Kovács, László (Ed)

ZEMPLÉN

The Scientist and the Teacher

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Contents

Introduction

In the series published by the Department we have already presented the biographies of Hungarian physicists who left the country and worked elsewhere in the western world. This time we wish to introduce the public to physicists who stayed and worked in Hungary. We intend to write about the physicists who are buried in Hungary not because their remains have been brought home from the USA or Germany, but because they were not only born in this country, but also worked and died here.

The first physicist to be introduced is Zemplén, Győző, the world famous researcher of hydrodynamics, a modern university professor. His life was abruptly ended by World War I., therefore we elaborate on the circumstances of his death at length.

Having been organising physics competitions for secondary school pupils, experiment demonstrations and trainings for physics teachers for 34 years now, the Secondary Grammar School Batthyány Lajos, Nagykanizsa, has set an example for all of us in keeping Zemplén's memory alive.

Besides presenting Zemplén's work and oeuvre from several aspects, we also give the reader an idea of how the physics competitions are organised. The volume is rounded off by the brief introduction of a few Hungarian scientists from the 19th and the 20th century.

Kovács, László

Scientist and Teacher ZEMPLÉN, GYŐZŐ[1]

Balogh, László-Grédics, Gyula-Kovács, László

Theoretical physicist and renowned professor of the motions of liquids, gases and of electric fields, Zemplén, Győző was born one hundred years ago. The turn of the twentieth century saw the far-reaching revolution of modern physics taking place and this is also the period when Zemplén lived and worked. Responding to all the subtle quivers of this ever-changing period, Zemplén, Győző showed extraordinary talent and untiring perseverance in his pursuit to push human knowledge beyond its limits and to enrich his country and the scientific world.

Attesting to his versatile personality, he set himself wide-ranging tasks in scientific research, teaching and public life alike. In order to depict both his work and his human grandness and the greatness of his mind, we had to go into relevant contemporary publications including the almanacs and yearbooks of the University of Budapest and the Technical University of Budapest, his published books and the obituaries written on his death. Only two publications [1, 2] have been issued so far on Zemplén's life, which we also resorted to when introducing Zemplén, Győző, the great son of Nagykanizsa.

Years of study (1879-1900)

Zemplén, Győző was born on 17 October, 1879 in Nagykanizsa. He was four when his family moved to the port Fiume2, Croatia. The lively commotion of the streets made a huge impression on the quick-witted child, developing his keen eyes and observation capacity. His mother taught him the three Rs herself. As demanded by the traditions of the family with a background of Hungarian civil servants, his mother raised him with strict consistency, so Zemplén grew up with a desire to fulfil his duties, and came to like work, to be industrious and ambitious. He graduated from secondary school in Fiume with flying colours.

In 1896 he was admitted to the prestigious Eötvös József College as a freshman at the Faculty of Arts of the University of Budapest. The immensely talented student commenced his scientific career at a rather early stage of his university studies. Zemplén was nineteen when he earned the Pasquich Prize with his paper 'On the Viscosity of Gases'. Later the Faculty of Arts commissioned him to apply his own new method to study the viscosity of gases. For his paper on the measurements carried out the university awarded him the Than Prize in 1901. Zemplén, Győző possessed an in-depth mathematical knowledge necessary to do research in theoretical physics. The scientific journal Mathematikai és Physikai Lapok published several of his papers on algebra and number theory, written as an undergraduate. As a fourth year university student Zemplén challenged the arguments of the English physicist Burbury, spelled out in Burbury's book on the kinetic gas theory, by publishing an article in the German physical journal Annalen der Physik (Über die Grundhypothesen der kinetischen Gastheorie-On the fundamental principles of the kinetic gas theory, 1900). Burbury first gave a blank refusal to the comments of the young physicist, but later he made public amends for this by discussing the principles of the kinetic gas theory entirely in Zemplén's sense in the second edition of his book.

The start of a career (1900-1904)

Zemplén graduated from university in 1900 and stayed there as a research assistant till 1902. His paper 'On experimental measuring; examination of the viscosity of gases, applying an experimental methods' earned him a doctorate in humanities in 1901, and obtained from the University Board his doctoral degree sub auspiciis regis in 1902.

Zemplén, Győző was a man of driving ambition, aspiring – in the best sense of the word. At the turn of the century the title 'royal doctor', (today's title 'doctor with a golden ring', sub auspiciis popularis) was established for students achieving an excellent performance both throughout their university studies and at their doctoral examination. When the news came out on the new title, Zemplén wrote the following in his diary - 'I shall get it for myself'. Before long, he did so indeed.

As an assistant lecturer he became the assistant of Eötvös, Loránd in 1902 at the Institute for Natural Sciences. Out of all students, he was the dearest one to Eötvös. Zemplén learned from his great professor how to use his huge potentials and how to pursue scientific objectives relentlessly. He acquired the minute tricks of precise scientific work, taking meticulous care in carrying out experiments. He was also able to acquire the rare gift of combining theoretical and practical work, and got the invaluable ability of painstaking and profound analysis under his belt. Zemplén held Eötvös in deep, genuine affection and great respect. He was sent to study abroad on Eötvös's recommendation, first to Götting and then to Paris (1904–1905).

The theoretical and experimental physicist (1904-1912)

His visit to Götting kindled Zemplén's interest in the so-called non-continuous phenomena, shock waves and the theory of breaking phenomena. This area of physics demands an in-depth mathematical knowledge, since the issue is closely related to solutions of non-linear equations of hydro-dynamics, where terms raised to a higher power can not be ignored, that is the approach to operate with waves of small amplitude is no use. With his new, variation principle, Zemplén was able to discuss continuous currents and shock waves in a unified fashion. It was in the mathematics seminar of the German professor Felix Klein that he tried to give a solution to the problem above in public. The world famous mathematician found Zemplén's presentation so fascinating that he invited Zemplén to contribute to Klein's encyclopaedia, the Encyclopaedia of Mathematical Sciences (Enzyklopädie der mathematischen Wissenschaften) and asked the young Hungarian scientist, then 25, to write the chapter on the non-continuous motions of liquids. Zemplén, Győző delivered such a superb paper that hinged the doors of the scientific world open and earned kudos for him. Zemplén achieved an outstanding performance in the theories of explosion-like processes and shock waves, where a great number of established professors had failed before him. Having arrived home from Götting he got married and his wife accompanied him in Paris, where he continued to go into the theory of shock waves. Zemplén made considerable contributions to the scientific debate among Hugionot, Raleigh, Weber, et al., which was sparked by a paper by Riemann. The problems identified in the debate were finally tackled by Zemplén's paper presented at the University of Paris. (L' impossibilité des ondes de choc négatives dans les gaz; The impossibility of rarefying shock waves in gases, Comptes Rendus, Paris, 1905.) Zemplén's crucial idea was to apply the second law of thermodynamics to shock waves in lieu of the energy conservation law, and this is how he arrived to the right conclusion in his investigations.

'The impossibility of rarefying shock waves can not possibly follow from the first law of thermodynamics, the law of the conservation of energy, as H. Weber insists on it, but from the second law, the Carnot-Clausius's statement. It seems also rather clear that the first law can not set the direction of phenomena, that can only be set by a principle with an unequal sign,' Zemplén pointed out in his paper 'On the theory of shock waves' published in the scientific journal Mathematikai és Physikai Lapok in 1912.

Zemplén, Győző was successful in proving the impossibility of 'rarefying shock waves'. The outcome of his investigation went down in history as Zemplén's law stipulating that shock waves in hydro-dynamics can be compressive waves only, 'that is, any sudden change in the flow of a gas, a shock wave can only be of compressing nature' therefore the wave can travel towards the rarer gas layers only.

The deep theoretical background of his train of thoughts and the significance, general applicability of his discovery is amply demonstrated by the fact that Zemplén's law is made good use of by current research into plasma physics. Returning home from his study trip, Zemplén was Eötvös's assistant again, and was keen to continue his experiments on the viscosity of gases and on non-continuous phenomena. Later he expanded his results on electrodynamics, too.

In acknowledgement of his scientific merits and work, Zemplén, then 26, he was appointed honorary lecturer of the University of Budapest in 1905, and the honorary lecturer of the Technical University of Budapest in 1907. In 1908 he became a member of the Hungarian Academy of Sciences. In 1911 The Academy awarded the Rózsay Prize to his latest paper 'On the viscosity of gases', in which he explained the theoretical background of his latest measuring method.

The professor of the Technical University (1912-1914)

The council of the Technical University established a department of theoretical physics in 1912 for the internationally renowned scientist, making Zemplén head of department. (The fact that the position has been vacant ever since is a clear testimony to the gesture, namely that it was established to honour Zemplén only.) Being a professor at the Technical University, Zemplén, Győző "achieved the goal he has pursued with great perseverance since his childhood, the goal which made his turn down lucrative offers, although his large family and the tight finances of Hungarian scientists must have been rather tempting. He is now in a position to devote himself fully to the spreading of knowledge by the magic of the spoken word and his charismatic personality, and by the prestige of professorship. He can now turn entirely to the noble art of teaching to infiltrate the hunger for knowledge and his passion for science into the coming generations of our youth.' (Söpkéz, Sándor: To the Memory of Zemplén, Győző. Journal of Natural Sciences, 21st-22nd joint issue, 1916)

Besides being a fruitful researcher, we should also remember his considerable teaching and public activities. His honest personality came best through his lessons. He was an excellent professor with impressive theoretical knowledge, resourceful researcher, fascinating and inspiring lecturer, a clear writer and amicable person.

Let us give the reader a brief chronological overview of his teaching career:

1902-04 assistant lecturer of Eötvös in the Institute for Natural Sciences

1904 leaves Hungary for a study trip. (after returning home) on 16 March, 1905 he was habilitated as the honorary lecturer of mechanics and thermodynamics at the University of Budapest, while he continues to work as the assistant lecturer of the Institute for Physics, lecturer of natural sciences.

Between 13 December, 1907 and 1912 – honorary lecturer at the Technical University and also:

Teacher of the Training Institute for Secondary School Teachers from 1908 on.

Between 25 May, 1912 and the summer of 1914 when he joined the army he was the public and appointed lecturer of the Technical University.

It seems worthwhile to mention at least a few of the titles of the many, one- or two-semester -lectures, he held at the Technical University:

The principles of analytical mechanics; Experiments to accompany the introduction of the notion force; Hydro-dynamics; Heat theory; Thermo-dynamics with a special view to its applications; Kinetic gas theory; Light theory; Experimental and practical physics for engineers; The theory of leading alternating current to distant places; Theory of potentials with a view to the theories of electricity and magnetism; The theory of electric waves with a view to wireless telegraphy; the theory of electric and magnetic fields.

These wide-ranging titles attest to Zemplén's versatile personality. At the beginning of the twentieth century he was the most modern physicist in Budapest keeping up with the cutting edge of science. Once he fully understood the latest results and theories, he immediately passed his knowledge, the latest approaches and views on to his students. He was the first to teach statistical mechanics at the University, it was him who introduced Maxwell's electro-dynamics to replace the laws on speed dependent forces causing interaction between charges at a distance, an idea favoured by Eötvös. In his lectures at the Academy, at the Society for Natural Sciences, at the Society for Mathematical and Physical Sciences and at the public academy Szabad Líceum, he was also trying to spread the notion of the electro-magnetic field, spell out the fundamental principles of the theory of relativity and point out the latest results of modern physics. He was not only spreading the vast knowledge he learnt abroad, he himself though about the problem at the root of the relativity theory, namely whether the travelling speed of light is affected by the motions of the source of the light, or not. His lecture explaining his measuring experiment to verify the theory of relativity was met with great acclaim at the Academy.

Besides his scientific work, his articles, books and lectures are also considerable contributions made to science. His 'Electricity and its practical applications' (1910) was a textbook unmatched even in contemporary international literature. He translated Mme Curie's 'Investigations of radioactive substances' (1906). Zemplén himself wrote a book titled 'On the radioactive behaviour of bodies' (1905) to popularise the issue. The book earned him a Bugát Prize in 1905.

He published countless papers and articles disseminating scientific knowledge in both Hungarian and international scientific journals and magazines.

Memberships in various societies gave him the opportunity to teach the general public and introduce the latest achievements of physics.

He was a member of the Society for Natural Sciences since 1898 and a member of the elections panel up until his death. He was also impressively active in the fore-runner of today's Eötvös Loránd Physics Society, in the Society for Mathematical and Physical Sciences, founded by Eötvös. In 1914 he was elected managing secretary, and became the ex officio editor of the society's journal. His activities and work gave a fresh impetus to the Society's life; the number of the members considerably rose at the time. Zemplén reorganised the society journal, made it more varied and particularly valuably papers were published while he was the editor of the column Physics Laboratory. From 1907 he was responsible for taking the minutes at the Hungarian Scientific Society Urania, from 1910 Zemplén was the secretary of the Society for Higher Education. Zemplén was also a member of the Hungarian Philosophy Society, the National Society of Secondary School Teachers, the Association of Hungarian Engineers and Architects, the Hungarian Society for Electrotechnics, the Physics Society in Germany and France (Deutsche Physikalische Gesellschaft, Société Francaise de

Physique), a founding member of the Athletics and Football Club of the Technical University. Besides all this, he also participated in various committees of the Academy.

He was a genuine and committed teacher and chairman of the Assisting Association of the Technical University, an enthusiastic friend and leader of the students who always found the time to listen to them and help tackle their problems whether minor or major. At the same time, however, he did sterling and arduous work yielding great results in solving the thorniest issues of modern physics, lying often quite far from one another.

Zemplén, Győző's attention was not confined to the affairs of higher education; he had a keen interest also in the state of teaching physics in secondary schools. At a 1912 general assembly of the National Society of Secondary School Teachers he delivered a lecture titled 'On the reform of teaching physics'.1 It is noteworthy that his lecture on the modernisation of the methods and the subject matter of teaching physics is still a topical issue and its observations are still valid. '...What and how shall we teach? ... I firmly believe that the entire reform process should take place in the spirit of ensuring freedom in teaching, the least a teacher is bound by curricula, regulations and central instructions, the more successful his teaching will be. Let us not look on the teacher as an instrument one needs to check upon and control all the time, we should allow more room for the development of his personality. Our concerted efforts to constantly improve our teacher training system and the honesty of our fellow teachers guarantee that our optimism shall not backfire on us. ... the ultimate objective of teaching physics is promoting a sound physical thinking and not merely tackling a list of topics. At examinations pupils should, therefore, give evidence of their clear, physical thinking.'

He proposed that a physics reform committee should be set up and demanded a root-and-branch reform to teaching physics in secondary schools. The general assembly of the Teachers' Society did indeed set up a reform committee and Zemplén was also a member.

He made invaluable contributions to the training of secondary school physics teachers by holding series of lectures in the summer holidays. He was renowned and acknowledged in the scientific world, was respected as a teacher. His public work earned him the admiration of his colleagues and fellows, which is aptly demonstrated by the great number of prizes and awards he received both in Hungary and abroad. He represented Hungarian scientists at international conferences.

His participation in World War I and his death (1914–1916)

The summer of 1914 saw the outbreak of World War I and Zemplén, Győző did not hesitate to join the army as an artillery lieutenant, leaving his wife, five little children, his department and his passion, the science. The Technical University requested that he be exempted from military service so that science could regain a most committed worker. Zemplén, however, chose to stay as he did not want to leave the post where his sense of duty sent him. His modesty forbade him to give in and refused to see that the loss he caused to science and education outweighed far the military benefit of his sacrifice, commanded by his manly sense of duty.

His untiring and resourceful spirit allowed him no rest amongst the bodily hardships and privations of the war either. He developed a method to locate the position of the enemy battery by tracing down their sound from three different directions. He reckoned that the War was inescapable, so he did not argue against it. Considering the characteristic features of the period will help one understand that.

In the summer of 1914 he was working on a physics textbook for technicians as commissioned by a Leipzig company. He had written about 50 pages when he was called up to join the army. At first he served at the Serbian front, and then he was responsible for the training of artillery volunteers in the town of Komárom. Later he was moved back to the Serbian front again, and finally as the commander of a battery of mortars (24cm in diameter) he served first at Doberdo, then at Kern. In the spring of 1916 he got severe typhoid fever. He lied ill for weeks in a Klagenfurt isolation hospital. When he recovered, Zemplén joined the great attack launched against the Italians. 'On 26 June, at night he climbed one of the highest points of the Assaiago plateau, Monte Dorole, 1550 metres high, where an artillery observation post was located. Realising that many grenades and bombs were coming from there, the Italians took the whole Monte Dorole under fire on 29 June. In the meantime Zemplén was hiding with his comrades behind the rocks, to move forth only when the fire ceased. All of a sudden an Italian shrapnel came down on him to lay him low. His comrades cleaned and dressed his wounds, and took him to the hospital.1 Zemplén wasn't even 38 when he departed four hours after being shot at. With his death the Hungarian physicist community lost one of its youngest and probably its most brightly talented member, whose spectacular and tremendous success promised an even brighter future, the foundation of which was laid by his insatiable appetite for knowledge, his eminent work and unrivalled power, boosted by his happy family life'. Quotation from Söpkéz, Sándor, as mentioned above.

On Zemplén's death several obituaries were published, and all of them underlined his truly humane qualities and honest personality. The Hungarian scientific community went into deep mourning.

Quotation from Laczkó, Géza (Nyugat, 1917/2.):

"The figure of Zemplén, Győző, whose death is an irrevocable loss not only to the Hungarian but to the European scientific community, is inseparable from the institution where I met him for the very first time, from the Eötvös College, which has already given so many great minds to this country.

The Eötvös College was opened in 1896 and Zemplén was among the first generation of its students. Zemplén was a slim boy from Fiume, with a brown face, sparkling black eyes, whose spirits were always high, who was always ready to make a joke, and whose quick wit was combined with an air of daring easiness. He was born in Nagykanizsa in 1879, but his family moved to Fiume when he was only four and it seems as if he had taken the vivid rush of the streets, the depth of the sea, the serenity of the blue sky and the wildness of the sun with him. The deep thinker, the serene man with a hint of sometimes aggressive wildness never changed with the years passing by, though his characteristic features were somewhat softened as he matured. He was naughty as a child who grew up to be a playful and witty man who, on one occasion, shouted up to the National Theatre's stage to Plautus's penny-pincher not to whine for his money-bag – it is behind the bush. And on another occasion swam across the River Danube between Nagymaros and Visegrád on a sunny October afternoon, although by that time he was the head of a family, that of a university department, a member of the Academy. Zemplén was a man of driving ambition bubbling over with vitality, a genuinely talented man with all the superb qualities Jókai made up for his heroes.'

Quotation from the Journal of the Association of Hungarian Engineers and Architects (1916):

'The blind strike of the war inflicted a wound upon the Hungarian scientific community, one beyond repair. On 29 June, 1916 a stray bullet took a tragic toll killing Zemplén, Győző, a man of great valour and true passion for science. We lost a genuine scientist, a manly Hungarian and an honest person. With an impressively superb and thorough knowledge, Zemplén was a disarmingly charming person, a fascinating lecturer, a brilliant writer, a researcher of exceptionally clear vision. His private life was respectable and commendable. He lived amongst us as the budding promise of the future that shall yield a hundredfold crop. In spite of his young age he had already been awarded all the honours due for eminent knowledge and extraordinary achievements. His sudden disappearance from the scientific stage wreaked havoc on vast intellectual achievements.'

Zemplén, Győző was 37 when a senseless war killed him. He could have made substantial contributions to the spiralling revolution of modern physics. His oeuvre is and stays now for ever unfinished, though countless new problems and their solutions awaited the committed scientist. His fruitful work carried out in various fields of mathematics and physics, his discussions filling volumes, wide-ranging scientific, public and pedagogical work attest to his greatness. We remember and pay tribute to Zemplén, Győző and his scientific achievements on the centenary of his birth. Posterity will remember him as a truly great man, a model of values to follow.

References

1. Abonyi Iván: Zemplén Győző, Fizikai Szemle, 16, 289, (1966/10).
2. Kovács László: Zemplén Győző élete és munkássága, Városi Tanács Híradója, Nagykanizsa, 1974/1.

Bibliography

1899

1. Elemi tétel az egész számok felosztásáról, Math. Phys. Lapok 8. 135-137.

1900

2. Über die Grundhypothesen der kinetischen Gastheorie, Annalen der Physik IV. 3. 761-763.
3. Tétel a szabályos csillagszögekről, Math. Phys. Lapok 9. 53-62.
4. Adalék az interpoláczió és a parciális törtek elméletéhez, Math. Phys. Lapok 9. 386-404.

1901

5. Próbamérések a gázok belső súrlódásának egy új kísérleti módszerrel való megvizsgálásához, I. Math. Phys. Lapok. 10. 300-308, II. Math. Phys. Lapok 10. 375-401. III. Math. Phys. Lapok 10. 375-401.
6. A kinetikai gázelmélet alaphipotéziseiről, I. Math. Phys. Lapok 10. 98-107, II. Math. Phys. Lapok 10. 172-182.

1902

7. Az algebrai egész alakok elméletének egyik alaptétele, Math. Phys. Lapok 9. 1-6.
8. Az oszthatóság algebrai génusztartományokban, Math. Phys. Lapok 9. 7-27.
9. A legnagyobb energiaforgalom elvéről, Math. Phys. Lapok 9. 318-336.

1903

10. Über die Energieumsatz in der Mechanik, Annalen der Physik IV. 10. 419-428.
11. Über die Anwendung der mechanischen Prinzipe auf reibende Bewegungen, Annalen der Physik IV. 12. 356-372 (Berichtigungen …, ibid. 13. 216. (1904)]
12. A mechanikai elvek alkalmazása súrlódással történő mozgásokra, I. Math. Phys. Lapok 9. 128-135, II. Math. Phys. Lapok 9. 162-187.
13. A mechanikai elvek alkalmazása súrlódással történő mozgásokra, Math. Phys. Lapok 9. 275-281.
14. A legnagyobb energiaforgalom elvéről, Math. Phys. Lapok. 9. 372-382.

1904

15. A grafikus interpolációról, Math. Phys. Lapok 13. 96-110.
16. Über den Energieumsatz in der Mechanik, Annalen der Physik IV. 3. 840-847.

1905

17. A gázok belső súrlódási együtthatójának kísérleti módszerrel való meghatározása, Math. Termtud. Ért. 23. 561-581.
18. A folyadékokban végbemenő nem folytonos mozgásról, Math. Phys. Lapok. 14. 361-390.
19. **L'impossibilité des ondes de choc négatives dans les gaz, Comptes Rendus (Paris) 141. 710.**
20. **Besondere Ausführungen über unstetige Bewegungen in Flüssigkeiten Encyklopädie der matematischen Wissenschaften, Bd. IV/2 Teil 3. 282-323.**
21. Étude sur l'interpolation des fonctions rationnelles en fractions partielles, Archives de Mathematique et de Physique 8. (13p)
22. Kriterien für die physikalische Bedeutung der unstetigen Lösungen der hydrodynamischen Bewegungsgleichungen, Mathematische Annalen 61. 437-449.
23. A testek radioaktív viselkedéséről, („A természettudományok elemei" című sorozatban jelent meg.) Természettudományi Társulat kiadása, Budapest

1906

24. Curie-Sklodowska: A radioaktív anyagokra vonatkozó vizsgálatok (Budapest, fordítás, Franklin Társulat, 127. 1.)
25. Bestimmung des Koeffizienten der inneren Reibung der Gase nach einer neuen experimentellen Methode, Annalen der Physik IV. 19. 783-806.
26. Kompatibilitätsbedingungen bei Unstetigkeiten in der Elektrodynamik, Mathematische Annalen 62.
27. Nemfolytonos jelenségek az elektrodinamikában, I. Math. Phys. Lapok 15. 342-349, II. Math. Phys. Lapok 15. 376-388, III. Math. Phys. Lapok. 16. 26-53 (1907)
28. A legnagyobb energiaforgalom elvéről, Math. Termtud. Ért. 24. 455-463.
29. Sur l'impossibilité des ondes de choc negatives dans les gaz, Comptes Rendus (Paris) 142
30. A tudomány értéke, Szerda, 1906. I (1): p. 17-23.
31. Tudománykritika, Szerda, 1906. I (6): p. 300-304.

1907

32. Über die Beobachtung von Wechselströmen mit Saiteninstrumenten, Physikalische Zeitschrift 8. 438-439
33. Kompatibilitätsbedingungen bei Unstetigkeiten in der Elektrodynamik II., Mathematische Annalen 63.
34. Az Einthoven-féle galvanométer és alkalmazása a váltakozó áramok mérésére, Math. Phys. Lapok. 16. 255-259.
35. Egyszerű eljárás hősugarak fotografálására, TTK 39. 58-59.
36. Elektromos regisztráló lázhőmérő, TTK 39. 59.
37. A rádium sugárzásának energiája, Természettudományi Lapok 59.
38. A színes fényképezés haladásáról, Uránia 13-13.
39. Nem mágneses elemek mágneses vegyületei, TTK Pótfüzetek 78.
40. A drótnélküli telefon, TTK 39. 205-210.
41. Az elektromos hullámtelegráfia, Kor. 190-196.
42. A légszivattyúról, TTK Pótfüzetek 91-103.
43. Kábelvezetékek a telefon szolgálatában, TTK, 39. 544-546.
44. A fémek sugárzásbeli kifáradásáról, TTK, 39. 641-642.

1908

45. Az emberi fül érzékenysége a magas hangok iránt, TTK, 40. 219-221.
46. A röntgensugarak energiája, TTK Pótfüzetek 15-25.
47. Jegyzetek Poincaré „Tudomány és föltevés” című művének magyar kiadásához, 223-252. Budapest, K.M. Természettudományi Társulat kiadása
48. A drótnélküli telefonálás haladásáról, TTK, 40. 680-684.
49. Izzó elektródok szerepe a gázok elektromos vezetésében, MFL, 17. 39-49.
50. Kis hosszúságváltozások vetítésben való bemutatása, MFL, 17. 50-51.

1909

51. Mai felfogásúak a radioaktív jelenségek mibenlétéről, KML, 16. 121-127.
52. A napfoltok mágneses terei, TTK, 41. 43-44.
53. A hélium folyósítása, TTK, 41. 158-159.
54. A Röntgen-sugarak polárossága, TTK, 41. 323-326.
55. Rendes léghajójáratok Franciaországban, TTK, 41. 492.
56. Poincaré: Tudomány és föltevés, MFTK, 39-41.
57. Untersuchungen über die innere Reibung der Gase, Annalen der Physik IV. 29. 869-908.
58. Vizsgálatok a gázok belső súrlódásáról, Math. Termtud. Ért. 27. 77-137.

1910

59. Az elektromosság és gyakorlati alkalmazásai [Electricity and its Parctical Applications] A kir. Magy. Természettudományi Társulat kiadása, Budapest (683 p.)

60. Magas hőmérsékletek méréséről, TTK, Pótfüzetek 42. 53-55.
61. A Nobel-díj természettudós nyertesei, Marconi és Braun, TTK, 42. 39-42.
62. A drótnélküli telegráf, TTK, 92. 233-257.
63. Sín nélküli elektromos vasút, TTK, 42. 262-263.
64. A fény hőegyenértéke, TTK, 42. 359-360.
65. A Nobel-díjak tudós nyertesei, Marconi és Braun physikusok, BSz 141. 131-135.
66. Ostwald: Nagy emberek című könyve, BSz, 141. 459-469.
67. Wundt: Die prinzipien der mechanischer Naturlehre, MFTK, 137-143.
68. Jelentés az akadémiai nagyjutalomról és a Marczibányi-mellékjutalomról, AÉ 260-265.
69. L'éther et la gravité, Előadás a Bruxellesi Nemzetközi Radiológiai és Villamossági Kongresszuson (sajtóban is megjelent)
70. Előszó Williams Archibald: Korunk találmányai című könyvhöz
71. Jódvegyületek elektromos vezetőképességéről, TTK, 42. 813-814.
72. Új radioaktív anyag: a mezotúrium, TTK, 42. 814-815.
73. Az elektromosság elemi mennyiségéről, TTK, 42. 905-910.
74. Láthatatlan foszforeszkálásról, TTK Pótfüzetek 42. 206-207.

1911

75. Az energia forgalma és szerepe a természettudományokban, TTK, 43. 32-42.
76. A dróttalan telegráf, TTK, 43. 195-196.
77. A hanghullámok hőhatásának kísérleti kimutatása, TTK, 43. 322-323.
78. A képtelegráfia haladásáról, TTK, 43. 425-428.
79. Törvényszerűségek az elemek atomsúlyában és a radioaktivitás, TTK, 43. 572-573.
80. A relativitás elvéről, MFL, 20. 331-347.
81. A napsugarak felhasználása elektromos áram keltésére, TTK, 43. 819-820.
82. Vizsgálatok a gázok belső súrlódásáról, Math. Termtud. Ért. 29. 645- 718.

1912

83. Untersuchungen über die innere Reibung der Gase, II. Versuche bei sehr kleinen und bei sehr grossen Geschwindigkeiten, Annalen der Physik. IV . 38. 71-125.
84. A lökéshullámok elméletéhez, Math. Phys. Lapok. 21. 339-348.
85. Über die Theorie der Stosswellen, Physikalische Zeitschrift 13. 498-501.
86. Megjegyzések az elektromosság és mágnesség tanához, I. Math. Phys. Lapok 21. 161-169.
87. A föld belsejének felkutatása elektromos hullámok segítségével, TTK, 44. 64-65.
88. Wien és Curiené. A Nobel-díjak nyertesei, B.Sz. 149. 133-135.
89. Henri Poincaré, Vasámapi Újság, 30. szám 604 1.

90. A fizikai oktatás reformjáról, [Ont he reform of teaching physics], OKTK, 1912. szeptemberi szám, 41-47. oldal

1913

91. Mi a Röntgen-féle sugár? TTK, 45. 485-495.
92. Max Verivorn: Kausale und konditionelle Weltanschauung, MFTK, 294-296.
93. Kiáramló telített gáz túlhűtése, MMÉEK, 435-436.
94. Schwingungszahl der Röntgenstrahlen und Quantenhypothese, Phys. Zeitschrift 14. 423-424.
95. A röntgensugarak rezgésszáma és az elemi energiaadagok hypotézise, Math. Termtud. Ért. 31. 416-423.

1914

96. A fényforrás mozgásának hatása a fényjelenségekre, Math. Termtud. Ért. 32. 225-246.
97. Vizsgálatok a folyadékok súrlódásáról, (Pogány Bélával) Math. Termtud. Ért. 32. 603-641.
98. Abhängigkeit der Lichtgeschwindigkeit von der Bewegung der Lichtquelle, Physikalische Zeitschrift 15. 534-536.
99. A tér és az idő fogalma a relativitás elvének világításában, TTK, 53. 66. és MFK, 35-51.
100. Kísérlet az erő fogalmának bevezetéséhez, MFL. 53-56.
101. Die Theorie der Strahlung und der Quanten (könyvismertetés), MFL, 23. 164-167.
102. A Nobel-díjak nyertesei: Kamerling-Onnes physikus, B.Sz. 137. 457-460.
103. Lehrbuch der Physik für Ingenieure und Techniker (félbemaradt) Veit u. Co Leipzig 1914

1916

104. Untersuchungen über die innere Reibung von Flüssigkeiten (Innere Reibung und Gleitung tropfbarer Flüssigkeiten) (Pogány Bélával), Annalen der Physik IV. 49. 39-70.

1927

105. Az elektromosság és gyakorlati alkalmazásai [Electricity and its Parctical Applications, second, revised edition, with Béla Pogány, Imre Selmeci Pöschl], második átdolgozott kiadás, A kir. Magy. Természettudományi Társulat kiadása, Budapest (664 p.)

Abbreviations

AÉ:	Akadémiai Értesítő
BSZ:	Budapesti Szemle
KML:	Középiskolai Matematikai Lapok
MFL:	Matematikai és Fizikai Lapok
MFTK:	Magyar Filozófia Társaság Közlönye
MMÉEK:	Magyar Mérnök- és Építész- Egylet Közlönye
OKTK:	Országos Középiskolai Tanáregyesületi Közlöny
TTK:	Természettudományi Közlöny
VU:	Vasárnapi Újság

Documents of Zemplén's Life

8 Via Stefano, Fiume
14 June, 1896

Right Honourable Minister of Education and Religion, Your Excellency,

I, the undersigned [Zemplén, Győző] am herewith most respectfully approaching Your Excellency to be gracefully admitted to the Baron Eötvös, József teacher training institute in Budapest.

I am in a position to support my humble request with the following documents.

A, I passed my matura in the Royal Hungarian Gymnasium in Fiume with excellent results in all subjects, as attested to by document A.

B, Document B is a certificate that my parents are without means and that my father, may he be a civil servant, would not be able to financially support me during my university studies.

C, Document C enclosed is a medical certificate prooving that I am perfectly fit and have no defects or bodily infirmities that would make me less able for becoming a teacher.

D, Document D is my birth certificate. I have been living in Fiume for 12 years, I read and write in Hungarian, Italian, German and French.

I avail myself of the opportunity to mention that if Your Excellency's generosity helps me go on with my studies, I would choose arithmetics and sciences as major subjects and I wish to earn a degree also in Hungarian literature and history as well. This way I would have the opportunity to take my share in the great and noble work of educating Hungarian youth to become useful citizens and I could even make a humble contribution to the intellectual progress of my beloved country.

If I was to come back here in Fiume as a teacher, it would also be a most wonderful task for me. Besides pursuing scientific and academic goals, it is the chief aim of the Hungarian Gymnasium in Fiume to educate the young in Fiume to be good countrymen ardent and consumed with passion for their country. Sharing this duty would mean achieving the very noble aim I set for myself.

I pray that Your Excellency make it possible for my humble self to enter the Baron Eötvös, József teacher training institute in Budapest and thus achieve this noble aim.

I close my letter hoping for Your Excellency's support.

I remain the humble servant of the highly respected and Right Honourable Minister of Education and Religion, yours sincerely,

Zemplén, Győző
graduated student of the Royal Hungarian Gymnasium in Fiume

5 Grosser Str., Götting
6 November, 1904

Dear Mr Director, [Dr. Bartoniek, Géza]

I have already arrived in Götting where all that German science is made. Of course it is like with everything, distance makes the heart go fonder, and great people seem a lot smaller when one takes a close look at them in person.

The lectures here aren't worth too much but I should think the seminars will live up to my expectations and also I think quite high of their exclusive Mathematical Soceity and their Physical Society. Each has members of up to 30 university professors who have a meeting once a week where the latest achievements are presented and discussed. Apart from the members, only their personally invited guests may take part in the meetings. I have already contacted my professors, Voigt, Riecke, Klein, Hilbert and Minkovski and provided them with copies of my papers (the ones written in German, of course) and they immediately invited me to both Societies. The scientific side is rather strong but the people themselves are more than boring, not sociable at all. The physicists are awful and the mathematicians are even worse except for prof. Klein, who is so very much pre-occupied with admiring himself that he is almost physically sick when he has to listen to someone else.

The lectures have been elaborated and published in writing, and one can have access to them, so I'll make sure that I get Klein lectures on didactics. I came here at a rather fortunate time, as they want to direct both mathematics and physics towards the more concrete sciences so that they are not just intellectual games with ideas and notions as before. The movement was initiated by Klein and now all the mathematicians are dealing with theoretical physics, the theory of solids and technical physics. When Hilbert got to see my papers in this respect, he cried out aloud in glee as this is exactly the direction they intend to move German youth who have neither the inclination nor the talent for concrete and practical things, and demanded that I hold a lecture for their Society on the Ostwald principle, which seems rather popular over here.

The laboratory in rather tight although it has many wonderful instruments. In the beginning I couldn't get to working as the assistant got ill and the institute was in a complete mess. But now things are getting back to normal and the mechanical is also preparing things necessary to the experiments. Voigt is a most kind person, and Riecke, too, I should think I will learn from them something that the mathematicians themselves are learning right now, i.e. physics. [...]

Hoping that I did not disturb you with my letter, I remain the grateful student of my honoured Director,

Zemplén Győző

Götting
10 June, 1905

Your Excellency, [Prof. Eötvös, Loránd]

In Paris we are approaching the end the scientific season. Since the hard-working Germans defy the scorching heat of the sun and work till mid August, I chose to return to Götting, where the summer term began just about a month ago.

Considering the heights of scientific life in Paris, I didn't even dare to think of getting into such a close contact with the professors there as here, but I still managed to get to know a few physicists and mathematicians. In the physical society I often met the old professor Amagat, Guillaumme, Benoît and Mathias. And I also had the opportunity to meet Madame Curie. I saw a number of rather fascinating instruments at the Eastern exhibition of the Society. [...]

In the meantime I have received the printer's proof sheet of the article I wrote for the Encyklopädie. I took it to Hadamard who, as I assumed, was the only man who could possibly have been interested in it. Hadamard read it and thought about it carefully and gave even a few tips promising to introduce me to a few mathematicians. This is how I met Poincare, and even though we are barely acquinted, of course, but now at least no-one could blame me for going to Paris without meeting at least Poincare. [...]

With the profoundest gratitude, I remain your respectful student,

Zemplén Győző

Nobel laureate Lénárd, Fülöp wrote as follows to Eötvös Loránd from Heidelberg on 9 October, 1913:

[...]

This summer I was going to travel to Budapest to see you, which made me more than happy. Unfortunately, my little son fell ill, which prevented me from doing so. I would have liked to see also Fröhlich and Zemplén.

[...]

Klagenfurt,
26th September, 1915

Your excellency, [Prof. Eötvös, Loránd]

Your Excellency was too kind to bring me exceptionally good news and what I can see from the gay and merry tone of your well-composed letter is that Your Excellency is rather well, which is great news to me. Yesterday, on receiving the letter from Your Excellency I had a day of doubled joy as it was then that I was allowed to leave my bed and I spent almost an hour walking on the sunny paths of the hospital garden. Today I am allowed to be up and about all day but unfortunately it's raining at present and I'm confined to sit in my room. Indeed, I was rather upset about getting ill right now and that I had to leave my excellent watching post amidst the most interesting fightings, I even bewailed it. I solemnly swear to do everything to get back there. Should I make it to Pest for a few weeks, I'll be only too pleased to enter the treadmill again, it will be something of a change for me. I'm glad to hear that Rybár has became a private teacher, he is a very good and agreeable young man, it's a pity that he is not a soldier. I wish that the cheerful serenity glowing from the letter of Your Excellency be with you for ever.

Remaining the respectful student of Your Excellency with the profoundest gratitude,

Zemplén Győző

As Written by Dr. Leopold Strauss,
The Regiment's Last Chief Medical Officer

From Sauer, Heinrich Oberst (a.D.), Linzer Hessen - Geschichte des k.u.k.Infantriereregimentes Ernst Ludwig Grossherzog von Hessen und bei Rhein Nr 114 und der Traditionstraeger. Linz on the Danube, xx, DXCII pp. Hessen Offizierbund, 1937; Chapter 'The Army Medical Service of the Imperial and Royal 14th Infantry Regiment', pp 460-480, trans., Jean Main1, 2002

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This account by Dr. Leopold Strauss forms a Chapter in the book 'Linzer Hessen' by Colonel (Rtd.) Heinrich Sauer published by the Hessen Offiziersbund, Linz on the Danube, 1937. (N.B. Maps of the region are available from Jean Main if required).

(In 1916) „However Monte Cimone was conquered by the Regiment which continued southwards and descended from a height of 1240 m above sea level to Arsiera at 320 m. A few days earlier the Regiment had still camped among the snow and now it suffered in Italy's June heat and this had a debilitating effect on the men. As well the food supplies could only reach them irregularly as the enemy had positioned artillery close-by and covered all entrances to the town with well- aimed fire.

Cold rain followed soon after these very hot days. The men were constantly involved in heavy fighting and had to bivouac in the open air. It is therefore not surprising that gastric diseases made their appearance. In most cases these proved to be ordinary but heavy gastric attacks but typhoid and dysentery also occurred.

These gastric diseases forced us to open larger Convalescent Depots for which the town had numerous buildings. Of course the town was subject to artillery fire at all times which forced us to move the hospitals from time to time but there was plenty of material to run the hospitals in accordance with the rules of hygiene. Men would be admitted quite dirty from the fighting in the offensive but we had the means to clean them up and to provide them with fresh underwear out of the town's stock. We were fortunate to have plenty of soap of German origin. Sick rooms were disinfected several times a day and so were the latrines as there were large supplies of Lysol and lime among the stores abandoned by the enemy.

The ready availability of mattresses and bed linen in the town enabled us to provide good clean beds for all wounded and sick. To get around the necessity of disinfecting these when evacuating our patients to the Divisional Medical Column we sent them along with their bed and bedding or at least their blankets and sheets.

That in this way we managed to incorporate into our own stock a large amount of the enemy's linen supplies could not have been of detriment to him. Of great benefit to us was also the huge amount of dressings that fell into our hands in Arsiero. The Regiment acquired a very large stock of these and was able to pass on large amounts to the Divisional Medical Column.

Unfortunately the location of the Dressing Station in Arsiero suffered greatly from the enemy's artillery fire. The enemy overlooked the entire basin of Arsiero and commanded it completely with his artillery, especially with the fearsome batteries at Schiri. Every dressing station was a target. At the dressing station in Maso a grenade destroyed the entire medical supplies. That the firing upon the dressing stations did not cause a blood bath was entirely due to luck.

One thing however has to be acknowledged in favour of the enemy - they never fired at the stretcher bearers while they were carrying the wounded on foot from the line all the way to Maso and Arsiero and this despite the fact that whenever and wherever one of our soldiers became visible he would be shot at unmercifully.

According to orders the wounded and sick were to be evacuated over Monte Cimone. Well, we had walked across this mountain and knew that it would need eight stretcher-bearers and a full day and much hard labour to move a single patient across this terrain and to use carts was quite impossible. We were aware of a good road that went from Arsiero via the valley of the Astach to the town of Pedescala, and so Dr. Bochskani decided, contrary to his orders, to evacuate the sick and wounded by way of the Astach valley.

This independent action saved much labour and made the evacuation shorter and far less strenuous. The higher command was miffed over this "independent move" but this did not last long and gave way to admiration for this decision. Admittedly the route had a spot that was not quite safe as in an open area the ambulances and carts had to pass within 600 paces of the enemy's line. At first the enemy had unsuccessfully shot shrapnel at the vehicles but soon allowed their free passage, in fact they assisted with the transfer of the wounded and sick by regularly providing floodlights.

During our time at Arsiero the medical service was provided with a small field cart drawn by a team of dogs (system Countess Hadik) that proved invaluable then and later for the fast and inconspicuous evacuation of the seriously wounded. A pre-condition for its use was a good path or road with a moderate gradient. For steep gradients on mountain roads even the strongest dogs proved to be too weak.

On 24 June the Regiment's line was withdrawn to the heights north of Arsiero. The men had been much weakened by the toil of the offensive and went into a rest area near Serrada and San Sebastiano. From a medical standpoint one can look back on this with considerable satisfaction. Our first duty was the cleaning up of the villages themselves that were found in a most unsanitary state for during the deployment of troops for the offensive they had served as temporary quarters for the most diverse of units.

The hard work of the men and the circumspection of the officers made it possible that after three days of scrubbing, washing and burying of rubbish, the two villages were unrecognizable. Within those few days they were transformed from disease-ridden filthy holes into welcoming mountain villages where it was a pleasure to be, both for body and soul. As there was a very effective bathing and delousing station at nearby Folgaria as well as a steam laundry, it did not take long for each man to have clean underwear and linen and to be free of vermin.

Certainly in the beginning there were numerous sick as many bowel infections had been brought along from Italy and at first the two villages had to be cleared of sources of infection. Soon under the influence of sanitary measures, good and regular food, and not the least under the influence of the wonderful summer weather in the mountains, all traces of illness disappeared. One could hear from the happy yodelling within sight of Lornetto and Filadonna (Evidently two mountains) and the wonderful homeland songs that rose to the azure blue sky how healthy and happy the men were.

Another good influence for the health of the troops was that, under direction of the Ministry of Economics, the men were engaged in farm work on the alpine meadows and in the somewhat sparse fields - work that was not too arduous. The men followed their normal farming occupations with joy and zeal and for a while were able to forget the horrible and unforgiving war. And that, I believe, from the point of view of a medical officer was very beneficial.

When the Regiment returned to the frontline in July it was ready in every way and in good health. The trench warfare that followed had the peculiarity that the Battalions were used as individual fighting units and geographically widely dispersed. Every terrain had its oddities even for the medical service."

[...]

„The garrison in the Zevio-Assa area was able to use an efficient bathing and delousing station at Ghertele. This station was however geographically remote and lost its significance as no clean underwear was available. After bathing the men had to again dress in their old dirty underwear and this made a mockery of the delousing process.

During the following trench warfare in the sectors Monte Dorole and Monte Rasta the Battalion was accommodated under hygienic conditions almost like their colleagues in the valley of the Astach. Of course the lack of water was an annoying difficulty that had to be overcome by the use of a cable car and pack animals.

Suddenly the Regiment was torn out of these favourable conditions in their beloved Tyrolean mountains to be transferred to Austria's most notorious front, the Isonzo, to make further bloody sacrifices.

The deployment areas to the battlefields of the Isonzo were different to those in Tyrol. We missed the beautiful scenery of the valley of the Wippach and the careful order and cleanliness of the military accommodation that we had become used to in the Tyrol. We knew that after experiencing the war for a number of years that these were the best means of protection against infectious diseases. We saw with surprise that it was not a matter of course to dig latrines for encamped troops. Perhaps the terrible bloody losses in the battles of the lsonzo made the losses through disease seem insignificant and therefore not Much effort and understanding was given to this. Perhaps this was the reason but for us this was new."

On the Reform of Teaching Education[1]

Zemplén, Győző

Ladies and Gentlemen, esteemed Assembly!

Honoured with you attention, please allow me to touch upon the teaching of physics, one of the most important components of secondary education. Enshrined in our hearts, the future of the nation is most dear to us all, therefore we take meticulous care to ensure that the dearest treasure of the nation, our youth receive the most modern and up-to-date education available, where the particular subjects take their due share as demanded by real life and the state of affairs of the particular field of science.

I'm not suggesting that our secondary education should follow the ephemeral fads of scientific trends; I would even argue that a certain degree of conservatism is of key significance for secondary school. Yet, it is beyond doubt that fundamental changes leaving their footprints behind in scientific history, and dramatically transforming the life of the society can by no means be ignored by secondary education.

I do not think I should be rebuked for being biased if I say that physics plays a pivotal role in today's general scientific development not only because physics itself as a detailed field of science has most recently been enriched with new and unexpected findings but also because other fields of science tend to rely more and more heavily on the results and methods of physics with a rather solid basis. And that should not include sciences only, which these days are all based on physics, but arts and humanities as well. I am not a man of the exaggerations demanding almost a carte blanche for various notions of physics, energy for instance, valid for all sciences. However, it seems certain that we can not ignore the great forces causing huge transformation on inanimate material in the world of animate beings and in the spiritual world either. Indeed, the fittest remedy against the hasty encroachments of the methods of physics and against sweeping overgeneralisations is developing and promoting a profound understanding of the notions of physics.

I don' think there's a need for me to prove what we owe to physics in practical and industrial life alike; these days, when physicians can literally see through us, when liners take dailies with news from overseas and at times, when Daedalus's dreams have come true.

It seems highly unlikely therefore that anybody should question the ultimate need to arrive at the most successful physical education in our secondary schools.

On the contrary I dare to say, and I am sure my learned colleagues shall agree with me, that it is exactly the teaching of physics that is the least fruitful out of all the subjects in secondary education. I'm neither the first nor the only one to stand up to say this. Let me support my claims with facts from first-hand experience.

I have had the opportunity for eleven years to contribute to the education and training of future teachers. We all know that the laboratory is the only place where the educator can gain most insights into the frame of mind of his pupils and where it soon turns out whether the pupil has acquired the genuine understanding of what he has learned in secondary school. All those, whom I had the privilege to introduce to investigatory methods of the laboratory and of whom many are with us today, can attest to my pursuit of an intensive and intimate intellectual relationship between me and my pupils. My judgements shall not be a shallow or snap one. Such experience has brought me to believe that pupils' knowledge of physics, graduating from secondary school, is not commensurate with neither their hard work nor with the respectable effort of keen teachers, made in teaching physics. One meets hardly any among the best pupils who got physics under his belt so that he can actually apply his knowledge when conducting relatively simple experiments. The pupil does not absorb physical arguments thoroughly enough to arrive at an intellectual capital at their fingertips, ready to use.

Let us compare average performance achieved in mathematics and physics. Secondary school pupils have so well acquired the mathematical curricula that they can follow university lectures on higher arithmetics without any problems whatsoever, as the said knowledge is assumed to be the rudiments of the science. That the new hopeful generation of mathematicians was able to raise the interest of the highest scientific circles is a clear testimony to their well-founded mathematical background.

But would it be at all possible to hold successful college seminars assuming the full knowledge and understanding of the arguments and theses of physics taught in secondary school, relying on them as aids? I believe this is impossible as yet, although the rapid development of science will sooner or later necessitate this, and college lectures can not be mere repetitions of secondary school material.

Please do not get me wrong. As long as they attend school pupils do know what they've learnt, some of them remember parts of it even later in their careers, but the material acquired does not support neither in their personal life nor at in-service trainings.

I think we could tackle these shortcomings by openly admitting that our results in teaching physics are indeed unsatisfactory. We can do so without feeling guilty as we do not intend to blame anybody for this inefficiency; for we all know that teachers of physics make a tremendous effort to do everything in their power within the external limits imposed on them by the current system.

We, therefore, should be looking for the root of the problem elsewhere, namely in the current system of teaching physics, I reckon.

Physics teachers in secondary schools operate with the very same, rather abstract notions we use in higher education and in the scientific community. Pupils, however, do not posses neither the intellectual maturity necessary to the full understanding of the abstract ideas and notions, nor the mathematical aids and knowledge necessary to conceive these notions.

Just think of the basic principles of dynamics, especially of the notions of force and mass and you'll clearly see that given the current system of secondary school education a full understanding of the genuine meaning of these notions borders on impossibility. It is no wonder since these notions, conceived by the great Newton, are definitely among the most abstract intellectual products of mankind. I personally hold the view that the true significance of the notion force in the description of physical phenomena is impossible without understanding differential equations. And we have yet to mention other notions of physics (work, energy, potential, etc), all based on the notion of force.

This is clearly a controversial situation that must be tackled employing all tools available. We have two choices, I should think. Either we make sure that secondary school pupils are equipped with the intellectual instruments and tools necessary to such degree of abstraction, or taking a U-turn we abandon our traditions and take satisfaction in teaching a new, purely practical physics which is limited to the mere description of physical phenomena, circumventing the usage of abstract notions, one, which does not wish to assign a scientific framework to these phenomena.

One could come up with rather convincing arguments on both sides. To support the first one, we can point out that the desirable movement all over the world advocating the reform of teaching mathematics, to which our Society has made considerably contributions through our mathematics reform committee, has set as its main aim to make the introduction of the said notions substantially easier. Coming down on the side of the second way, practical people and those with less affection for mathematics will surely argue that the latter solution would ensure our control over phenomena, with disproportionately more modest mathematical knowledge.

I do not wish to table a clear-cut scheme on the reform of physics teaching but my aim is to persuade the General Assembly that there is a pressing need to reform physical education. If I succeed in doing so, I shall call upon the Assembly to find ways of remedying the problem as it is in its power. The mathematical reform committee has achieved such beneficent performance that their work deserves being set as an example. Let us then call upon our members, active in physics to form a committee and outline their ideas on how we could eliminate the shortcomings and deficiencies. The detailed tasks would be identified by this group of experts. I personally can tell you that I find the first option more suitable for the purposes and objectives of secondary education, I would even say it is more worthy of secondary education by enhancing pupils' intellectual capacity so that abstraction won't be a problem any more. The need to provide professional training for teachers supports this option as given the time frame we have in higher education it is impossible to repeat secondary school material, even if we do so in a nutshell. It is not only teachers of physics and engineers who feel a crying need for more detailed physical knowledge, but physicians, too. Having said that, I find the second way, the purely practical approach fully satisfactory for higher elementary schools and for ladies' colleges. In secondary school it is absolutely necessary to have a detailed, purely descriptive, practical physics to teach pupils to see and perceive, on which then the science of physics can be built. Such preparatory physics should be started as early as possible, in the first form already.

In my humble opinion the entire subject matter and the entire curriculum of physics need substantial and fundamental reform the details of which would be outlined and laid down by the committee we should set up.

Let me briefly spell out the competence of the Committee. It should first of all deal with the grouping of forms, and the number of lessons. As I have pointed out, I find it indispensable to teach physics already in lower forms. Teaching some of the purely descriptive physics as I have explained above already in the first form of the secondary grammar school could enchant pupil and teacher alike. A profound insight into the simplest physical phenomena could exert a beneficial and desirable effect on the development of a child's psyche, so susceptible to external impacts and yet capable of realistic thinking. The upper grade is at present limited to the seventh and eighth forms and I propose that it be extended to include three forms altogether as I think it is more efficient to have education over a longer period of time, as long as we have an equal number of lessons, particularly in the case of a field of science where one has to deal with a large number of new notions, all food for thought.

And now that we have arrived to the most delicate issue of the number of lessons, let me address our fellow members teaching arts subjects. I can only assure you of my deepest respect and of my sincere and undiminished admiration for their fields of science. I am fully aware of and acknowledge the utmost importance of the emotional world in our life. I definitely do not share the views of my far too modern colleagues of mine who believe in the ultimate and absolute superiority of sciences. The present reforms are definitely not meant as a crusade against arts subjects, it's merely physics fighting for its due rights. I'm calling upon my fellow members active in humanities to tolerate the slight increase in the number of physics lessons I deem as indispensable to carry out the reform in vision. We are all working in pursuit of one and the same goal, so I'm calling on you to look on us not as foes but as your fellow teachers heading for one and the same ideal, taking different ways, though.

Correct me if I'm wrong, but as far as I know philology is understood nowadays as the scientific investigation of a whole nation or of the civilisation of a whole historical period. From the classical world on up until the Middle Ages natural sciences played a rather inferior role, so it is understandable that philologists of ancient periods regard natural sciences as inferior at least from the point of view of the own field of science. But this is something the modern philologist can not allow himself. Combining theory with experiments resulted in suitable methods of research through which natural sciences have experienced a dramatic development, almost unprecedented among arts. We too are witnesses of their incredibly rapid development and one would have to be deliberately narrow-minded to ignore or play down the significance of natural sciences when giving an overview of civilisation in our modern age. When we desire that slight increase in the number of physics lessons, say, at the cost of Latin classes, it is by no means meant as a vicious attack on arts and humanities. We are only trying to adjust the school education provided for our youth to the requirements of our modern age, and we support modern philology against classical philology as we can do little to fully hinder that classical times not be somewhat worn out, passing into oblivion.

The increase I propose is very modest indeed, three lessons a week in the sixth, seventh and eighth forms each, which would mean a single lesson extra in higher forms. I reckon that physics gaining new grounds is not commensurate with its latest dramatic development this, but we would be happy for a start. It would not mean a radical increase in the total number of lessons either as it could take over the lessons of physical geography in the third form, which in turn under the reform would be abandoned to give way to descriptive physics in the first form.

Given the new framework, let us move on to fill it with content, so I am now seeking an answer to the question what and how to teach.

Allow me a general remark here. I firmly believe that the entire reform process should take place in the spirit of ensuring freedom in teaching, the least a teacher is bound by curricula, regulations and central instructions, the more successful his teaching will be. Let us not look on the teacher as an instrument one needs to check upon and control all the time, we should allow more room for the development of his personality. Our concerted efforts to constantly improve our teacher training system and the honesty of our fellow teachers guarantee that our optimism shall not backfire on us. Our committee shall not have as its main task to elaborate a compulsory curriculum, one for all irrespective of individual needs. Their task shall be to lay down the most crucial principles upon which the entire reform hinges. They shall also produce a detailed sample lesson, which shall by no means be obligatory for all teachers to follow, merely one out of countless alternatives, which can all be equally good.

Mr Grimsehl, a teacher from Germany is an ample example that the idea of freedom in teaching is well understood and practised abroad. He chose to spell out a chapter of physics in detail to each year of pupils according to the inclination of the majority of his pupils, once favouring mechanics and electricity the next year while touching on other chapters only briefly. I consider his idea rather remarkable because immersing into a chapter of physics triggers a way of physical thinking that enables the pupil to easily understand the chapters discussed briefly as well. There can be no objection to such methods of teaching regarding examinations and qualifications as the ultimate objective of teaching physics is promoting a sound physical thinking and not merely tackling a list of topics. At examinations pupils should, therefore, give evidence of their clear, physical thinking.

Consequently, besides reiterating the principle of freedom in teaching, our Committee could help teachers select the material they wish to teach and the methods they wish to employ. Even if we were to include the latest results of scientific development in physics into our secondary school curriculum, we have no reason to worry about overburdening pupils as the careful selection of the material saves considerable time. Physics has many aspects which are traditionally dealt with at sometimes undue length, commensurate with neither the theoretical nor the practical importance of these chapters. Let me mention electrostatics, the practical role of which is really small and which takes far too much time in contemporary teaching than it deserves while at the same time alternating current, the resource of cutting edge technological inventions to which Hungarian engineers have also substantially contributed are completely ignored.

As for the question how to teach, I think I have already given an answer and I do not wish to go further into details now for this is what the Committee should actually be coming up with. It could decide the share of theory and experiments in teaching physics, the mathematical apparatus to be employed with regard to the ongoing reform of teaching mathematics, the value of experiments, exercises for pupils and so forth.

Finally, I can not leave the subject chemistry unaddressed. I find it an absolutely intolerable situation not to establish chemistry in secondary schools as a subject in its own rights. It is unmatched among natural sciences in its depth, theoretical and practical importance. And what are we to see? One meets chemistry as a far-fetched issue, supporting botany in the fourth form and combined with geology and mineralogy in the sixth form.

To my best knowledge, the Society has already set up a committee to prepare the reform of teaching chemistry in secondary schools. Given the close relationship between physics and chemistry, the new Committee should put their heads together with the chemistry committee and work out the programme of teaching chemistry and physics.

The committee should, of course, consider the teaching of astronomy, cosmography and meteorology as well.

Subsequently, when we have a clear vision of the teaching of physics in the future we could proceed to discuss the adequate training of physics teachers, involving the bodies competent in this.

Esteemed Colleagues! I was trying to convince you of the crying need to reform the teaching of physics in secondary schools; which need was and is triggered by the tremendous development in the science for which neither persons nor institutions are responsible. It is the duty of the Society to take steps to pave the way for the reform. I herewith propose that the general assembly should give mandate to the high panel to set up a committee which shall study the reform of teaching physics and shall table a report on the results of its investigations.

The said reform has been long desired by a vast majority of scientists and competent teachers. The greatest physicist of the nation, the greatest pride of our scientific life also approves of the idea and said he would be keen to contribute to the work of the new committee.

I hope that my proposal shall be given a broad welcome and shall be taken up by the Assembly.

Zemplén's Monography on „Electricity and its Practical Applications" From 1910

Abonyi, Iván

The first comprehensive account of the triumphant electricity was made available to the Hungarian intelligentsia reading circle in 1910. The author was a thirty-one years old physicist, at that time lecturer at the Palatine Joseph Technical University of Budapest (József Nádor Műegyetem). Before analyzing this magnificient volume, let us turn our attention towards the author.

The young Győző (Victor) Zemplén was born on 17th October, 1879. He studied physics and mathematics at the Budapest University under the well known professor Roland Eötvös. He began even the research in physics, followed Eötvös in the research of viscous properties of liquids and gases (1). But this work - which finally led him to obtain the doctor's degree in physics - was not so satisfactory to him. From certain signs we ourselves may judge that even Eötvös was willing to see that it is not worth-while to limit Zemplén to this activity. Eötvös tried to find a position to his pupil at the Technical High School which has been elevated to the rank of University at that time. Zemplén, during his university studies has become acquainted with the most modern branches of physics, especially hydrodynamics and electrodynamics, and not to forget a comparatively new branch, the mathematical physics. During his first years at his new place, he began statistical mechanics, published papers on its foundation. But very soon, on the occasion of his visit to France, he published his first papers on shock waves of hydrodynamics (2). In these papers he gives the first general treatment of shock relations in ideal fluid and announced a theorem, saying that only compressive shock waves do exist (rarefaction version may not exist, on the base of the Second Law of Thermodynamics). Later he gave a general mathematical study of general disruption phenomena (3) where one provides that not only the fundamental hydrodynamical quantities, but their derivatives may be discontinuous, that is to say, they may have a jump. The relation which classifies the shock waves, has trereafter been called Zemplén's theorem. He has continued this research, even trying to find the shock waves in the newest continuum theory, the Maxwell electrodynamics (4), but this has not become so well received, since at that time electrodynamics was considered acting alone, not combined with other properties of the medium, as in our days, when different kinds of matter may manifest their properties in response to electrodynamics effects, e.g. magnetohydrodynamics.

Before analyzing Zemplén's work on electricity and magnetism, let us mention the basic data about his life. Quite sorrowful, his life was not long. He was mobilized in the First World War to the artillery of the Austro-hungarian monarchy, went to the Italian front as a lieutenant of artillery, and on a seemingly quiet day he lost his life on 29th July 1916 due to an Italian artillery action.

As regards his volume on "Electricity and its Practical Applications" we must state, that this work is the very first book on electrodynamics in Hungarian (5). It was published by the Royal Scientific Society enjoying the cooperation of the Hungarian Academy of Sciences. The Editors were busy to aid the author because they were convinced, there is a great necessity to give a general account of the new science of electrical phenomena and its industrial benefits to the reading circle. The work was successfull: we do confess, the book is quite interesting to read even nearly hundred years after its publication - admitting, that maybe now we would prefer a somewhat different thematical structure for it, but as a historical document, it is very interesting and thoughtful.

Let us summarize the thematics of the book. It is divided into eleven chapters - the whole volume reaches about 683 pages. It starts with the concept of work and energy, and soon considers the energy resources available to the manking. Then it introduces us to the steady electric currents, its effects, networks, electromagnetism and the energy of electric currents. Next chapter considers alternating currents, the induction phenomena, treats the self induction and capacity, discusses resonance phenomena. The fourth chapter treats the electromagnetic waves, Hertz's experiences with the propagation of the electromagnetic waves, the electromagnetic theory of light, enumerates the experiemnts on propagation, determines the propagation velocity, treats refraction and diffraction phenomena, discusses the - at that time - available spectra of waves (the interval of the frequency of oscillatons between and Hz) concludes to the electromagnetic theory of light. The applications are discussed in the following seven chapter. This begins with the sources of electric currents, steady or alternating ones. Relatively long chapter is devoted to the energy transport realized by electricity, this involves batteries, transformators, switchboards, transmission lines, lightning phenomena, electric networks, and discusses the transportation problem of electric energy to great distances (the capacity of long wires, telephone lines in intercontinental connection). A separate chapter is devoted to explain the problems of work transmission (different kinds of electromotors). Next point is electric lighting. (The black-body radiation is discucced from Kirchhoff law to Stefan-Boltzmann law, including the Wien relation, however, Planck's name is not mentioned.) The heating and different industrial application of electric currents to melt substances like steel; and aluminium production, and the problem of the production of nitrogen from the air are discussed. Following that, the chemical effects of electric steady currents are discussed (electrolysis, galvanoplastics, ozoneproduction). The most interesting chapter of the time might be this one which discusses the transmission of human thoughts by means of electric currensts (telephony) and electromagnetic waves (with our modern vocabulary: by means of radio, though this review really mentions Guglielmo Marconi, but it actually refers to the wireless telephony rather than to the modern radio). The last chapter treats the cathode-rays, Lenard's experience, the exploration of Röntgen-rays, their properties and utilization. This theme is the last one of the volume.

The book - naturally an original Hungarian volume - is quite easily readable even now, a hundred years after its preparation. To tell the truth, the book appeared also in 1927, sixteen years after the original publication, but this volume has been eloborated by two actual professors of the Technical University (6), Béla Pogány and Selmeczi Pöschl Imre. The result is somewhat surprising: the elaborated vertion is of 664 pages (the original one is of 683), the elaboration takes care mainly some problems arising from the evolution of the Hungarian language, and the new volume contains more figures than the original one (+150) and as a matter of fact, the radio is discussed in more detail, the first appearance of the radio tubes in Hungarian literature is here in this book.

The triumph of electricity and magnetism is - so to speak - glorified in this volume. We must stress, that the electric traction used to underground railway was realized first on earth in Budapest, for the commemoration (1896) of the thousand years of Hungarian statehood. It is interesting, however, how the problems of the appearance of quantum effects (Plank's constant and atomic physics), the relativity (the Lorentz transformation property of Maxwell's equations) and the very basic fundamental equations of electrodynamics, the Maxwell's equations fall aside to both volumes!

One may say, that this volume has been taken to be a textbook on electrodynamics for the first years of the Technical High School, or even it was meant to be an information giving manual for those interested in propagating the practical use of electrodynamics for the use of already diplomed engineers. Anyhow, Zemplén himself has been quite well informed on the basic laws of electrodynamics, the Maxwell's equations. One can easily demonstrate it by referring to an article os Zemplén, in which he tried to investigate the disruption phenomena of the Maxwell's equations (4). As regards Planck's conception on black-body radiation (the action-quantum and its role) and on the beginning of the relativity theory we find nothing. We draw the conclusion: Zemplén's original book is an interesting document of the practical importance of electrodynamics of the early 1900 years. It does not risk to go into details of the modern branches of electrodynamics which are more connected with the structure of matter. This is not a sign of the world picture of Zemplén - who some years before this volume gave the Hungarian translation of Henry Becquerel's and Mme Curie's work on radioactivity. This is only the sign of opening a new gate of reality before the Hungarian readers, introducing them to a magnificient and almost omnipotent new scientific branch. We can only suggest the young Hungarian colleagues to get ecquainted withthis original volume of Győző Zemplén even now.

References

1. Zemplén, Gy.: Próbamérések a gázok belső súrlódásának egy új kísérleti módszerrel való meghatározásához, I. Mathematikai és Physikai Lapok, 10. 300-308, II. ibid. 375-401. - Über die Anwendung der Mechanischen Prinzipe auf reibende Bewegungen, Annalen der Physik, IV. 12. 356-372. (1903), (Berichtigungen) ibid. 13. 216. (1904)
2. Zemplén, Gy.: Sur l'impossibilité des ondes de choc négetives dans les gaz, Comptes Rendus (Paris) 141. 710. (1905)
3. Zemplén, Gy.: Besondere Ausführungen über unstetige Bewegungen in Flüssigkeiten, Encyklopädie der math. Wiss. Band IV. 2. T. 3. 282-323. (1905)
4. Zemplén Gy.: Kompatibilitätsbedingungen bei Unstetigkeiten in der Elektrodynamik, Mathematische Annalen 62. (1906), 63. (1907)
5. Zemplén, Gy.: Az elektromosság és gyakorlati alkalmazásai, Királyi Magyar Természettudományi Társulat 82. kötete, Budapest, 1910.
6. Zemplén Gy.-Pogány Béla-Selmeci Pöschl Imre: Az elektromosság és gyakorlati alkalmazásai, második, átdolgozott kiadás, Királyi Magyar Természettudományi Társulat, Bp., 1927.

A Hundred Years Make No Small Difference: Popularization of Science in Hungary at the Turn of Two Centuries

Zemplén, Gábor Á.[1]

The development of physics, the focus of scientific debates, the institutionalization of science and science education in Hungary (admittedly on the peripheries of Europe) significantly differed from that of the most advanced parts of the continent. (1–3) One might say that this process continues even today, as the Hungarian Academy of Sciences plays an unusually powerful (and conservative as well as conserving) role, and as the notion that each field has to have its national expert is still generally accepted, to name just a few of the several factors playing a role in the process. This observation is naturally extendable to the popularization of science as well. Whether this notion is tenable or not will be investigated in this article.

After a cursory overview of popularization of science in Hungary and the history of science writing, I will compare works from the turn of the 20th and 21st centuries. The selection is naturally not comprehensive: only a few examples are discussed in detail. I will argue that a hundred years ago, Hungarian scientists writing for the general public could communicate both the most up-to-date scientific developments and new ideas in philosophy of science, while in the recent years popularization of science has taken a rather fundamentalist turn in Hungary.

The paper contributes, on the one hand, to the appreciation Győző Zemplén's work, on the other, it gives a critique of present-day popularization of science in Hungary, thus touching on recent debates on the role of popularization of science.

Popularization of science and history of science in Hungary

General remarks on popularization

Popularization of science in Hungary during the first half of the nineteenth century was closely connected to reform movements, aiming at establishing a vocabulary in Hungarian for all fields of inquiry. Thus it was primarily not aimed at legitimating the scientific enterprise as such (as can be seen in a number of eighteenth century European works – a tradition still visible today), but rather to narrow the developmental gap between Western Europe ("center") and the periphery, and to create – if necessary "artificially" – a Hungarian scientific community and readership in Hungarian1. As Márton Varga wrote in his 1819 Science of Wonderful Nature (Gyönyörű Természet Tudománya): "The embellishment, fame, profit of my nation, promoting religion, and improving the morals were my main urges not to write in Latin (which would have been less troublesome), but in Hungarian. I have shown that our mother tongue can carry Philosophia, and that using it it is possible to write about physics at the level of Latin school-books… This road, as all know, has not been travelled before." (5: 30)2.

The popularization of science was and is seen as part of a greater political agenda, promoting the development of the nation-state (or linguistic community) and has throughout (with some exceptions) positive connotations (and its opponents are often seen as enemies of development and prosperity). As Ferenc Pulszky in an 1891 speech summarised the role of the Academy, in its first phase, it "worked mostly on enriching our vocabulary, establishing the rules of Hungarian eloquence and the polishing of the literary language". In its second phase, "the Academy concentrated on cultivating scientific approaches, not being content with acquainting the readers with translations on foreign research, but also collecting data and furthering science in its own efforts; having reached the level of science in cultured nations, and thus being respected abroad" (7: 125-6). While Pulszky's view that by the 1890's Hungarian science has reached a third phase and, as he originally wrote in the manuscript of his speech "is aiming at bringing the fruits of science (to which our own efforts have also contributed) to all the educated (so that science be popularized)" is surely illusory, and it clearly marks the importance of the popularization of science.

The second half of the nineteenth century with the founding of new schools, societies (8: 7-42), and new journals, like the Természettudományi Közlöny (Communications in the Natural Sciences) established in 1869 and still running, contributed to an unprecedented growth. Scientific research and popularization remained closely connected, partly as a result of the underdeveloped higher educational system. Most researchers receiving support for their studies were teachers in academic high-schools.

Remarks on the history of science writing

The popularization of science and the nation-preserving and -furthering goals both contribute to the special status of the history of science in Hungary. Even today it is seen as a means of popularizing science and scientific understanding (and its legitimation as a discipline in its own right is still being questioned). This, while not an unknown aim, is by far not seen as the major task of the discipline in most European countries.

An example can highlight the differences, and show how differently Hungarian actors are presented to the general public. While great national scientific heroes have mostly become anti-heroes, and icons at times representing negative values (as Locke, Bacon, and Newton represented the Unholy Trinity for William Blake, etc.), this anti-science sentiment and rejection of scientific attitudes has not characterised the Hungarian scene. Here, the Romantic Movement was not characterised by the critical attitude typical of German or English romantics1. Similarly, the creation of the atomic bomb (where Hungarian scientists played no insignificant role) is seen as a sign of the level of Hungarian intellectual training between the World Wars. The tenability of the image of Hungarian "scientist-heroes" has also received much less criticism and attention as their counterparts in the "center".

Most historians of science see their work as part and parcel of the popularization of science in Hungary: writing portraits of great men, enumerating Hungarian-born Nobel-prize winners (often including ones, like Elie Wiesel or John Charles Polanyi, who have never lived or were educated in Hungary (13)), or exploring the "cultural history" of science – the general cultural background of a given epoch without implying that external factors would play a constitutive role in the development of science. In a number of cases a novel (and less cajoling) reading receives no little resistance from promoters of the received view: an example is the interpretation of Bolyai is Imre Tóth and János Tanács, both embedding the discovery of non-euclidean geometries into a greater framework of scientific concept-building (14). In an article on Bolyai, László Vekerdi notes how Hungarian history of science writing lags generations behind that of the center, sometimes not responding to whole trends.

My approach on the surface might seem to belong to the above mentioned tradition, as I will aim at contributing to the appreciation of the works of one of the early-twentieth century icons, Győző Zemplén by drawing attention to his views on the philosophy of science, but in order to contrast his solution to the problem of popularization of science with that of contemporary writers.

The scientific scene at the turn of 20th century, and the works of Győző Zemplén

The above mentioned peculiarities have to be taken into account when the popularization of science is investigated. The developments at the end of the nineteenth century resulted in a generation of scientists whose knowledge and training surpassed all previous generations. Important factors were reforms in secondary education and the increasing importance of natural sciences in the curricula, as well as the rapidly growing number of students in sciences and engineering (earlier the majority of students were trained at faculties of law). New universities and departments were established – some sponsored by the growing and strengthening industry. Special training colleges were created – probably the most famous being the József Eötvös College (founded in 1895), furthering the training of highly qualified teachers, and modelled on the École Normale Supérieure (15).

Győző Zemplén (1879-1916) was a student of the Eötvös College1, and soon became one of the favourites of its founders, Loránd Eötvös. Eötvös, himself a student of Kirchhoff, Helmholtz, and Bunsen was a pre-eminent experimental physicist in Hungary (for a short biography see 19). His mentor's support allowed Zemplén to travel to Göttingen and Paris. Professor by the age of 26, soon becoming head of department, and member of the Hungarian Academy of Sciences in 1911, he achieved everything that a young researcher possibly could, even before his sudden death during World War I in 1916 (20).

Apart from his main research interest in the viscosity of gases (for a bibliography of works see 21,22) he became a pioneer in communicating the latest developments of physics to the Hungarian readers. He was the first to teach statistical mechanics at a Budapest university, and introduced Maxwell's electrodynamics. His work as a popularizer of science includes a book on radioactivity (23), a translation of Marie Curie's book (24), a book on electricity and its practical applications (25), notes on the translation of Poincaré's work (26) and dozens of articles for the general reader. While a number of studies highlight Zemplén's scientific achievements, his views on the status of scientific knowledge are less well-known. In an article On the value of Science (A tudomány értéke, (27)2), he openly questions the validity of scientific statements, and whether they can ever be considered "final". His argument highlights the crucial role of conventions in science, from the empirical foundations to the accepted rules of reasoning. According to his views, inter-subjectivity is necessary as a basis of observations in science, but cannot be guaranteed. In organizing phenomena, the method of induction is only permissible if our belief in the existence of laws of nature is accepted (as a "background assumption or basic hypothesis", p. 20.). But even the laws of logic and of our reasoning are not necessarily true. "But who decides on the laws of logic, who guarantees their correctness? It might be not a little disappointing that the answer to even this question is that nobody does; even the laws of logic are assumptions, hypotheses, or if you like it, axioms. The gist of the matter remains: these are laws which cannot be proven, rules, the correctness of which we cannot be ascertained of." (ibid.) Neither reasoning (which would use the same laws), nor experience (which can only result in inductive generalizations that have predictive power, but cannot prove the matter) can come to our help. "We therefore have to admit that even logic, which governs all the sciences and our whole life, is nothing more than a few assumptions" (p. 21.).

The conclusion – while not unprecedented – is not typical of the ruling intellectual climate in Hungary, strongly preferring positivistic, scientistic agendas at the time : "Taking a look at the sciences, we have shown that all of them – including logic and mathematics – are built on hypothetical foundations, or to formulate it differently, are the results of conventions that are significantly influenced by the human environment." (p. 23.).

The strong influence of French conventionalist thought (a current and fashionable view in the scientific “center”) is clearly visible in the work. The arguments presented are not philosophically novel or especially well worked out – but they show that a leading Hungarian scientist-teacher was well-versed in the current views and debates about the status of scientific knowledge (personal acquaintance with Poincaré obviously played a part in this). Popularization of science was not detached from the philosophical reflection about science. Zemplén embraced anti-foundationalist views but believed in scientific progress – a position shared by leading contemporary figures, like Poincaré, Duhem, or Neurath1. Győző Zemplén’s work shows that it was possible to contribute to the development of science, to engage in furthering the public understanding of science and be up-to-date with respect to notions in the philosophy of science.

The development of physics in the twentieth century has surpassed most beginning-of-century expectations. It is in the realm of early science fiction (like the works of Jules Verne) where we find the best (visionary) descriptions of what the physical sciences have reached in one century. A pressing and troubling question is whether the teaching and popularization of science has undergone changes that even faintly resemble the developments of the sciences. As for Hungary, I will argue for the negative, or to rephrase the quote by Ferenc Pulszky: even today Hungarian science has not successfully reached the third phase of its development – 100 years after the announcement.

The turn of the 21st century and “sceptic” popularizers of science

The popularization and teaching of science faces radical challenges throughout the world. In Hungary, the linguistic problem remains – and with the continuously accelerating development, the market trends not favouring long projects and the employment of adequately trained translators, the results are sometimes of staggeringly low quality.

But in the last years, promoters of the scientific world-view face new (or at least radically strengthening) challenges: the legitimacy of science and the scientific enterprise is more and more openly questioned in Hungarian popular culture (or at least so it is seen). Popularization for many of the Hungarian scientist-writers (and usually not science-writers, as most popularizers actively pursue an academic carrier) means more and more a bitter polemic against what they see as the enemies of science: pseudo-scientists, charlatans posing as scientists, etc. Symptomatic of this trend is the founding of the Society of Fact-Respecters (Tényeket Tisztelők Társasága), supported by a number of prominent media-personalities. So-called “Sceptical conferences” are regularly held, and the aforementioned Természettudományi Közlöny (also called Természet világa) now runs a “Sceptical corner”.

While the analysis of the popularization of science as it is pursued in the new media would be especially rewarding, I will only investigate a few pieces written or translated for the “Sceptical corner”. The reviewed journal plays a leading role in communicating novel scientific results to the general public, and especially to high-school teachers of the natural sciences and to interested students. It is also a journal in which Győző Zemplén had published at least 32 articles – making this cursory comparison less ad hoc.

To appreciate the special flavour of Hungarian popularization of science, let us first see a short editorial of the “Sceptical Corner”, titled “Only the real scientist can go wrong” (33). The article establishes a dichotomy: the real scientists are those who admit their mistakes, the posers are the ones who do not. The language used is emotionally loaded – thus influencing the reader – and the general statement in the title is supported by individual observations. The article is based on the English editorial “I Was Wrong - Those three words often separate the scientific pros from the posers” by Michael Shermer – founder of the Skeptic Society and Skeptic magazine (34). The original is already not a value-free evaluation, since it is written by an ardent critic of non-traditional scientific practices, but the differences are highly significant. The English title admits a personal failure – and does not make a universal statement (which is false for obvious historical reasons), it only states what the difference "often" is. The Hungarian version uses a typical argumentum ad baculum, excluding from the discourse all who do not agree with the stated position: "As all real practitioners of science know…" in §3 – this, again, is missing from the original. A number of manipulative phrases are present only in the Hungarian version (like the sympathetic scientist, who "has not hesitated for a second to abandon his position as soon as he obtained the new data").

Such supposed dichotomies often appear in the "Sceptical Corner": "Two medicines, the orthodox and the alternative, cannot coexist" (35). In general, the texts are only weakly argumentative, if at all – my favourite example is a short paragraph in an article attacking alternative medicine, where the only argument against drinking urine is that a Czech diplomat, who himself has used this therapy, left his office in Jemen when charged with corruption, leaving nothing but urine-samples of the employees behind (36)1.

I strongly believe that the above mentioned polemical writings do very little to promote the understanding of science. Their writers do not seem to possess knowledge and understanding of contemporary philosophies of science – or even hundred-year-old ideas. While in the first example, Győző Zemplén could be seen as a faithful promoter of then contemporary ideas about science, the recent examples show further and unnecessary radicalization of already radical (and not too well-argued, philosophically not much appreciated) views.

Though science develops and the role it plays in our everyday lives increases, the popularization seems to have taken a different course and has become foundationalist (if not fundamentalist) and dogmatic in its assertions. The "Sceptical Corner" is by no means sceptical about the status of the assertions made, and unless the sentiments taken for granted in the articles are reopened for rational debate, I see little hope for the popularization.

Conclusions

I have tried to show that not just the development but also the popularization of science took a different course on the "periphery" than in the "center" of Europe. The early aim was closely connected to a generally accepted national political agenda, and only the recent years brought new challenges to the "periphery": the sciences are now seen as fighting for their own legitimacy, and the status of science is being questioned from different sides. This has always been recognized as a major problem in the "center" and popularization was seen as one of the remedies.

I consider most unfortunate the separation of the teaching and popularization of science from developing thinking about science. On the one hand, while attempts have been made in Hungary to base secondary science education thoroughly on the history of science (37), these have not become generally recognized. The status of the history of science in Hungary (as discussed in 1.2) render it a discipline producing biographies, chronologies, and anecdotes – and not arguments, that could be used for (or, for that matter, against) the popularization of science. On the other hand, science in Hungary has separated from the philosophy of science (where the significance of the history of science has increased radically in the last 40 or so years), partly due to the ideological commitments of the post-World War regime. The results are clearly visible in the quality of arguments discussed in part 3. Thus, while a hundred years resulted in enormous development of science, in popularization it has not.

While strongly opposing the raising of national icons, I believe we do have something to learn from our forefathers: successful popularization must not only focus on the content of science, but has to take into consideration the status of science as well. To achieve this, up-to-date notions about the role of the history of science, and increased attention to the philosophy of science seem to be required.

References

1. M. Zemplén, Jolán, A felvidéki fizika története 1850-ig. 1998, Piliscsaba: Magyar Tudománytörténeti Intézet.
2. M. Zemplén, Jolán, A magyarországi fizika története 1711-ig. 1961, Budapest: Akadéemiai Kiadó.
3. M. Zemplén, Jolán, A magyarországi fizika története a XVIII. században. 1964, Budapest: Akadéemiai Kiadó.
4. Palló, Gábor, A recepció és kreativitás összefüggése a magyarországi tudományban, in A honi Kopernikusz-recepciótól a magyar Nobel-díjakig, G. Palló, Editor. 2004, Áron Kiadó: Budapest. p. 7-22.
5. Simonyi, Károly, A magyarországi fizika kultúrtörtnete. XIX. század. Természet Világa, 2000. 130 (special issue (I.)): p. 1-100.
6. Harkai Schiller, Pál, Bevezetés a pszichológiába: A cselekvés elmélete. 1944, Budapest: Pantheon.
7. Vekerdi, László, "A Tudománynak háza vagyon". Reáliák a Régi Akadémia terveiben és működésében. Magyar Tudománytörténeti Szemle Köyvtára 1. 1996, Piliscsaba: Magyar Tudománytörténeti Intézet. Tájak-Korok-Múzeumok Egyesület.
8. Németh, József, Műszaki fejlődés - természettudományos műveltség. Műszaki és Természettudományi Egyesületek, Társaságok Magyarországon. 1998, Budapest: MTESZ.
9. Zemplén, Gábor, A természettudós Goethe. Természet Világa, 2000. 130 (12): p. 552-556.
10. Cunningham, A., Jardine, N., ed. Romanticism and the Sciences. 1990, Cambridge UP: Cambridge.
11. Steinle, Friedrich, Egy romantikus kísérlet története, in Tudás az Időben, M. Fehér, B. Láng, and G. Zemplén, Editors. 2004, Műegyetemi Kiadó (forthcoming): Budapest.
12. Zemplén, Gábor, Megroppant szivárvány?, in Tudomány és történet, G. Forrai and T. Margitay, Editors. 2002, Typotex: Budapest.
13. Nagy, Ferenc, Magyar származású Nobel-díjas tudósok. 1995, Budapest: MTESZ.
14. Tanács, János, Rejtőzködő párhuzamosság. Magyar Filozófiai Szemle, 2001. 45 (4): p. 473-489.
15. Nemes, Tibor, A Kollégium és az École Normale Supérieure kapcsolatai (1897-1947), in Tanulmányok az Eötvös Kollégium történetéből, J.Z. Nagy and S. István, Editors. 1989, Eötvös József Kollégium: Budapest.
16. Móra, László, Zemplén Géza. A múlt magyar tudósai. 1995, Budapest: Akadémiai Kiadó.
17. Palló, Gábor, Tudományos intézmények, konzervativizmus, kreativitás. A Budapesti Műszaki Egyetem modernizáló szerepe, in A honi Kopernikusz-recepciótól a magyar Nobel-díjakig, G. Palló, Editor. 2004, Áron Kiadó: Budapest. p. 269-290.
18. Zemplén, Zemplén Jolán, in Asszonysorsok a 20. században, B.M.e. al., Editor. 2000, BME Szociológia és Kommunikáció Tanszék: Budapest. p. 99-107.

19. M. Zemplén, Jolán and László Egyed, Eötvös Loránd. A múlt magyar tudósai. 1970, Budapest: Akadéemiai Kiadó.
20. Kovács, László, A múlt hagyományaival a jövő fizikusaiért. Zemplén Győző és Mikola Sándor élete, munkássága (kézirat). 1975, Zalaegerszeg: MTESZ-ELFT.
21. Abonyi, Iván, Zemplén Győző, in Műszaki Nagyjaink, IV., I. Pénzes, Editor. 1981, Gépipari Tudományos Egyesület: Budapest. p. 305-323.
22. Balogh, László, Gyula Grédics, and László Kovács, Zemplén Győző a tudós és tanár. Fizikai Szemle, 1979: p. 321.
23. Zemplén, Győző, A testek radioaktív viselkedéséről. A természettudományok elemei. Vol. 82. 1905, Budapest: Természettudományi Társulat. 664.
24. Curie-Sklodowska, Marie, A radioaktív anyagokra vonatkozó vizsgálatok. 1906, Budapest: Franklin Társulat.
25. Zemplén, Győző, Elektromosság és gyakorlati alkalmazása. Vol. 82. 1910, Budapest: Természettudományi Társulat. 664.
26. Poincaré, Henri, Tudomány és föltevés. 1908, Budapest: Királyi Magyar Természettudományi Társulat.
27. Zemplén, Győző, A tudomány értéke. Szerda, 1906. I (1): p. 17-23.
28. Fülöp, Géza, Olvasók, könyvek, könyvtárak.
29. Zemplén, Győző, Tudománykritika. Szerda, 1906. I (6): p. 300-304.
30. Perecz, László, A pozitivizmustól a szellemtörténetig. Athenaeum, 1892-1947. Horror metaphysicae. 1998, Budapest: Osiris.
31. Galison, Peter and David J. Stump, The Disunity of science: boundaries, contexts, and power. Writing science. 1996, Stanford, Calif.: Stanford University Press. XIV, 567 s.
32. Cartwright, Nancy, et al., Otto Neurath: philosophy between science and politics. 1996, Cambridge: Cambridge Univ. Press.
33. (editorial), B. Gy., Csak az igazi tudós tévedhet. Természet Világa, 2002. 133 (03): p. 141.
34. Shermer, Michael, I Was Wrong - Those three words often separate the scientific pros from the posers. Scientific American, 2001 (Oct. 16.).
35. Rák, Kálmán, Merre tart az orvostudomány? "Nem lehet kétféle medicina, ortodox és alternatív". Természet Világa, 2003. 134 (4): p. 174-5.
36. Mornstein, Vojtech, Alternatív orvoslás és áltudomány - Egy biofizikus megjegyzései. Természet Világa, 2003. 134 (3): p. 132-134.
37. Both, Mária and F. László Csorba, Tudománytörténet I. 1993, Budapest: Gondolat.

The Zemplén Competitions and Memorial Days In Nagykanizsa as an Homage to the Brilliant Hungarian Physicist

Kovács, László

My professor lecturing on the history of physics, Abonyi, Iván helped us develop an eye for seeing things from the point of view of physics history. This means that we, teachers of physics introduce our pupils or students to the lives of physicists and to the history of discoveries, hoping that they understand the principles and laws of physics better and that we are able to kindle the love of the subject in them.

The education in the history of physics takes place on three levels. We work hard to keep the memory of physicists of local importance, national and international significance and fame. We were in such a lucky position with Zemplén, Győző, native to Nagykanizsa, that he is a physicist of both local and national, even international importance, so it was our utmost duty to make sure that his footprints in the history of physics shall not fade.

The Eötvös Loránd Physics Society erected a commemorative plaque in the 1960s to mark the house at 2. Széchenyi tér, Nagykanizsa, in which Zemplén was born. The working group of the physics teachers led by Kovács, László at Landler Jenő Secondary Grammar School decided to remember Zemplén, Győző by launching physics competitions under his name. The first two competitions were organised at a county level but later they were called Zemplén Memorials Days with participants coming from all over the country.

We offer an overview of the Zemplén competitions and the various ways and occasions of remembering the outstanding physicist in separate pages.

The competitions launched in the 1970s set an example for other schools nationwide, as there were only two significant national competitions at the time, local initiatives followed mostly our example. The national competition organised for pupils aged 17 and 18 involved a relatively great number of students, but it consisted merely of a five-hour problem solving session. Later it was exactly the Zemplén competitions that made the organisers add another experimental round to the national competition. A new competition for students aged between 14 and 16 was also launched and named after Mikola, Sándor. The most prestigious Hungarian physics competition was initiated by Eötvös himself, and bears thus his name, but it has little more to with Eötvös.

The Zemplén Győző Physics Competition in Nagykanizsa came up with several novelties. Each competition lasted for two days, and it wasn't just the students coming from all over the country but their teachers as well. The competition also involved getting to know the life and work of Zemplén Győző. In the beginning we laid wreaths at the plaque on the house he was born in. After the erection of the Zemplén statue in 1974 we paid tribute there as well. The well-known physics teachers and renowned university professors who set the tasks were also present at the competitions, and offered a deatiled anaylsis of the tasks of the competitions for their colleagues present usually in great numbers, thus providing an intensive training opportunity for them. As we have already pointed out, a further distinguishing feature of the competitions was that there was always an interesting measuring task. The lecturers of ELTE University and the researchers of the Central Research Institute for Physics held fascinating lectures with amazing demonstrations every time, adding yet another individual touch to the Zemplén Memorial Days. It is important to note that the friendly atmosphere of the competitions helped the participating students and their teachers develop a rapport both for Zemplén Győző and the competitions as they had the opportunity to gain an insight into his oeuvre. It proved rather useful for the teachers to see physical problems set as competitions tasks for their students.

The descendants of Zemplén were always invited to the competitions, whose presence made the whole event even more special. The awards and diplomas were first handed over to the winners by professor Mrs Mátrainé neé Zemplén, Jolán, Zemplén's daughter, an acknowledged physics historian. After her death college professor Zemplén, Elemér, his son took this duty over. After the competitions were restarted in 1994 at the initiative of Balogh, László, and Piriti, Janos it was mostly university professor Radnai, Gyula (Eötvös Loránd University) and Kovács, László (Berzsenyi Dániel Teacher Training College) who held the lectures and the experimental demonstrations.

The participants and winners were awarded honorary diplomas and complimentary books, and could take the instruments home with them, which were prepared with meticulous care. The most outstanding teachers receive from 1979 on the bronze Zemplén medal by the Zalaegerszeg sculptor Szabolcs, Péter.

The local and national dailies and also the physics literature always reported the event. It was great help both for the students and their teachers preparing for the competitions that we always published a book with the detailed and fully analysed solutions of the theoretical and experimental tasks from the previous year.

The Berzsenyi Dániel Lutheran Secondary School in Sopron nurtures and fosters talented students in an excellent way similar to ours by organising competitions named after Fényes, Imre, Mikola, Sándor and Vermes, Miklós.

That former student participants are today renowned teachers, researchers and even members of the Hungarian Academy Sciences is a clear testimony to the fact that the Zemlén Memorial Days have been and are a resounding success.

Event Calendar – Zemplén competitions and memorials

Kovács, László – Balogh, László

March, 1970
The I. Zemplén Győző County Physics Competition in the Secondary Grammar School Landler, Nagykanizsa
Experimental problem solving task: electrical measurings with the instrument Univeka

14-15 March 1972
Zemplén Győző Memorial Days·The II. Zemplén Győző County Physics Competition (with 60 pupils participating and their 26 teachers)
Experimental problem solving task: the investigation of even motion using a tube filled with water and contains an air bubble (Mikola tube)
The laser demonstration of the physicists of the Central Reseach Institute for Physics

25-26 March, 1974
The III. Zemplén Competition (organised nationwide with 60 participants from classes specialised in physics).
Experimental problem solving task: measurings using a physical pendulum.
Lectures held by the professors and lecturers of the Eötvös Loránd University

28 October, 1974
The dedication of the limestone bust of Zemplén by Szabolcs, Péter, sculptor from Zalaegerszeg. The bust was erected in the yard of the Secondary Grammar School Landler.

15-16 March, 1976
The IV. National Zemplén Competition (with 71 pupils and their 36 teachers)
Experimental problem solving task: measurings using an electronic black box.
A street was named after Zemplén, Győző in the Eastern part of Nagykanizsa·Pupil Buczkó, Amália prepared a ceramics Zemplén plaque.

19-20 March, 1979
The V. Centenary National Zemplén Competition (with 63 participating pupils and 36 teachers)
Experimental task: Investigating vibrations with steel plates and a spring of great mass.
Experiment demonstrations in solid state physics, with hologramms and laser, lecture on nuclear physics (held by the researchers of the Central Research Intitute for Physics and the professors of ELTE University, respectively)·Szabolcs, Péter made a bronze plaque of Zemplén, Győző·The Zemplén Győző Itinerary Exhibition was opened in Nagykanizsa (on display later also at the National Conference for Physics Teachers in Zalaegerszeg and Szombathely, and at the commemorative session of the Hungarian Academy of Sciences, Budapest, and in the student hostel Eötvös József Kollégium)

17 October, 1979
Commemorative Zemplén session at the Hungarian Academy of Sciences, occasioned by the centenary of Zemplén's birthday

1984
The primary school working in the so-called Pioneers' house in Nagykanizsa chose to bear Zemplén's name. The school was closed down in 2003.

15-16 October, 1994
The Zemplén competitions were restarted by organising the VI. National Zemplén Physics Competition (36 pupils with their 10 teachers)
Experimental problem solving task: floating a candle in water.

19-20 October, 1996
VII. Zemplén Győző National Physics Competition (42 pupils with their 14 teachers)
Experimental problem solving task: measuring the adhesion coefficient.

6-7 March, 1999
VIII. Zemplén Győző National Physics Competition (32 pupils with their 12 teachers)
Experimental problem solving task: measuring the wall width and the moment of inertia of a table tennis ball.

8 December, 2001
IX. Zemplén Győző Physics Competition (organised in the county only, 28 pupils and their 10 teachers)
Experimental problem solving task: analysing V-scope data.

9 October, 2004
X. Zemplén Győző Physics Competition (organised in the county only)

Problems of the Zemplén Győző Physics Competition[1]

Problem-solving tasks of the first round

For students of technical secondary schools

1. A point-like object rests on the edge of a table cloth of length L. Pull the cloth away from under the object. The table cloth moves at some constant speed v all the time and the object is sliding on the cloth throughout. What is the value of v if the object is to come to a rest at distance s on the table, compared to its initial position? The coefficient of friction between the cloth and the object, and between the object and the table is assumed to be the same, namely μ. (Further data to be used: L=2 m, s=10 cm, μ=0,25.) (35 pts for a correct and complete solution.)

2. In a heat-insulating tank with rigid walls there is some ice m1=1 kg, t=0 OC and some water m2=2 kg t=0 OC into which a bent glass tube is held. In the horizontal section of the glass tube there is a drop of mercury, which is separating the air in the glass tank from the air outside. The external air pressure is 1 atm, its temperature is 0 OC. There is a heating wire of R=20 ohm resistance in the tank. Connect to the outlets of the wire a voltage of U=50 V for a period of 25 minutes. How far will the drop of mercury move in the tube of A=0,3 cm diametre? (20 pts for a correct and complete solution)

3. In the plane of a wired frame shaped like a square of side length a, there is a very long, straight wire hanging parallel to the frame. The resistance of one side of the wire frame is R and a current I is flowing in the long straight wire. What force is acting on the wired frame if a battery with a terminal voltage of U is connected to it, and if the distance between the long straight wire and the nearest side of the frame is d? (Make a=10 cm, R=2 ohm, I=100 A, U=40 V, d=2 cm.) (30 pts for a correct and complete solution)

4. A Toricelli tube is hanging from a spring dynamometer as shown in the Figure. (Assume that the end of the tube is hanging into a vessel correct of mercury). What does the dynamometer show? (15 pts for a correct and complete solution)
Total: 100 pts.

For the students of secondary grammar schools

1. A vertical axis going through the centre of a solid, homogeneous disk of radius R, mass M, resting horizontally. The disk is assumed to be revolting around the axis with no friction. We lay flat a smaller disk of radius r and mass m onto the larger disk so that the centre of the smaller one is at distance d from the centre of the larger one. The coefficient of the adhesive friction between the disks is μ. There is a flexible, non-stretching cord, assumed to be weightless, tied around the the larger disk. The cord is passing over a pulley and a body of mass m' is hanging from the vertical end of the cord. We leave the system to rest alone. Calculated from the beginning, how long does it take for the smaller disk to start to slide? (40 pts for a correct and complete solution)

2. Make the following drawing. Take a horizontal line (e) and take points A and A' on both sides of the line. Make sure that the section connecting the two points is not perpendicular to the line. Assume that line (e) is the principal optical axis of a spherical mirror and that A' is the reflected image of A. On the basis of your drawing how can the image of any point B constructed? (20 pts for a correct and complete solution)

3. An insulating, solid sphere of radius R=10 cm has an evenly distibuted charge of Q=10-5 C. What is the first cosmic speed of a point-like object, m=1 g and q=10-6 C at a distance of d=2 cm from the surface of the sphere? The entire system is in the state of weightlessness, assume that air resistance is neglectible. Compare your results with grativational cosmic speed and exlpain the difference. (20 pts for a correct and complete solution)

4. All the circuits in the Figure have the same generator and coil. Put the currents into growing order. Justify the order. (20 pts for a correct and complete solution).
Total: 100 pts.

Problem-solving tasks for the written round, for students from specialised classes

1. A homogeneous, solid disk of mass m1=4 kg and radius R=0,5 m is attached to a still-standing and vertical axis with well-set bearing. There is a smaller disk of mass m2=10 kg and of radius r=0,25 m on an axis fixed to the large disk parallel to the main axis at a distance d=30 cm. The smaller disk is revolting at n=20 s-1. The large disk is resting. Let the smaller disk slide downwards its axis so that it touches the large disk. What work is done by the force of friction altogether? (30 pts)

2. Determine the growth of internal energy of a mass of helium expanding in volume from 5 to 10 litres under a constant pressure. The process takes place under a pressure of 2 atm. (20 pts)

3. A diverging lens of 16 cm focal length is placed at a distance of 16 cm from a converging lens of 12 cm focal length. Where is the image of an object produced, placed at a distance of 24 cm from the converging lens? Determine the magnifying capacity of the system and draw the picture. (20 pts)

4. A metal disk of radius R=20 cm is revolting evenly at an rpm of n=1000 s-1. What voltage is created between its middle and its edge? (30 pts)

Zemplén Győző Physics Competition

Experimental task

The organisers provided an electronic "black box". On the basis of Radnai, Gyula's task, the instrument was produced by Nagy, Emil, who did a splendid job. The solutions offered by the students were evaluated by Radnai, Gyula.

Experimental task

There is a so-called "black-box" to which you can connect through two plugs. On the box there is also a button. Your task is to find out what's inside the box.

Additional tools you may use:

1. Electronic experimenting instrument for schools (VOLTAX-2, VA-meter, measuring ranges: 6-30 V, 0,6-3 A, basic instrument: 3 mA, 60 mV)
2. A 4,5 V battery, opened up at its bottom so that it can be used as a 1,5 V or a 3 V battery, too.
3. A timer (60 mp)
4. Millimetre paper and cords

Solution: The box contained the circuit below: A,B: plugs at the top of the box, G: re-set button at the top of the box, D: diode, C: 1000 μF condensator, R: a resistance of 4,7 kohm.

Appendix

Some of the Important Hungarian Scientists and Teachers

Jedlik, Ányos István (11 Jan 1800, Szimő/ Zemné – 15 Dec 1895, Győr) He made the world's first electric motor, the dynamo and the ancestor of the cascade generator. The first real genius in experimental physics in Hungary, he was a Benedictine monk, who taught physics at the Budapest University between 1840 and 1878. Recommended by Werner Siemens, Jedlik's electrostatic machine, a very high capacity electric condenser was awarded the „Medal for Progress" at the 1873 Vienna World Exhibition. Jedlik was the first electrotechnician, the first precision-mechanician and the first physics educator in Hungary. He attached paramount importance to teacher training. His successor, Loránd Eötvös was the founder of professional research of physics in Hungary.

Bolyai, János (15 Dec. 1802, Kolozsvár – 27 Jan. 1860, Marosvásárhely), The other great Hungarian mathematician (beside Neumann). He founded of the non euclidian Bolyai-Lobachevsky geometry and the absolute geometry. He discovered that the structure of the geometrical space is determined by the masses involved.

Báró Eötvös, Loránd (27 July 1848, Buda – 8 April 1919, Budapest) The greatest Hungarian physicist, one master of classical physics. He taught and conducted research in the Physical Institute of Budapest University Pushkin street 5-7 from 1886 till 1919. His name is commemorated in the Eötvös Law, in the Eötvös gravitational torsion balance and in the Eötvös-effect. Eötvös was the founder of the Hungarian Mathematical Physical Society, and the [Baron Roland Eötvös] Geophysical Institute. He was awarded the Beneke Prize of the Göttingen Academy (1909) and was nominated for the Nobel Prize by P. A. Lénárd.

Rátz, László (9 April 1863, Sopron - 30 September 1930, Budapest) Mathematics, physics teacher and director of the Budapest Lutheran Gymnasium (1890 - 1925). Rátz's most noteworthy scholarly endeavors included his leading role in the implementation of reforms in secondary-school mathematics education (1905–1914) and his editorship (as successor to Dániel Arany) of the Középiskolai Matematikai Lapok (Journal of Secondary-School Mathematics) from 1896 to 1914. Certain of those mathematics problems and their solutions which had appeared in that journal were thematically organised and published separately by Rátz under the title Matematikai Gyakorlókönyv 1-2 (Mathematics Practice Book 1-2), which appeared in two installments in 1904 and 1905.

Mikola, Sándor (16 April 1871, Felső Petrócz, now Gornji Petrovci - 1 October 1945, Nagykanizsa) Mathematics, physics teacher and director of the Budapest Lutheran Gymnasium (1897-1935). He was member of Hungarian Academy of Sciences in recognition of his experimental research on the electrical behavior of insulating materials. Mikola did much to further reforms in the teaching of both mathematics and physics at the secondary level. His physics textbook for third-form pupils of real schools was in use right up to 1945. From 1915 to 1924 he succeeded Győző Zemplén as co-editor, with Lipót Fejér, of the Journal of Mathematics and Physics [Matematikai és Fizikai Lapok]. Mikola 's publication in the filed of epistemology were very important.

Bay, Zoltán (24 July 1900, Gyulavári – 4 Oct. 1992, Chevy Chase, MD) studied in the Calvinist Gymnasium in Debrecen, at Budapest University and in Berlin. He was professor at Szeged University then at the Budapest Institute of Technology. After leaving Hungary in 1948, he held professorship at George Washington University, and at the American University in the U. S. He received the Boyden Premium of the Franklin Institute „for overview on the topics of speed of light and based upon it, for his contribution to metrology" (U. S.). A member of the Hungarian Academy of Sciences, he was the Director of the Tungsram Institute for Research between 1936 and 1944. On 6 February 1946 he sucessfully received microwave signals reflected off the Moon. He set up the United Time-Space Measurement System.

Vermes, Miklós (3 Apr. 1905, Sopron – 5 Apr. 1990, Budapest) Successor of Mikola, Sándor at the Lutheran Gymnasium. He was the greatest Hungarian physics teacher, high school and university educator of his time, and a master of demonstrational experiments.

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