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

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

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,
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## 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