shall be in the plane no fundamental curves, *i. e.* no curves all of whose points correspond to a single point of the cubic. On the cubic surface, however, the six base points of the plane are represented by six straight lines. The author shows in detail what plane curves give rise to the rest of the twenty-seven lines on the cubic. Six of these are conics which contain five of the base points apiece; the

others are the fifteen join lines of the six base points. This
study is essential in preparation for the topics which follow.

In the latter half appears the main object of this research.
In the singular point to be resolved is placed one of the six
base points of the plane cubics. Thus on the surface this r-
fold point appears as r ordinary points on the corresponding
fundamental line. Conscientiously it is proved that other mul-
tiple points do not change their essential character by the trans-
formation. For this purpose Jordan's definition of cycle of a
plane curve is happily generalized. Then are specified the five
loci on the cubic surface which must be avoided in choosing a
center for the projection back on the plane, and it is proved that
these restrictions are sufficient for the exclusion of new higher
singularities.

It should be noted that Dr. Walker takes his start from
Noether's reduction of the curve to one at whose singular points
the tangents are all distinct. This work is a thoroughly read-
able presentation of what is probably the most graphic reduc-
tion of the higher singularities.

                                              H. S. WHITE.

*Die Kegelschnitte des Gregorius a St. Vincentio in vergleichender
    Bearbeitung.* Von KARL BOPP. Mit 329 Textfiguren.
    *Abhandlungen zur Geschichte der mathematischen Wissenschaf-
    ten,* XX Heft, 2 Stück, pp. 83–314. Leipzig, B. G. Teubner,
    1907.

THE glare of notoriety of Gregorius a St. Vincentio as a
circle-squarer has cast his solid achievements into obscurity.
At a time when only four of the seven books of the conics of
Apollonius of Perga were known in the occident, Gregorius
prepared a masterly work on conic sections, the Opus geometri-
cum, which was published at Antwerp in 1647. He did not
possess the genius of his great contemporaries, Desargues and
Pascal. Yet in the endeavor to gain a detailed picture of the
progress of geometry of the seventeenth century, one cannot
overlook Gregorius a St. Vincentio. Through the researches
of Bosmans there has been an enrichment of biographical detail
of this man. To make a knowledge of his very diffuse treatise
more readily accessible and to point out his relation to ancient
writers, as well as his influence on the progress of geometry,
Mr. Bopp has prepared the booklet under review. The chief
novelty in Gregorius's geometry is the method of transformation