



# On the magnetization of iron rings slit in a radial direction

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not necessarily of all such motions, but of those among them which are capable of restoring energy to the parts of the molecule carrying electra (see Stoney on "Double Lines in Spectra," Scientific Transactions of the Royal Dublin Society, vol. iv. part xi.) whenever the motion of the electron has transferred energy from the molecule to the æther. As fulfilling this criterion we are probably to include all irrotational motions within the molecules, and we must also include relative motions of the molecules—all of them indeed if time enough be allowed for turmoil within a fluid to subside. It does *not* include any motion which the molecules have in common, as in wind, or in the rotation of a wheel.

When these circumstances are taken into account, it is obvious that the energy of the heat-motions of an individual molecule undergoes rapid fluctuations, while there may be a definite *average* of the energy of these motions, whether estimated by what happens in an individual molecule over a sufficiently long period of time, or when estimated by what occurs simultaneously in all the molecules of a body. In other words, the motions of an individual molecule do not from instant to instant conform to the Second Law of Thermodynamics, although the law may apply both to the average of the motions of a single molecule taken over a long period of time, and to the average of the simultaneous motions of vast multitudes of associated molecules. As regards *molecular* motions (the motions within a solid, or motions within a fluid that do not produce currents in the fluid), the millionth of one second is a long period.

### XXXVIII. Intelligence and Miscellaneous Articles.

ON THE MAGNETIZATION OF IRON RINGS SLIT IN A RADIAL DIRECTION. BY H. LEHMANN.

THE chief results of the present research may be summed up in the following principles, which hold for an imperfectly closed ferromagnetic ring, the radius of which is large in comparison with the radius of the section :—

1. The demagnetizing factor, or the factor which, multiplied by the mean magnetization, gives the mean factor of the demagnetizing force, is constant up to about half the saturation.
2. The coefficient of dispersion (*Streuungs-coefficient*), the ratio of the mean induction to that in the slit, is constant up to half saturation.
3. The region of the dispersion of the lines of force is limited essentially to the vicinity of the slit, and is narrower as the magnetization increases.
4. The coefficient of dispersion is independent of the radius of the ring; in regard to its constancy (2), it only depends on the

relative width of the ring  $d/r$ . The empirical expression for this dependence is a linear one of the form

$$1 + h \frac{d}{r};$$

where  $h$  is a constant which, for the Swedish iron investigated, has the value 7, and will presumably have values differing but little from this in the case of other ferromagnetic metals. This will probably be the case more especially in the kinds of iron used in technical processes.

5. When the empirical constant  $h$  is known, the factor of demagnetization can be calculated from the geometrical dimensions of the system by the formula

$$\bar{N} = \frac{2d}{\left(\rho - \frac{d}{2\pi}\right) \left(1 + h \frac{d}{r}\right)},$$

in which  $\rho$  is the radius of the ring,  $r$  that of the section, and  $d$  the width of the slit. This formula holds with the same limitation as (1), (2), and (4), that is, up to demisaturation. In general the equation holds,

$$\bar{N} = \frac{2d}{\left(\rho - \frac{d}{2\pi}\right)} \cdot \frac{1}{\nu},$$

in which  $\nu$  is the factor of dispersion.

6. For high magnetizing values the factor of demagnetization approaches the limiting value

$$N \propto 2 \frac{(d + r - \sqrt{d^2 + r^2})}{\rho - \frac{d}{2\pi}}.$$

The previous results may find an approximate application even in imperfect magnetic circuits of complicated shapes.—Wiedemann's *Annalen*, No. 3, 1893.

#### THE SPECIFIC HEAT OF LIQUID AMMONIA.

BY C. LUDEKING AND J. E. STARR.

The specific heat of liquid ammonia, though it has often been the subject of calculation in development of theory and practice, has not yet been satisfactorily determined experimentally, if we except the work of Regnault. His results, however, were unfortunately lost during the Paris Commune. He assumed the specific heat to be 0.799. Since then the interest in this constant has very considerably increased through the rapid development of the artificial ice industry. Generally the specific heat has been taken at unity. Thus De Volson Wood in his 'Thermodynamics,' page 337, recommends this value "until the experimental value is determined."

It was our good fortune to have ready access to all the means necessary for executing the somewhat laborious experiments involved, and we take this opportunity to present briefly the