



LVII. A method of calculating the amount of magnetism of a magnetic circle for each strength of current acting on it

W. Moon

To cite this article: W. Moon (1883) LVII. A method of calculating the amount of magnetism of a magnetic circle for each strength of current acting on it , Philosophical Magazine Series 5, 15:96, 389-391, DOI: [10.1080/14786448308627371](https://doi.org/10.1080/14786448308627371)

To link to this article: <http://dx.doi.org/10.1080/14786448308627371>



Published online: 28 Apr 2009.



Submit your article to this journal [↗](#)



Article views: 2



View related articles [↗](#)

dimensional by a quantity corresponding to the length

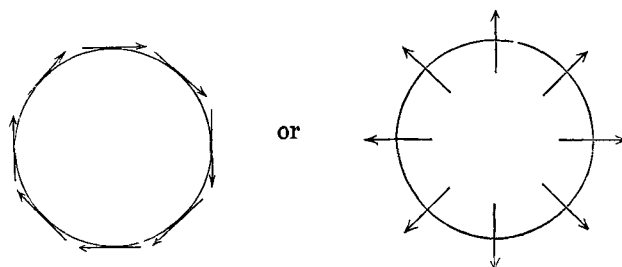
$$2na \sum \frac{\kappa^{-1}a^{-1}}{\kappa^2 a^2 - n^2} \dots \dots \dots (25)$$

For $n=2$, the values of κa from (21) are 3.054, 6.705, 9.965, 13.1, 16.3, &c.; and thus (25) becomes .2674 a .

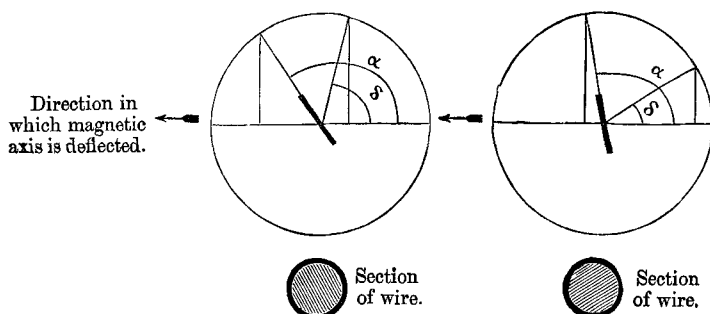
March 1883.

LVII. *A Method of Calculating the Amount of Magnetism of a Magnetic Circle for each Strength of Current acting on it.*
By W. MOON*.

IN unmagnetized iron the magnetic axes of the molecules lie indifferently in every direction; and this is equivalent to their forming small closed circuits, the axes of the two opposite molecules being opposed in direction. An electric



current acting upon a group of molecules tends to direct them to a certain position with respect to the current. The current exerts an equal force upon all molecules at the same distance from it; but since the molecules in their normal positions form different angles varying from 0° to 180° with current, some of the molecules would be deflected through a greater distance than others.



* Communicated by the Author.

Let δ equal the angle the molecule normally forms with the current, and let α equal the angle to which the current deflects the molecule. Then the power of the current to deflect the molecule will be equal to $\sin \alpha$, and the force tending to draw the molecule back to its normal position will be equal to

$$\text{versin } \alpha - \text{versin } \delta = \cos \delta - \cos \alpha;$$

but since the action of the current on each molecule is equal, therefore $\frac{\cos \delta - \cos \alpha}{\sin \alpha}$ will be the same with every molecule, whatever may be the value of δ .

Since the action of the current on the iron is proportional to the current-strength,

$$\therefore a = \mu \frac{\cos \delta - \cos \alpha}{\sin \alpha},$$

where a is current in ampères and μ a constant.

The amount of magnetism of the group of molecules is equal to the summation of the different distances through which the molecules are deflected

$$= \mu \int_{\delta=180^{\circ}}^{\delta=0^{\circ}} (\cos \delta - \cos \alpha) d\delta.$$

The values of $\cos \alpha$ corresponding to the different values of $\cos \delta$ from 0° to 180° in each value of $\frac{\cos \delta - \cos \alpha}{\sin \alpha}$ may be calculated by the following series:—

$$\text{Since } a = \mu \frac{\cos \delta - \cos \alpha}{\sin \alpha},$$

$$\therefore \cos \alpha = \cos \delta - \frac{a}{\mu} \sin \alpha,$$

$$\therefore \cos \alpha = \cos \delta - \frac{a}{\mu} \sqrt{1 - \cos^2 \alpha},$$

$$\therefore \cos \alpha = \cos \delta - \frac{a}{\mu} \sqrt{1 - {}^2 \left\{ \cos \delta - \frac{a}{\mu} \sqrt{1 - {}^2 \{ \cos \delta \dots \right.},$$

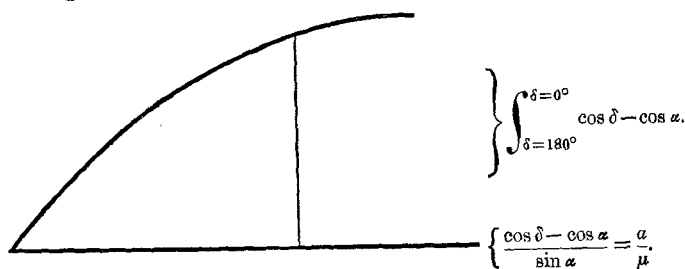
and the magnetism of a molecule

$$= \cos \delta - \cos \alpha = \frac{a}{\mu} \sqrt{1 - {}^2 \left\{ \cos \delta - \frac{a}{\mu} \sqrt{1 - {}^2 \{ \cos \delta \dots ;$$

and this series, integrated for all values of δ between 0° and 180° , would give the amount of magnetism (for any current-strength a) of a group of molecules that would in their normal position form a closed magnetic circle.

If the constant μ is made equal to unity, and a number of

values of $\int_{\delta=180^{\circ}}^{\delta=0^{\circ}} \cos \delta - \cos \alpha$ corresponding to each value of $\frac{\cos \delta - \cos \alpha}{\sin \alpha}$ were calculated, until each increment of $\int_{\delta=180^{\circ}}^{\delta=0^{\circ}} \cos \delta - \cos \alpha$ became very small as compared with each increment of $\frac{\cos \delta - \cos \alpha}{\sin \alpha}$, it would be found that the different values of $\int_{\delta=180^{\circ}}^{\delta=0^{\circ}} \cos \delta - \cos \alpha$ form the ordinates of a curve which approaches towards an asymptote,—the abscissæ representing the current-strengths, and the ordinates the amount



of magnetism of a magnetic circle of molecules—that is, the intensity of magnetism of the iron.

LVIII. *Dissymmetry in the Electrolytic Discharge.* By ALFRED TRIBE, *F.Inst.C., Lecturer on Chemistry in Dulwich College*.*

IN the *Philosophical Magazine* for June 1881, p. 446, I gave the results of some experiments, from which it was concluded that the electrical discharge through an electrolyte whose transverse section was greater than the width of the electrodes was accompanied by dissymmetry in opposite but corresponding parts of the field of electrolytic action. The evidence consisted in the very different superficial magnitudes of the electrifications registered on similar plates of silver in corresponding positions near the + and — electrodes respectively. The silver plates, which I have called *analyzers*, were immersed in a solution of copper sulphate undergoing electrolysis. It was likewise shown that the dissymmetry was connected with the spreading-out of the lines of force; for as this was prevented, so the dissymmetry was less and less marked;

* Communicated by the Author.