Dr. P. ZEEMAN. *Measurements on Kerr's phenomenon in the case of reflexion from the polar surface of a magnet made of iron, cobalt and nickel.*

Dr. SISSINGH measured the amplitude and the phase of the new magnetic component, which appears when light falls obliquely upon an iron mirror, magnetized tangentially (aequatorial reflexion). In order to avoid further complications the incident light was polarized either in or at right angles to the plane of incidence

The comparison with Prof. LORENTZ's theory taught him that at different angles of incidence existed a constant difference amounting to about 85° between the observed and calculated phases. I will call this difference of phase SISSINGH's phase S. In the continuation of the inquiry it seemed indicated to consider (*a*) in the first place whether the reflexion from a normally magnetized mirror (polar reflexion) can be described by this theory.

(*b*) Further, to examine the existence of the relation required by the theory between polar and aequatorial reflexion.

(*c*) The influence of the colour of the reflected light on the phenomena was in the last place a point of research. Although these researches are not yet (June '92)

closed, it may be perhaps of interest to give a preliminary communication.

As to point (*a*) there is something to be learned from KAZ's en RIGHI's observations calculated by Dr. SISSINGH. It follows from the observations of KAZ, accepting values for the ordinary optical constants, that there exists a difference of phase between theory and experiment amounting to about 68°. This value is derived from the observations at the angles of incidence 80°, 68°, 60°, these giving the most accurate result.

A difference of phase $S = 75^0$ follows from RIGHI's observations at 6 angles between $44^0 18'$ and 87°, likewise accepting values of the optical constants.

From the experiments of both these observers result very irregular oscillating values of the quotient of the calculated and observed amplitudo's.

As to the second point (*b*) it is impossible to draw any conclusion from a comparison of the aequatorial and the polar observations of KAZ and RIGHI, as they give not the magnetizations made use of in their experiments which are moreover insufficient as follows from the just named anomalies.

We have referred to the third point (*c*). Observations made by RIGHI, but they cannot be exactly compared with the theory as there is no statement of the optical constants of his mirror for the not accurately defined rays.

Hence the desirableness of new measurements. Therefore I have made experiments on the reflexion from the *pole* of an *iron* mirror; I have found that also in this case there exists a SISSINGH's phase S, the preliminary value of which is about 80^0.

This follows from measurements relating to 3 mirrors, the optical constants, I and H, of which were found for light of refrangibility D:

A.	$I = 76^0\ 20'$	$H = 27^0\ 40'$
B.	$73^0\ 59'$	$28^0\ 45'$
C.	$76^0\ 13'$	$27^0\ 39'$

The difference of phase just named following from our measurements is:

in the case of mirror	A,	$S = 80^0\ 47'$
	B.	$79^0\ 58'$
	C.	$80^0\ 30'$

As to our second point (b) the relation between aequatorial and polar reflexion, I have found till now what follows.

According to theory, at $i = 51^0\ 22'$ the magnetization being the same, the amplitudo's μ_{aeq} and μ_{pol} have the following relation:

$$\frac{\mu_{aeq}}{\mu_{pol}} = 0{,}194.$$

From SISSINGH's aequatorial and my polar measurements follows:

$$\frac{\mu_{aeq}}{\mu_{pol}} = 0{,}294.$$

In SISSINGH's case the magnetization was 1400. C.G.S. and in my measurements 850 C.G.S. hence:

$$\frac{\mu_{aeq}}{\mu_{pol}} = 0{,}179.$$

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by the proportionality of μ and magnetization, as proved by DU BOIS.

The difference is about 8%.

Point (c): the dispersion of the phenomenon is investigated for 3 colours at an angle of incidence $i = 51^0\ 22'$ and polar reflexion. The light was made monochromatic bij means of a Hilger-Christie spectroscope. The optical constants of the iron-mirror were determined for the same colours. Variations of the mirror-surface were controlled by repetitions of this determination. Also the invariability of the light used was especially controlled. In this manner it was found (m being the phase):

	$m - 180^0$ from observations.	from theory.
for red light w. l. $\lambda_1 = 0{,}618\ \mu$	$39^0\ 8'$	$-\ 29^0\ 58'$
» blue » w. l. $\lambda_2 = 0{,}460\ \mu$	$53^0\ 10'$	$-\ 24^0\ 58'$.

According to theory the dispersion ought to be $+ 5^0$, the calculation being made with the determined optical constants. Hence it follows that SISSINGH's phase has a different value for various colours and hence results the existence of *a magneto-optic dispersion of the phase;* the dispersion of the phase from blue to red is $+ 14^0\ 2'$.

To the present time measurements on reflexion from magnetized cobalt from which phase and amplitude might be calculated did not exist. Therefore I commenced with measurements on light reflected from the pole of a magnet made from a solid piece of cobalt. For 3 colours the optical constants were found as follows.

$\lambda_1 = 0{,}618\,\mu$	$I = 76^\circ\,33'$	$H = 30^\circ\,49'$
$\lambda_2 = 0{,}540\,\mu$	$75^\circ\,20'$	$31^\circ\,23'$
$\lambda_3 = 0{,}460\,\mu$	$73^\circ\,44'$	$31^\circ\,27'$

At $i = 60^\circ$ my measurements again give a *magneto-optic dispersion of the phase;* the change of the magneto-optic amplitude with colour may be called *magneto-optic dispersion of the amplitude.*

The results are the following:

colour	$m - 180^\circ$ observed	$m - 180^\circ$ calculated	μ observ.	μ calcul.	S.	$\frac{\mu \text{ observ.}}{\mu \text{ calcul.}}$
λ_1	$22^\circ\,33'$	$-18^\circ\,39'$	$2{,}30 \times 10^{-3}$	$2{,}77\,A$	$41^\circ\,12'$	$0{,}83 \times \frac{10^{-3}}{A}$
λ_2	$32^\circ\,30'$	$-16^\circ\,53'$	$2{,}41 \times 10^{-3}$	$2{,}44\,A$	$49^\circ\,23'$	$0{,}99 \times$ "
λ_3	$33^\circ\,55'$	$-16^\circ\,56'$	$2{,}18 \times 10^{-3}$	$2{,}03\,A$	$50^\circ\,51'$	$1{,}07 \times$ "

For the constant $A = \frac{2\pi}{T}\,\varepsilon_1\,h\,N$. vide theory. The hitherto given and yet following amplitudes relate to the intensity of magnetization $I = 700$ C.G.S.

Inferior in exactness is a determination at $i = 50^\circ$:

λ_2	$25^\circ\,9'$	$-22^\circ\,21'$			$47^\circ\,30'$	

At $i = 72^\circ$, phase not very exact:

λ_2	$45^\circ\,5'$	$-6^\circ\,44'$	$1{,}96 \times 10^{-3}$	$2{,}02\,A$	$51^\circ\,49'$	$0{,}97 \times \frac{10^{-3}}{A}$

On a mirror of electrolytically deposed *nickel* was found at $i = 50^\circ$:

$\lambda = 0{,}589\,\mu$	$11^\circ\,40'$	$-19^\circ\,30'$	$1{,}20 \times 10^{-3}$		$31^\circ\,10'$	$0{,}52 \times \frac{10^{-3}}{A}$

Dr. P. ZEEMAN. *Measurements on Kerr's phenomenon in the case of reflexion from the polar surface of a magnet made of cobalt at different angles of incidence.*

Not long ago appeared a theory of KERR's phenomenon by GOLDHAMMER (Wied. Ann. Bd. 46).

He introduces into his theory the difference of phase S, the existence of which Dr. SISSINGH deduced from his observations on light reflected from tangentially magnetized iron. GOLDHAMMER's δ is $= -S$. The formulae arrived at are the same as those given in LORENTZ's theory; only the expression for the phase differs with a constant quantity $-\delta$. Somewhat later also DRUDE gave a very comprehensive memoir on the same subject (Wied Ann. Bd. 46). DRUDE also communicated at the same occasion some observations made by him, on the reflexion from tangentially magnetized cobalt and iron (aequatorial reflexion). I calculated as well from these observations as from LORENTZ's theory the phase and amplitude of the magneto-optical component. The values adopted for the optical constants, the principal incidence and principal azimuth are for cobalt those determined by DRUDE; for nickel the usually given ones. From DRUDE's observations on aequatorial reflexion on