

OBSERVATIONS OF EARTH-CURRENTS IN STOCKHOLM ON
MAY 19, 1910, DURING PASSAGE OF HALLEY'S COMET.

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During the transit of Halley's comet across the Sun's disc on May 19, 1910, magnetic observations were made, on the initiative chiefly of Prof. Birkeland, at several places of the globe. The authors thought it, therefore, not uninteresting to have earth-current observations in this connection made at the Central Telegraph station in Stockholm. Two telegraph lines belonging to the Royal Swedish Telegraph Office, Stockholm-Göteborg and Sundsvall-Stockholm, were used. The geographic co-ordinates for these three places are as follows:

Table I.

	LATITUDE N	LONGITUDE E. OF GR.
Stockholm	59° 21'	18° 3'
Göteborg	57 42	11 58
Sundsvall	62 23	17 19

Before commencing the observations, the resistance of the line Stockholm-Göteborg was fixed at 2940 ohms, and that of the line Sundsvall-Stockholm 2336 ohms. At all three stations the earth-conduction was accomplished by connection with the water-works' pipes. The current-strengths were measured with milliampèremeters, whose scale value was 0.1 milliampère. The instruments proved correct within the errors of observation.

The measurements were made during the interval 0^h 40^m to 3^h 45^m A. M., all times given being mid-European. The current-strengths observed during this period in the line Stockholm-Göteborg are shown in the curves I and II, abscissas representing the times, and positive ordinates (above the abscissa axis), current-strengths in the direction Stockholm-Göteborg. The curves III and IV show the current-strengths in the line Sundsvall-Stockholm, positive ordinates representing current-strengths in the direction from Sundsvall to Stockholm. The times were taken from the standard clock of the telegraph station.

The potential differences expressed in millivolts per km. are calculated from the current-strengths expressed in milliampères by multiplication with $\frac{r}{l}$, r indicating the ohm-resistance and l the distance in kms. from end to end. The components V and V' in the directions E-W and N-S are obtained from the formulæ:

$$V = \frac{v \sin \beta - v' \sin \alpha}{\sin (\beta - \alpha)},$$

$$V' = \frac{v' \cos \alpha - v \cos \beta}{\sin (\beta - \alpha)};$$

v = the potential difference in the Göteborg line expressed in millivolts per km.,

v' = the potential difference in the Sundsvall line,

α = the angle between the directions Stockholm-Göteborg and E-W,

β = the angle between the directions Sundsvall-Stockholm and E-W.

From table I we obtain $\alpha = 26^\circ 40'$, $\beta = 96^\circ 26'$, the distance Stockholm-Göteborg, 403 km. and the distance Sundsvall-Stockholm, 337 km. When calculating both the components we consequently use:

$$V = 7.73 i - 3.32 i',$$

$$V' = 0.871 i + 6.60 i',$$

i and i' indicating, respectively, the observed current-strengths on the Stockholm-Göteborg and the Sundsvall-Stockholm line.

The values of V and V' , expressed in millivolts per km., are given in Table II for the interval 0^h 40^m to 3^h 45^m A. M., May 19, and in addition, the calculated results as well of some single measurements made for three hours before the stated interval beginning at 9^h 43^m P. M., May 18th.

The variations of V during the time 0^h 40^m to 3^h 45^m are shown by the curves V and VI, and the corresponding variations of V' by the curves VII and VIII.

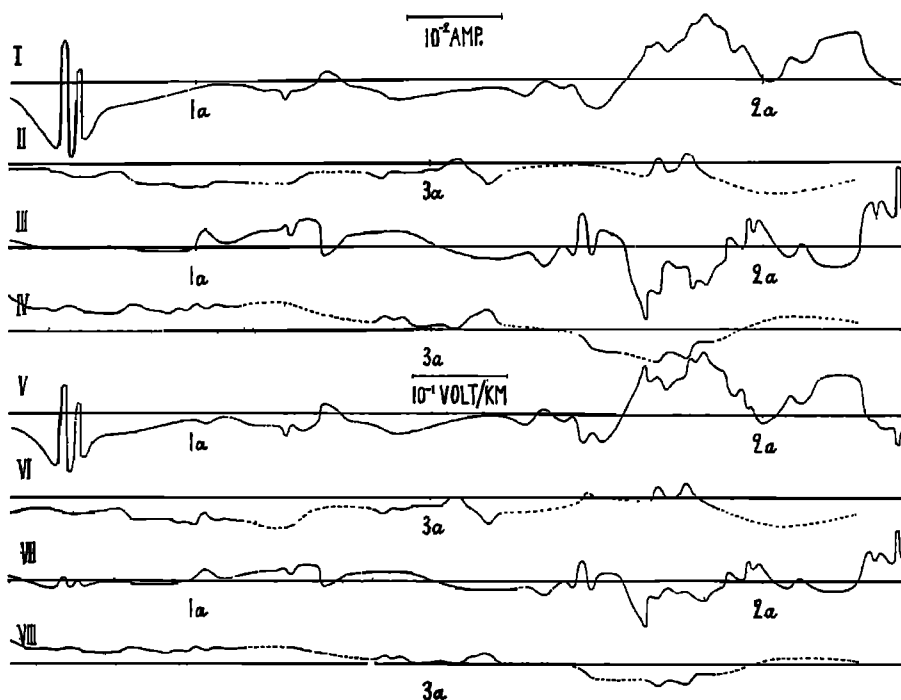


TABLE II.

TIME Mid. Eur.	V	V'	TIME Mid. Eur.	V	V'	TIME Mid. Eur.	V	V'
H. Min.			Hrs. Min.			Hrs. Min.		
P. M.			A. M.			A. M.		
9 43	+28.8	- 8.6	I 25	-13.7	+ 1.2	2 14	-13.4	-20.2
53	-12.3	- 4.9	30	- 3.4	- 9.5		-32.2	+56.6
56	-20.3	- 5.0	33	- 4.2	- 9.6	15	-16.5	+24.6
57	-26.1	- 5.0	35	-11.7	- 6.2	16	-14.9	+20.0
58	-16.8	+ 0.9	37	+ 5.7	-14.7	18	-11.9	-15.5
			39	- 7.7	- 0.9	19	-11.9	+15.5
10 00	-16.0	- 8.8	40	- 2.1	- 7.2	20	-14.3	-13.7
	-14.0	-12.7	41	-30.2	+21.1	21	-16.4	+16.3
	-19.5	-13.3	42	-20.0	- 9.2	22	-19.5	+16.0
02	-22.1	-13.0	43	-28.8	+ 8.6	23	-17.8	-12.7
	-20.8	-15.6	45	- 6.2	+ 4.2	25	-14.8	+11.5
10	- 2.1	-12.1	46	+14.6	-19.3	27	-13.2	+13.8
13	+ 5.4	-19.0	47	+35.4	-37.8	28	-22.4	+17.0
14	+10.2	-12.2		+42.2	-43.3	29	-24.1	+15.5
16	+ 4.3	- 3.7	47	+53.7	-49.8	30	-23.5	+12.7
19	+ 8.0	+ 8.5	48	+36.8	-16.2	31	-23.2	+12.1
25	+ 1.3	+ 7.1	49	+41.6	-17.7	32	-22.5	+10.7
26	- 8.4	+ 5.4	50	+28.2	- 7.3	33	-26.5	+13.8
28	-11.1	- 0.6	51	+38.8	-12.3	34	-26.6	+12.3
50	+ 5.4	+ 0.6	52	+42.9	-11.0	35	-28.2	+17.1
	-20.5	+ 8.3		+61.6	-15.2	36	-16.5	+13.7
			53	+58.6	-19.2	37	-24.0	-16.8
11 00	- 8.1	+ 9.7	54	+68.1	-21.6	38	-23.4	+15.5
05	+ 7.6	+19.0	55	+52.8	-10.1	39	-24.2	+15.5
07	+ 9.4	+46.5	56	+46.7	- 5.2	40	-24.8	+16.8
10	+ 3.9	+ 0.4		+29.4	+ 9.6	45	-25.5	+16.7
			57	+21.5	+ 5.9	47	-14.7	+13.0
			58	+28.5	+ 1.8	54	-12.7	+ 4.2
A. M.				+18.5	+16.8	55	-17.1	+ 7.9
0 22	+17.8	- 2.9		+15.1	+18.5	56	-11.0	+ 5.7
40	-15.4	+ 4.6		+11.5	+20.9	57	-11.7	+ 7.0
45	-55.6	- 6.3		+ 9.2	+20.6	58	- 8.7	+ 1.1
46	+31.7	+ 4.0		+ 6.5	+21.0	59	- 8.4	+ 0.4
	-63.3	- 7.1	59	+ 8.2	+12.8			
47	-46.4	- 5.2		+ 1.3	+16.9	3 00	- 7.2	+ 1.3
	+11.6	+ 1.3		- 4.7	+19.0	01	- 7.9	+ 2.6
48	-47.9	- 5.4				02	± 0.0	± 0.0
50	-24.1	- 1.5	2 00	- 8.0	+15.8	03	+ 1.6	+ 1.6
55	-16.5	- 3.7	02	+ 7.3	- 4.8	04	- 9.4	+ 7.3
I 00	- 6.8	+ 2.0	03	+21.8	- 5.9	05	-16.5	+10.0
01	-10.9	+12.1	04	+13.2	+ 2.9	06	-26.3	+11.7
03	- 3.6	+ 2.3	05	+21.8	- 4.5	07	-16.6	+ 3.7
07	-13.3	+10.3	06	+39.8	- 9.5	16	- 0.4	- 5.6
09	-14.8	+11.5	08	+44.4	-10.3		+ 5.0	- 9.9
	-23.1	+13.5	10	+41.9	- 2.2	17	+ 3.6	-13.5
10	-12.1	+ 6.2		+23.3	+22.2	23	- 2.6	-17.9
11	-17.0	+16.8		+16.3	+23.4	24	+13.9	-23.6
13	- 7.9	+15.8		+ 9.0	+25.5	25	+ 0.6	-17.3
	+11.0	- 4.9	11	+ 0.7	+29.4	26	+ 2.4	-18.7
15	+ 3.9	+ 0.4		- 5.2	+32.3	27	+16.5	-20.6
16	- 5.9	+ 7.0	2 12	- 4.8	+22.5	28	+ 2.1	-10.3
20	-16.9	+ 9.3		-10.3	+30.3	30	- 8.8	-10.2
I 21	-21.1	+ 9.5		-12.8	+30.2	37	-30.0	+ 6.4
						3 45	-16.9	+ 2.9

Meteorologiska Centralanstalten, Sweden,
Stockholm, June 2, 1910.