Proceedings of the Iowa Academy of Science

Volume 30 | Annual Issue Article 14

1923

The Trace Left by a Helical Beam of Electrons on a Plane Perpendicular to Its Axis

C. J. Lapp
University of Iowa

Let us know how access to this document benefits you

Copyright ©1923 Iowa Academy of Science, Inc.
Follow this and additional works at: https://scholarworks.uni.edu/pias

Recommended Citation
Lapp, C. J. (1923) "The Trace Left by a Helical Beam of Electrons on a Plane Perpendicular to Its Axis," *Proceedings of the Iowa Academy of Science, 30(1),* 72-74.
Available at: https://scholarworks.uni.edu/pias/vol30/iss1/14

This Research is brought to you for free and open access by the Iowa Academy of Science at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Iowa Academy of Science by an authorized editor of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.

THE TRACE LEFT BY A HELICAL BEAM OF ELECTRONS ON A PLANE PERPENDICULAR TO ITS AXIS

C. J. LAPP

Experimental work has been done by the writer in which a fine beam of electrons was caught in a magnetic field and turned into a spiral. A photographic plate placed across the path was marked by a trace which at first appeared to be a circle. A close examination however showed that the trace was unsymmetrical and that its curvature appeared to change with the length of Arc.

From theoretical consideration the equation of this curve has been found to be:

$$\rho = I \frac{2 m_0 C S \sin \phi}{e H \sqrt{c^2 t^2 (n+\lambda)^2 \cos^2 \phi - S^2}} \sin \pi\lambda$$

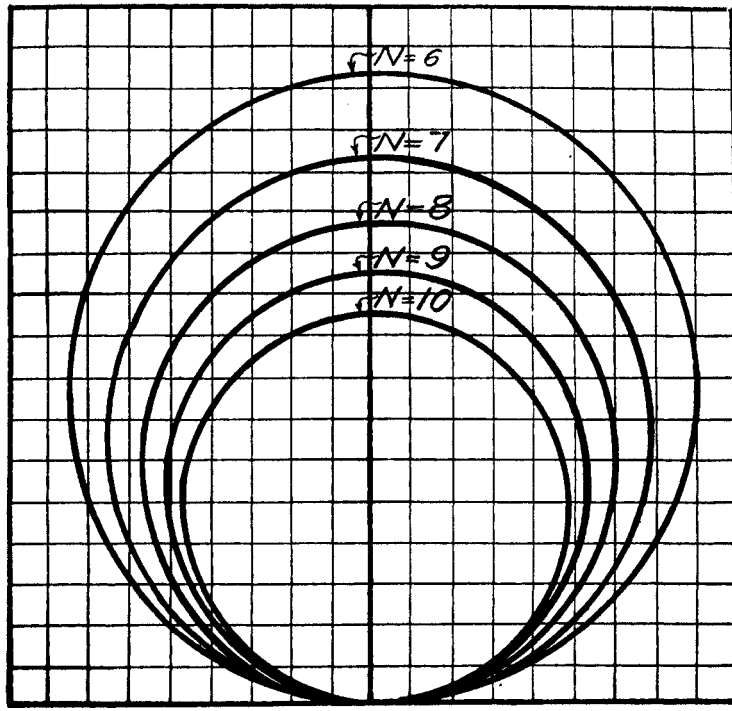

Fig. 2 a.

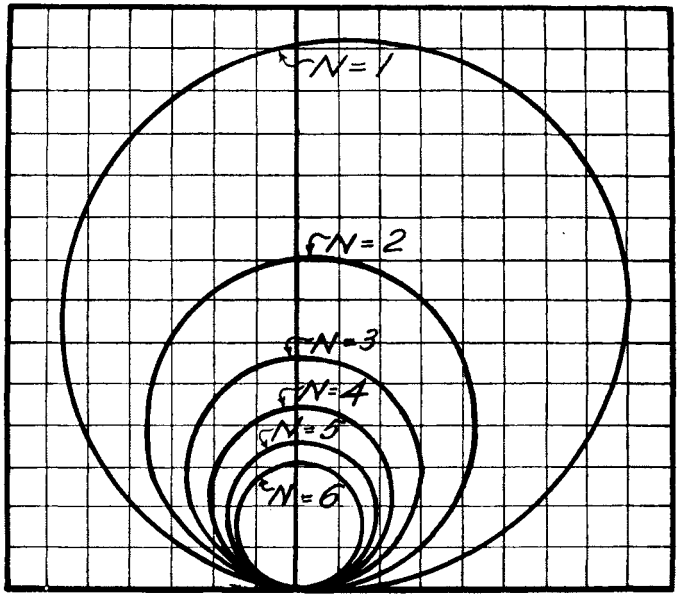

Fig. 2 b.

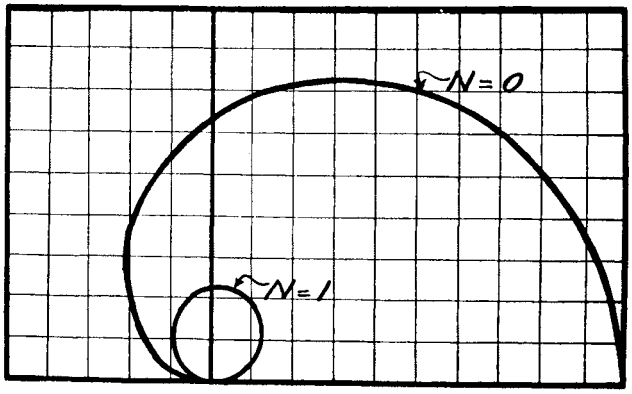

Fig. 2 c.

where M_0 is the mass of the electron
C is the velocity of light
e is the charge of the electron
H is the strength of the magnetic field
S is the distance of the photographic plate from the electron source
ϕ is the angle between the axis of the spiral and the tangent to the electron beam at the source.
t is the time required for the electron to make one convolution
N is the whole number of convolutions made by the electron
λ is a fraction such that $(n + \lambda)$
is the total angle swept out by the electron.

This equation is of the form

$$\rho = \pm \frac{K}{\pi\lambda + n\pi} \sin \pi\lambda$$

where K is constant, which is the equation of the LeCochleoide a known higher plane curve. The curve is shown in figure 2. Photographs of the actual electron trace are similar in every respect to this curve.

PHYSICAL LABORATORY
UNIVERSITY OF IOWA