

Mysterious patterns of Lichtenberg

Lichtenberg, who lived in the 18th century, was an outstanding naturalist, art critic, satirist, aphorist, and one of the creators of the German experimental physics. In his article *A handful of remarks about the aerostatic machines* from 1784, published in the *Göttingisches Magazin der Wissenschaften und Litteratur* (The Göttingen Magazine of Sciences and Literature), he wrote about the achievements of the age he lived in: 'Our 18th century has nothing to be ashamed of when it will pass its inventory of the acquired knowledge and designed inventions to the 19th century someday.' If the 19th century would ask the 18th: what do you bring with you and what new have you seen?, it could answer: 'I've stated the form of Earth. I've lifted up huge loads by the use of fire, like Montgolfier brothers. I've learned how to face the lightning – using the Franklin's lightning rod. In 1780 by the hands of Lichtenberg, I've conducted the series of experiment with the lightning rod on the hills around Göttingen and installed this device in his suburban house. Furthermore, I can pour the lightning/flash to the Leyden jars like a champagne. I've discovered the fish that kill another under the water by the unseen thunder – these are electric eels.' The main Lichtenberg achievements in the area of sciences can be added also to this collection. Our story touches the matters of the discoveries concerning the field of the electricity from the 18th century.

It is the year 1778. Let's move to the small lake, where the group of boys decided to relax in the summer, sunny day. The temperature was high enough to put the shirts off to sunbathe and to swim. The laughing group of young boys has just left the lake and has come to the beach nearby. Andrew was the last one, and Peter was just before him. Suddenly, Andrew came up to Peter and asked:

'Peter, I can see some marks on your back. What is that?'

'I don't know, try to guess...'

Andrew touched the well-seen, crowned lines with his fingertips. These lines created some figures on the Peter's body, which looked like thousands of tunnels of the anthill. The contours branched off like never-ending roots of a huge tree. Light red marks were on the whole area of the scapulae, they were grouping in the middle of the spine into the thicker trunk, and, narrowing, they were going down, where they ended with spirals and meanders.

After that investigations, Andrew asked his colleagues: 'Do you have any ideas, how to explain these unusual marks? Could you give your suppositions?..'

'I probably know! – Peter may like step on the trees. So, it could happened that he injured themselves the body' – said Henry.

John was thinking for some time and told: 'I have read that such patterns on the skin can be caused by diseases.'

'Peter, do you have a tattoo? Why didn't you say a word?', said Paul with claim.

'Oh, come on, no... I was once hit by a lightning. The veins go to the top due to the hit and hot. Well, father told me something like this. It's a miracle, I am still alive.', he straighten himself, not thinking about the Andrew's touch and he reached toward his shirt.

'Can I?', he asked teasingly, smiling. The young boy fluttered his eyelashes nervously and returned the shirt to the owner. The shirt again hid the narrow, curly threads.

'Lichtenberg figures... I have seen similar patterns at the physics lectures!', exclaimed delighted Andrew.

'Whose figures?' – said almost everybody except John at one moment.

‘Those marks were discovered for the first time by a German physicist, Georg Christopher Lichtenberg, who was studying and demonstrating them at the University of Göttingen. Lichtenberg built a large electrophorus to generate the high-voltage static electricity. After discharging it, he discovered strange patterns at the surface of a non-conductive material.’ – recited red-haired Andrew, almost like in the course book. There was silence. Everybody looked at Peter like he was the eighth miracle of the world.

‘You have never mentioned that, even we have studied together for three years already’ – said John without any feelings, and he looked emphatically at his friend.

‘I’ve forgotten about that, I didn’t want to remember, never mind. These “patterns” were supposed to disappear or to become hardly visible scars, I don’t see my back usually.’ – Peter lifted his arm and pointed his thumb at the back to present what he thought of.

‘They are really amazing’ – said Henry with the cutest voice he could come up with. He added also his cute, snow-white smile. John smiled to him in the same way. Andrew didn’t give up, he walked up to ‘a lucky boy’ and put up the hem of his shirt to have a chance to see that scientific phenomenon once again. The boy only looked back over his shoulder and eloquently rolled his eyes. At that moment, Andrew’s eyes narrowed softly, wrinkled, his round glasses in thin frames slightly slid down, and then his eyes widened with shock.

‘Can you see these marks here? They appeared as a result of the interaction of Peter’s skin with the electric discharge – a lightning of the high voltage. As far as I remember from the lectures of professor Lichtenberg, the similar marks can be obtained by the use of the device generated high voltage electricity called an electrophorus.’

When Andrew saw the faces of his friends full of amazement and admiration, he asked:

‘Maybe you would like to take part in the next, remarkable, famous scientific shows of professor Lichtenberg? It appears that they have already been announced and they will take place soon. Göttingen is not a big city, but there are crowds of listeners at professor Lichtenberg’s lectures, they even come from other regions in Germany. His experiments very often end up with loud explosions, sometimes the boom is so huge, that all the dogs nearby start to bark.’

Peter, John, Paul and Henry exclaimed at the same moment: ‘we would like to go for this lecture with pleasure!’

The day of presentations on the subject ‘The imprinted lightning patterns’ finally came. Mikołaj Bogusław Ciechański, a Polish man, who was the supervisor of the University Office of the Machines Models, helped Lichtenberg in preparing the experiments.

The crowds of people came to the lecture, so the group of our young friends had a problem with making their way through the crowd. Nonetheless, they managed to find suitable places to observe the lecture.

Professor Georg Christoph Lichtenberg walked onto the platform, because of his height, and he started stately: ‘during today’s lecture we will find out how and what for we can use a simple physical device – an electrophorus. At the beginning the electrophorus, which is the prototype of the electrostatic machine, used to creating the electrical charges, was being improved by Swedish scientist, Wilcke, and described by him in 1761. However, it became famous thanks to Alessandro Volta from Italy. This device consists of a resin cake, put inside a metal, earthed bowl. To create and separate the charges, the electrophorus has to be chafed. And I use also my cat for this chafing, with ‘huge benefit’: ‘I put it on the isolated table, I chafe it a little, and I touch it with the disc of a small electrophorus, which very often creates the sparks as long as $\frac{3}{4}$ inch’.

To conduct our experiment in a traditional way we have to act as follows: ‘we put the isolated, metal plate on the charged resin cake and we earth it. When the earth is removed, the metal plate is elevated, and a person conducting this exercise might obtain a spark from it and can repeat it many times.’

After this explanation Lichtenberg told how conducting these experiments he managed unexpectedly get on resin cake the mysterious patterns. ‘I followed the principle: “one has to do something new in order to see something new”. So, if I was interested in electrophorus, I built several ones, the biggest one with the diameter of around 2 meters. Then, I started to repeat the experiments with discharging electrophorus and because my laboratory was full of dust, I was able to observe an unusual phenomenon: at the area on the resin cake, where were the electric discharges, the dust formed specific, mysterious figures – in fact two types of figures created by two types of electricity (positive and negative). In fact, I was really lucky!...’

References

- Hewitt P. G., *Fizyka wokół nas*, Wydawnictwo Naukowe PWN, Warszawa 2010
http://de.wikipedia.org/wiki/Georg_Christoph_Lichtenberg
<http://www.br.de/radio/bayern2/sendungen/radiotexte-am-dienstag/georg-christoph-lichtenberg102.html>
 Turlo J. (ed.), *Eksperymenty historyczne w nauczaniu fizyki*, Top Kurier, Toruń 2001
 Zatorski T., *Georg Christoph Lichtenberg: Pochwała wątpienia*, Wydawnictwo słowo/obraz terytoria, Gdańsk 2005

Story: Mysterious patterns of Lichtenberg was edited by Jozefina Turlo and is based, in part on **Historical Background: Electrophorus** written by Peter Heering and on **Biography: George Christoph Lichtenberg** written by Dawid Basak.

Story: Mysterious patterns of Lichtenberg was written by Dawid Basak and Jozefina Turlo with the support by the European Commission (project 518094-LLP-1-2011-1-GR-COMENIUS-CMP) and Institution, Country. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.