

Remarkable Hungarian mathematicians at the Cluj University

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Abstract. We provide a brief overview of the life and activity of the most remarkable Hungarian mathematicians who worked at the University of Cluj, from the beginnings to the present day.

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1. Introduction

The first higher education institution in Cluj (Kolozsvár, Claudiopolis), a Jesuit college with three faculties: Theology, Philosophy and Law, was set up on May 12, 1581 by Stephen Báthory, the prince of Transylvania and king of Poland.

Over the centuries astronomy and mathematics had an important role between the subjects taught at this catholic school. The most remarkable professors of astronomy and mathematics of this school were Miklós Jánosi (1700–1741) and Maximilian Hell (1720–1792). Jánosi and Hell published the first mathematical textbooks in Cluj:

Miklós Jánosi: *Trigonometria plana et sphaerica cum selectis ex geometria et astronomia problematibus, sinuum canonibus et propositionibus ex Euclide magis necessariis*. Claudiopoli, 1737.

Maximilian Hell: *Compendia varia praxisque omnium operationum arithmeticarum*. Claudiopoli, 1755.

Elementa mathematicae naturalis philosophiae ancillantia ad praefixam in scholis normam concinnata. Pars I., Elementa arithmeticae numericae et litteralis seu algebrae. Claudiopoli, 1755.

Exercitationum mathematicarum Partes Tres. Claudiopoli. 1760.

A new era begins in the Cluj university education on October 12, 1872, when the emperor Franz Joseph I of Austria approves a decision of the Hungarian Parliament for setting up the University of Cluj. This Hungarian university was between the

first universities which have had in structure a separate Faculty of Mathematics and Natural Sciences.

At this university, moved to Szeged (Hungary) in 1919, worked world renowned mathematicians who founded a remarkable mathematical school. In the next section we present the most outstanding Hungarian mathematicians who contributed to the development of this important mathematical centre.

2. Hungarian professors of the University of Cluj

Professor Samu Borbély (1907–1884)

Samu Borbély was born in Torda (today Turda in Cluj country, Rumania) on April 23, 1907.

University studies: After his high school studies in Torda, Kolozsvár and Kecskemét, Samu Borbély started the university studies in mechanical engineering and mathematics in Budapest and continued in Berlin where he had personal contacts with *Albert Einstein*. He graduated as engineer-mathematician the Technical University of Berlin in 1933, and get his Ph.D. in 1938, at the same university under the supervision of professor *Rudolf Rothe*.

Didactical activity: In 1941 Borbély moves from Berlin to Cluj, where he is assistant professor and associate professor at the Ferenc József University. In 1944 he is taken to Berlin, where refusing to collaborate in the development of the V2 rockets he is incarcerated. He escapes in December 1944 and is hiding in Budapest until the end of the second World War, when he came back to Cluj, as professor of the Hungarian Bolyai University. Until 1949, when he moved back to Hungary, he contributed essential to the scientific development of the new university and to the rise of new generations of mathematicians at the Bolyai University.

After 1949 Samu Borbély activates at the University of Miskolc as head of the department of mathematics. Starting with 1955 he is the head of the department of mathematics at the Technical University in Budapest. In 1960 he is moving to Magdeburg, where he leads the department of mathematics of the Otto von Guericke University until 1964, when he came back to his position as head of the department of mathematics at the Technical University in Budapest. He is retired in 31 december, 1977.

Research activity: Between 1933 and 1941 Borbély, as associate researcher at the German Institute of Aeronautics in Berlin, studied problems of aerodinamics and technical mathematics.

His researches are oriented toward different problems of the applied mathematics. Main results concern ballistic problems, aerodynamics and nonlinear heat transfer.

In 1946 professor Samu Borbély becomes a corresponding member and in 1979 full member of the Hungarian Academy of Sciences.

Samu Borbély passed away in Budapest (Hungary) on August 14, 1984 and is buried in Târgu Mureş (Romania).

Professor Sámuel Brassai (1800–1897)

The information about the date and place where Sámuel Brassai was born is uncertain. We can find: June 15, 1800 in Torockószentgyörgy, Hungary (now Colțești, Alba county, Romania), or February 13, 1800, Torockó (Râmetea, Alba, Romania).

University studies: Brassai has never attended any university, he was an autodidact. Initiated by his father, a Unitarian minister in the mysteries of knowledge, he studied from the age of 12 at the Unitarian High School in Cluj. After the high school he completed his knowledge by traveling through Transylvania and Hungary, and as tutor in several families.

Didactical activity: After a long teaching experience at the Unitarian High School of Cluj and at Budapest, Brassai is appointed in 1872 professor of the elementary mathematics at the new founded University in Cluj (Magyar Királyi Tudományegyetem). Sámuel Brassai gives various courses of the elementary mathematics, focussing especially on the future teachers training. He also deliver courses on general linguistics and Sanskrit language. In academic year 1879-80 Brassai holds the position of rector of the university.

Research activity: Brassai was not a mathematician in the ordinary sense of the word today. He was a polymath, often remembered as the last Transylvanian polymath, attracted by mathematics, among many other sciences (history, geography, astronomy, linguistics, statistics, economy, theory of music, ...).

He published many scientific papers and articles to promote sciences, in various journals and newspapers of the time. In the area of mathematics he published textbooks for school education, articles about didactics of mathematics, and his most significant result has been the first translation in Hungarian of Euclid's Elements.

In recognition of his scientific merits, Brassai was received in the Hungarian Academy of Sciences a corresponding member of the department of mathematics and natural sciences in 1837, a full member of the department of history and philosophy in 1865, and honorary member in 1887.

Sámuel Brassai passed away in Kolozsvár on June 24, 1897.

Professor Vilmos Cseke (1915–1983)

Vilmos Cseke was born in Hátszeg, Hungary (now Hațeg, Hunedoara county, Romania) on May 15, 1915.

University studies: Vilmos Cseke graduated mathematics at the Cluj University in 1936 and received Ph.D. at the same university in 1947 advised by professor Teofil Vescan.

Didactical activity: After four years spent in the Catholic High School in Cluj, Vilmos Cseke is appointed assistant professor at the Cluj University in 1941, where he activates as associate professor (from 1948) and professor until his retirement. Professor Cseke contributed (1957–1979) to the development of the mathematical teaching as member and leader of the editorial board of the mathematical and physical magazines: *Matematikai és Fizikai Lapok*, and *Matematikai Lapok*.

Research activity: His research is focused on problems of the theory of probability, mathematical logics, mathematical statistics and applications of the mathematics in economy.

Professor Vilmos Cseke passed away in Kolozsvár on March 10, 1983.

Professor Lajos Dávid (1881–1962)

Lajos Dávid was born in Kolozsvár (Cluj) on May 28, 1881.

University studies: Lajos Dávid studied in Cluj, Göttingen and Paris. He attended courses taught by Gyula Farkas, Lajos Schlesinger and Frigyes Riesz in Cluj, David Hilbert and Felix Klein in Göttingen. He obtained the Ph.D. in mathematics at the Cluj University, advised by Lajos Schlesinger (1903).

Didactical activity: Gyula Dávid was a tutor at the Cluj University (1910) and at the Budapest University (1916), privatdozent in Budapest (1919) and professor from 1925 at the University of Debrecen. He leads a chair of mathematics in Cluj (1940–1944).

Research activity: Gyula David has published results concerning problems of algebra, theory of functions and history of mathematics. His research concerning the life and the activity of the two Bolyai is materialized in two books: *A két Bolyai élete es munkássága* (Budapest, 1923), *Bolyai-geometria az Appendix alapján* (Kolozsvár, 1944).

Professor Lajos Dávid passed away in Budapest on January 9, 1962.

Professor Gyula Farkas (1847–1930)

Gyula Farkas was born in Sárosd, Fejér Country, Hungary on March 28, 1847.

University studies: Gyula Farkas graduated the high school at the Benedictines gymnasium of the famous Pannonhalma abbey, founded in 969 by Prince Géza. After completing his schooling by the Benedictines, Farkas went to the Pest University with the intention of studying law and music. Soon he changed the direction of his studies and graduated chemistry in 1870. Later he continued his studies in chemistry and physics, obtaining the doctoral degree in 1876.

Didactical activity: Farkas worked as a private tutor for a while before returning to university to study physics and chemistry. He then returned to his native county of Fejér, teaching at the Modern School in the county town of Székesfehérvár. In 1874 he went to work for Géza Batthyány, the Count of Polgárdi, teaching his children mathematics and physics. Farkas now had time to undertake research both in mathematics and physics. Farkas was also given the opportunity to make visits abroad to broaden his background in mathematics and physics.

By 1880 Farkas had an impressive publication record in *Comptes Rendus* and was appointed as a dozent in function theory at the university in Pest. His career continued to flourish and on January 1887 he was appointed as an extraordinary professor at the University of Kolozsvár (Cluj), and in the following year he became an ordinary professor of theoretical physics there. Not only did Farkas serve the University of Kolozsvár as a professor, but he also served as Dean and as Rector of the University. In 1915 he resigned his position at the University since his eyesight was deteriorating. He retired to Budapest where he lived in retirement for 15 years.

Research activity: Gyula Farkas is known in mathematics for Farkas Theorem (or lemma) which is used in linear programming and also for his work on linear inequalities. In 1881 Gyula Farkas published a paper on Farkas Bolyai's iterative solution to

the trinomial equation, making a careful study of the convergence of the algorithm. In a paper published three years later, Farkas examined the convergence of more general iterative methods. He also made major contributions to applied mathematics and physics, particularly in the areas of mechanical equilibrium, thermodynamics, and electrodynamics.

The Hungarian Academy of Science elected him corresponding member in 1898 and full member in 1914. For his contribution on developing Italian–Hungarian scientific collaborations he was elected member of the Circolo Matematico di Palermo and awarded with the title of Doctor Honoris Causa of the Padova University (1892).

Professor Gyula Farkas passed away in Pestszentlőrinc (today part of Budapest), Hungary on December 27, 1930.

The Hungarian professors of the Department of Mathematics and Informatics of the Babeş-Bolyai University of Cluj has named their association, founded in 2001, the *Gyula Farkas Association for Mathematics and Informatics*.

Professor Lipót Fejér (1880–1959)

Lipót (Leopold) Fejér was born in Pécs, Hungary on February 9, 1880.

University studies: Fejér graduated from the high school in Pécs in 1897. In the same year he won second prize in the national Eötvös Mathematics Competition and entered the Polytechnic University of Budapest. Here he studied mathematics and physics until 1902, except for the year 1899–1900 which he spent at the University of Berlin, where he attended courses by Georg Frobenius, Lazarus Fuchs and Hermann Schwarz.

Fejér presented his doctoral thesis focusing on his fundamental summation theorem for Fourier series to the Eötvös Loránd University in Budapest in 1902. He spent the winter of 1902-3 on a visit to Göttingen, attending lectures by David Hilbert and Hermann Minkowski, and the summer of 1903 in Paris where he attended lectures by Émile Picard and Jacques Hadamard.

Didactical activity: Lipót Fejér started his university career at the University of Budapest (1903-1905) and continued as privatdozent in Kolozsvár (Cluj) from 1905 to 1911.

In the years he spent in Cluj he offered different courses, like: Differential and integral calculus, Differential equations, Partial differential equations, Theory of functions, Exercises for beginners, New results on integer transcendental functions.

In 1911 Fejér was appointed to the chair of mathematics at the University of Budapest and he held that post until his death. During his period in the chair at Budapest, Fejér led a highly successful Hungarian school of analysis. According to the Mathematics Genealogy Project current on-line database, Leopold Fejér has 20 students and 6336 descendants. Among his PhD students we can find prominent mathematicians as Paul Erdős, George Polya and John von Neumann.

Research activity: Discussions with Hermann Schwarz in Berlin led Fejér to look at the convergence of Fourier series and prove the highly significant "Fejér's theorem": *The Fourier series is summable $(C, 1)$ to the value of the function at each point of continuity*, result submitted to be published to the Paris Academy of Sciences on 10 December 1900, in a paper titled *Sur les fonctions bornées et intégrables*. During the

years spent in Cluj professor Fejér produced many high quality beautifully written papers: six in 1906, three in 1907, five in 1908, four in 1909 and six in 1910. After moving to Budapest Fejér continued to publish important works such as *Über die Konvergenz der Potenzreihe an der Konvergenzgrenze in Fällen der konformen Abbildung auf die schlichte Ebene* (1914), *Über Interpolation* (1916), and *Interpolation und konforme Abbildung*, (1918).

Fejér's main work was in harmonic analysis. He worked on power series and on potential theory. Much of his work is on Fourier series and their singularities but he also contributed to approximation theory. He collaborated to produce important papers, one with Carathéodory on entire functions in 1907 and another major work with Riesz in 1922 on conformal mapping.

Lipót Fejér was honoured with election to the Hungarian Academy of Sciences in 1911 and being a vice-president of the International Congress of Mathematicians held in Cambridge, England, in August 1912. He was elected to the Göttingen Academy of Sciences (1925), the Bavarian Academy of Sciences (1954), and the Polish Academy of Sciences (1957). He was elected an honorary member of the Calcutta Mathematical Society (1930), and awarded an honorary doctorate by Brown University in Providence, USA (1933) and by Eötvös Loránd University of Budapest (1950). He also served as an editor of the *Rendiconti del Circolo Matematico di Palermo* and of the *Mathematische Zeitschrift*. In addition, he received the highest state awards: the *Kossuth Prize*, first grade (1948), the *People's Order of Merit* (1950), and the *Labour Red Flag of Merit* (1953).

Professor Lipót Fejér passed away in Budapest, Hungary on October 15, 1959.

Professor Jenő Gergely (1896–1974)

Jenő (Eugen) Gergely was born in Kolozsvár, Hungary on March 4, 1896.

University studies: He attended all studies, from primary to university level in hometown. He graduated from the Faculty of Science of the University (Hungarian at the time) in Cluj. Jenő Gergely presented his doctoral thesis entitled: *Variations of double integrals*, supervised by of Alfred Haar, in 1921 at the University of Szeged, Hungary.

Didactical activity: Jenő Gergely served from 1918 to 1948 as professor of mathematics at Marianum, the Catholic school for girls, in Cluj, publishing a handbook of Algebra in 1937. Later, in the last 15 years of his activity, he followed all the steps of the academic career at universities in Cluj, first Bolyai University (1948–1959), then, after the unification of the two universities, the Babeş-Bolyai University (1959–1966). He published two university courses, one of Ordinary Differential Equations (1951), and another of Differential Geometry, with Árpád Kiss in 1957.

Research activity: Jenő Gergely worked in several areas of geometry and topology. He studied the classification of areas based on their intrinsic geometry, the geometry of Bolyai-Lobachevski, the polar theory of ovals and ovaloids based on their intrinsic equations and problems related on practical applications of geometry. In the last period of activity, he was interested in n-dimensional manifolds in separable Hilbert spaces and their applications in particle physics.

Professor Jenő Gergely passed away in Kolozvár (Cluj), Romania on May 15, 1974.

Professor Alfréd Haar (1885–1933)

Alfréd Haar was born in Budapest, Hungary on October 11, 1885.

University studies: Alfréd Haar attended the *Fasori Evangélikus Gimnázium* in Budapest. When he was a high school student has worked for the magazine for students *Középiskolai Matematikai Lapok* and won *Eötvös Loránd* national mathematics contest. Haar has started his university studies at the department of chemical engineering at the Technical University of Budapest, but in the same year moved to the University of Budapest, and after one year he becomes a student at the University of Göttingen. His professors were Carathéodory, David Hilbert, Felix Klein, Ernest Zermelo. Alfréd Haar presented his PhD thesis, written under the direction of David Hilbert, in June 1909.

Didactical activity: At age 24 Alfred Haar was appointed as a privatdozent at the University of Göttingen. He then moved to Zürich, where he taught mathematics at the famous technical university. In 1912 he was invited at the Franz Joseph University in Cluj, in the place of Fejér, called at the University of Budapest. He remains at the Hungarian University of Cluj until 1919, when he went to the University of Szeged. Haar, together with Riesz, rapidly made in Szeged a major mathematical centre from the new university. With support from the *Society of Friends of the Franz Joseph University*, they had founded the famous journal *Acta Scientiarum Mathematicarum* in 1930.

Research activity: Most of Haar's work was in analysis. The main results of his thesis, entitled *Zur Theorie der orthogonalen Funktionensysteme* appeared in a paper which he published in *Mathematische Annalen* in 1910. After the work of his thesis, he went on to study partial differential equations with applications to elasticity theory. He also wrote on Chebyshev approximations of functions, linear inequalities, analytic functions, and discrete groups. Between 1917 and 1919 he worked on the variational calculus, proving *Haar's Lemma*, and applying his results to problems like *Plateau's problem*. Haar introduced a system of orthogonal functions, a measure in mathematical analysis, with special properties, which today bears his name.

He was honoured in 1931 by election to the Hungarian Academy of Sciences.

Professor Alfréd Haar passed away in Szeged, Hungary on March 16, 1933.

Professor Lipót Klug (1855–1945)

Leopold (in German) or Lipót Klug (the Hungarian version) was born in Gyöngyös, Hungary on January 23, 1854.

University studies: Lipót Klug attended the gymnasium in his hometown and entered the University of Budapest in 1872. He graduated from the University on July 1874 with a teaching diploma. Later he undertook research, first for his diploma which was awarded in 1882, then for his habilitation (1897).

Didactical activity: After he graduated from the University, he was appointed on 25 September, 1874 as a high school teacher in the Science High School in Pozsony (Bratislava). He taught there between 1874 and 1893, writing his first books on

geometry, after which he taught at a secondary school in Budapest. He also taught as a privatdocent in Synthetic Geometry at the University of Budapest from 1891. During these years, he was greatly influenced by Gyula Kónig who taught at the Technical University of Budapest from the early 1870s. In 1897 Klug was appointed to the Franz Joseph University of Kolozsvár (now Cluj) as an extraordinary professor in Descriptive Geometry. After two years he was appointed to the chair of Descriptive Geometry at the University of Kolozsvár, a position he held for nearly twenty years, until 1917, when he retired and moved back to Budapest.

Research activity: Research areas: descriptive and synthetic projective geometry. In this topic has been one of the most influential and prolific Hungarian mathematician.

Professor Lipót Klug passed away in Budapest, Hungary on March 24, 1945.

Professor Lajos Martin (1827–1897)

Lajos Martin was born in Buda, Hungary on August 30, 1827.

University studies: His school education took place in Buda where he attended the Roman Catholic Secondary School. He then began studies at the university in Pest, taking courses in the Faculty of Arts in his first two years of study. However he then turned towards engineering taking courses at the university's Institutum Geometrico-Hyrotechnicum. The revolutions that swept Europe in 1848 disrupted his studies. Due to his active participation to the revolution, at the end of this, he was imprisoned and later enrolled to the army of the Austrian Empire, where he continued his technical studies, graduating in 1854 the military engineering academy in Vienna.

Didactical activity: Starting with 1855 he was teaching in the artillery school. Leaving the army, he started to work in 1860 as engineer, later being the chief Engineer of Buda town (1861). Then he taught first in a school in Selmecebnnya (now Banská Štiavnica, Slovakia), and from 1862 at a school in Bratislava. He also worked as the director of a telegraph office at one stage in his career during the 1860s. During these years he wrote some textbooks for secondary schools. In 1872 he was appointed as Professor of Mathematics in the Department of Advanced Mathematics at the new University of Kolozsvár. Here, Martin took also on the reorganization and the management of the Observatory of the University, which had been founded by Jesuits in 1755 but had been very neglected. He served this university until 1897, being rector in 1895/96.

Research activity: In army Martin started to undertake research in ballistics, an later continued this, both making theoretical calculations and carrying out practical experiments. He became interested in hydraulics, undertaking research on ships propellers, and giving an early formulation of the principle of the steam turbine. Later Martin published his studies of the theory of the best propeller and windmill. Lloyd's of London, the shipping insurance firm, were interested in Martin's screw propellers which they tested but Martin refused to sell patents for his ideas.

He was honoured with election to the Hungarian Academy of Sciences as a corresponding member in 1859, becoming a full member in 1861.

Professor Lajos Martin passed away in Kolozsvár, Hungary (now Cluj, Romania) on March 4, 1897.

Professor Árpád Pál (1929–2006)

Árpád Pál was born in Hodgya (Hoghia, Harghita country, Romania) on June 25, 1929.

University studies: After finishing elementary school in his native village, he continued the high school studies in Gyergyószentmiklós (Gheorgheni) and graduated in 1949 from Udvarhely Mixed High School (now Tamási Áron High School, Odorhei). In the same year gave admission to Bolyai University, Faculty of Mathematics and Physics in Cluj. He graduates as chief of promotion in 1952, and was sent to study in Moscow at the VM Lomonosov Astronomical Institute, Stenberg Department of Celestial Mechanics. Here he completed post-graduate studies with a thesis entitled *Analytical theory of interpolation of small planets (55) Astrea*, advised by professors Duboshin and Moiseev (1957).

Didactical activity: His entire academic career, starting from 1957, is linked to the University of Cluj, where he attended all functions of hierarchy even after his retirement (1995), when he became a consultant professor and continued the work with his Ph.D. students until his death.

He was particularly well regarded as teacher, as researcher and as manager: he was Dean of the Faculty of Mathematics (3 legislations), scientific secretary of the Senate, Vice-Rector of the University. A remarkable result was the construction of the modern buildings of the Astronomical Observatory (1982). As a doctoral supervisor gave the country 23 PhDs in astronomy (celestial mechanics) some of which itself became doctoral supervisors.

Research activity: He wrote (alone or jointly) courses and textbooks and more than 150 scientific papers in different journals. He founded as editor in chief the Romanian Astronomical Journal. He presented his scientific results at dozens of national and international scientific conferences. His central theme of research was celestial mechanics.

He was a member of the International Astronomical Union, the European Astronomical Union, the Romanian National Council of Astronomy, the Romanian Mathematical Society, the Academy of Science of America. As president and later honorary chairman of the Romanian National Astronomical Committee, represented Romania at several general assemblies and promoted most valuable Romanian astronomers to become members of the International Astronomical Union.

Professor Árpád Pál passed away in Kolozsvár, on July 21, 2006. In recognition for his outstanding scientific results, the international astronomical community honored him in 2012 by naming an asteroid (Arpadpal, 257,005) in his memory.

Professor Ferenc Radó (1921–1990)

Ferenc (Francisc) Radó was born in Timișoara on May 21, 1921.

University studies: After undergraduate studies in his hometown, he studied at the Engineering School in Bucharest and at the University of Cluj, where he graduated mathematics at the end of the second World War, in 1945. He got his PhD at the same university in 1959, under the supervision of professor Tiberiu Popoviciu.

Didactical activity: He worked as a teacher in Timișoara, then was appointed assistant professor in 1950 at the Bolyai University in Cluj. After the unification of

the Bolyai and Babeş universities, he was associate professor and later full professor at the Babeş-Bolyai University until his retirement in 1985. For many years he worked as a researcher at the Institute of Computing of the Academy. In the academic year 1969–70 was a visiting professor at the University of Waterloo (Canada).

Research activity: He has published articles in the country and abroad in the fields of: functional equations, nomograms transformation, algebraic and geometric structures, about the foundations of algebraic geometry, isometries in metric spaces, convex sets, geometries over rings (Barbilian type structures) etc. In 1981 he published the monograph in Hungarian: "A geometria mai szemmel" (Geometry seen today - with Béla Orbán).

Professor Ferenc Radó passed away in Kolozsvár, on November 27, 1990. His name was given to the Ferenc Rado Mathematical Association (established in 1993), which publish the mathematical journal for undergraduate students MatLap. Each year, in Cluj is organized the Ferenc Rado Memorial Mathematical Contest for High School students.

Professor Mór Réthy (1846–1925)

Mór Réthy was born in Nagykőrös, Hungary on November 9, 1846.

University studies: After following the primary and secondary school in his native town Nagykőrös, Mór Réthy attended the Technical Universities of Vienna and Budapest. He graduated with a degree in mathematics and descriptive geometry from the Technical University of Budapest in 1870.

Thanks to a state bursary suggested by Baron Loránd Eötvös, he had the opportunity to continue his studies at the famous universities of Göttingen and Heidelberg. In Heidelberg Kirchhoff, Königsberger and Schering assured him lifelong mental munition. He obtained his doctoral degree from Heidelberg University in 1874.

Didactical activity: Following his graduation, Réthy worked for two years as a teacher of mathematics and descriptive geometry at the Modern Technical School of Kőrmöcbánya (now Kremnica, Slovakia). Returning home after the award of his doctorate, he was appointed extraordinary professor at the University of Kolozsvár (1874). His seminars in mathematics – on elliptic functions, complex functions and determinants – gave a new colour to contemporary mathematical life. In 1876 he was promoted professor in the Mathematical and Theoretical Physics Department at Kolozsvár. He was also promoted as a Dean of the Faculty of Mathematics and Natural Sciences, serving in this role on two separate occasions. From 1884 to 1886 he was the Head of the Department of Elementary Mathematics. In 1886 Mór Réthy was invited to the Technical University of Budapest, where he first lectured on geometry. Then his interest turned to theoretical problems of physics and mechanics. From 1892 he was professor of the Analytical Mechanics and Theoretical Physics Department.

Research activity: His first paper on the diffraction of light was presented at Göttingen in 1872. During his stay at Kolozsvár problems concerning of navigation, including the question of constructing the most efficient propeller, were the focus of interest. Mór Réthy took part in very fruitful debates between outstanding mathematicians of his age and soon enriched the literature with two papers on the topic. His

whole life was interwoven with analysing, communicating and developing the work of the two Bolyais.

In 1878 Professor Mór Réthy was elected a corresponding member of the Hungarian Academy of Sciences and in 1900 became a full-member of the Academy. On 24 July 1924, he was awarded with a Jubilee doctorate from Heidelberg University.

Professor Mór Réthy passed away in Budapest, on October 16, 1925.

Professor Frigyes Riesz (1880–1956)

Frigyes Riesz was born in Győr, Hungary on January 22, 1880.

University studies: Frigyes Riesz studied at several universities: Technical University in Zurich (1897–99), Technical University in Budapest (1899–1901) and University of Göttingen (1901–1902). He obtained his doctorate from the Eötvös Loránd University in Budapest, in 1902. His doctoral dissertation was on geometry, supervised by Gyula Vályi.

Didactical activity: He spent a few years teaching in high schools in Lőcse (now Levoča, Slovakia) and Budapest before being appointed to a university post. Riesz was appointed to a chair in Kolozsvár in 1911. Starting with 1920 he continued to work at the Franz Joseph University moved to Szeged, Hungary.

In Szeged in 1922 Riesz set up the Bolyai Mathematical Institute in a joint venture with Haar and founded the journal of the Institute: *Acta Scientiarum Mathematicarum*.

In 1945 Riesz was appointed to the chair of mathematics in the University of Budapest.

Research activity: Riesz was a founder of functional analysis and his work has many important applications in physics.

By using Fréchet's ideas of distance, in his dissertation Riesz constructed a link between Lebesgue's work on real functions and the integral equations developed by Hilbert and his student Schmidt.

Many of Riesz's fundamental findings in functional analysis were incorporated with those of Banach. His theorem, now called the Riesz-Fischer theorem, which he proved in 1907, is fundamental in the Fourier analysis of Hilbert space. It was the mathematical basis for proving that matrix mechanics and wave mechanics were equivalent. This is of fundamental importance in early quantum theory.

Riesz made many contributions to other areas including ergodic theory where he gave an elementary proof of the mean ergodic theorem in 1938. He also studied orthonormal series and topology.

Frigyes Riesz received many honours for his work. He was elected to the Hungarian Academy of Sciences (corresponding member in 1916, full member in 1936) and, in 1949, he was awarded its Kossuth Prize. He was elected to the Paris Academy of Sciences and to the Royal Physiographic Society of Lund in Sweden. He received honorary doctorates from the universities of Szeged, Budapest and Paris.

Professor Frigyes Riesz passed away in Budapest, on February 28, 1956.

Professor Ludwig Schlesinger (1864–1933)

Ludwig (Lajos) Schlesinger was born in Nagyszombat, Hungary (now Trnava, Tyrnau, Slovakia) on November 1, 1864.

University studies: Ludwig Schlesinger started elementary school in Trnava and followed the high school in Presburg, now Bratislava (Slovakia). He then studied mathematics and physics at the universities of Heidelberg and Berlin, and he received a doctorate from the University of Berlin in 1887 for a thesis on differential equations, advised by Lazarus Immanuel Fuchs and Leopold Kronecker.

Didactical activity: In 1889 Schlesinger became an associate professor at the University of Berlin; in 1897 he was an invited professor at the University of Bonn, and in the same year he was appointed professor of mathematics at the University of Kolozsvár, Hungary (now Cluj, Romania). Here he served as head of the department of higher mathematics and, in 1906–07, he was the dean of the Faculty of Mathematics and Sciences. At the Franz Joseph University he was one of the most dedicated organisers of the centenary festivities dedicated to the hundredth anniversary of János Bolyai (1902). He identified the house in which János Bolyai was born and he held an excellent conference on the centenary festivity. During his stay in Kolozsvár (Cluj), Schlesinger contributed significantly – together with Gyula Farkas and Gyula Vályi – to the advancement of mathematics in the city. They also had a decisive role in the establishment of an excellent mathematics library within the university. He wrote in Kolozsvár 16 undergraduate courses in Hungarian, in several areas of mathematics. In 1911 he left Kolozsvár and moved to the University of Giessen, Germany, where he continued to teach until he retired in 1930.

Research activity: Like his professor Fuchs, he worked primarily on linear ordinary differential equations. His two-volume *Handbuch der Theorie der Linearen Differentialgleichungen* was published from 1895 to 1898 in Teubner in Leipzig (Vol.2 in two parts). He also published *Einführung in die Theorie der gewöhnlichen Differentialgleichungen auf funktionentheoretischer Grundlage* (Auflage, 1922), *Vorlesungen über lineare Differentialgleichungen* (1908) and *Automorphe Funktionen* (Gruyter, 1924). In 1909 he wrote a long report for the annual report of the *German Mathematical Society* on the history of linear differential equations since 1865. He also studied differential geometry, and wrote a book of lectures on Einstein's general relativity theory.

Today, his best known work is *Über eine Klasse von Differentialsystemen beliebiger Ordnung mit festen kritischen Punkten* (*Crelle's Journal*, 1912). There he considered the problem of isomonodromy deformations for a certain matrix Fuchsian equation; this is a special case of Hilbert's 21st Problem (existence of differential equations with prescribed monodromy). The paper introduced what are today called *Schlesinger transformations* and *Schlesinger equations*.

Schlesinger was also a historian of mathematics. He wrote an article on the function theory of Carl Friedrich Gauss and translated René Descartes' *La Géométrie* into German (1894). From 1904 to 1909 with R. Fuchs he collected the works of his professor Lazarus Fuchs, who was also his father-in-law.

From 1929 until his death he was co-editor of *Crelle's Journal*.

In 1902 Schlesinger was elected as a corresponding member of the Hungarian Academy of Sciences, and in 1909 he was honoured with the award of the Lobachevsky Prize.

Professor Ludwig Schlesinger passed away in Giessen, Germany on December 16, 1933.

Professor Gyula Szőkefalvi-Nagy (1887–1953)

Gyula Szőkefalvi-Nagy was born in Erzsébetváros, Hungary (now Dumbrăveni, Sibiu country, Romania) on April 11, 1887.

University studies: Gyula Szőkefalvi-Nagy studied mathematics and physics at the University of Cluj, where he received a doctorate in 1909, for a thesis on arithmetic properties of algebraic curves, advised by Gyula Schlesinger. In 1911–12, he made postgraduate studies, supported by a state stipendium in Gottingen, where he had contacts with the best mathematicians of the moment, like David Hilbert.

Didactical activity: Following his graduation, Gyula Szőkefalvi-Nagy worked for two years in high schools at Privigye (now Prividza, Slovakia) and Csíkszereda (Miercurea-Ciuc, Romania). Returning home after his studies in Germany, he was appointed extraordinary professor at the University of Kolozsvár (1915) and in the same year, director at the Catholic School Marianum in Cluj. He left Kolozsvár in 1929, and continued to work at the Ferenc József University moved to Szeged (Hungary). During the second world war he was appointed to the chair of geometry of the University of Kolozsvár (1940–1945). Starting with 1945 he was leading the chair of geometry in Szeged, until his death in 1953.

Research activity: The main results of Gyula Szőkefalvi-Nagy are in the geometrical applications of algebra and number theory. His results were published in the most prestigious journals, like *Bulletin of the American Mathematical Society*, *Archiv der Mathematic und Physik*, *Mathematische Annalen*, *Acta Scientiarum Mathematicarum*, ...

Professor Gyula Szőkefalvi-Nagy was elected to the Hungarian Academy of Sciences (corresponding member in 1934, full member in 1946). He passed away in Szeged, Hungary on October 14, 1953.

Professor Gyula Vályi (1855–1913)

Gyula Vályi was born in Marosvásárhely, Hungary (now Târgu-Mureş, Mureş country, Romania) on January 25, 1855.

University studies: After graduating the high school in his hometown in 1873, he went to Kolozsvár, the capital of Transylvania, where he attended the recently established university. After qualifying as a teacher of mathematics and physics in 1877, Vályi was awarded a scholarship to allow him to study for two years at the University of Berlin, where he attended lectures of Kummer, Borchardt, Weierstrass and Kronecker. A few months after his return to Cluj, in 1880 Vályi receive his Ph.D., with a thesis titled: *On the theory of partial differential equations of the second order*.

Didactical activity: Gyula Vályi become a dozent at the University of Kolozsvár in 1881, is appointed professor of theoretical physics in 1884, and in the following year he also became professor of mathematics, lecturing on analysis, geometry and

number theory. He was lecturing also on non euclidean geometry following the *Appendix* of János Bolyai. Vályi remained in Kolozsvár all his life despite being offered a professorship in Budapest. He retired in 1911 because of his deteriorating eyesight.

Research activity: His research were focused on partial differential equations, analytic and projective geometry, elementary mathematics and number theory. His doctoral dissertation on the theory of the propeller, which led to his developing on the theory of partial differential equations of the second order, published originally in Hungarian, was republished in 1906 and published also in German in 1909. He published in *Matematikai és Természettudományi Értesítő*, in *Crelle's Journal*, and other domestic and foreign journals. He also contributed essentially to the research of the Bolyai-legacy.

Professor Gyula Vályi was elected a corresponding member of the Hungarian Academy of Sciences in 1891.

Professor Gyula Vályi passed away in Kolozsvár, Hungary (now Cluj-Napoca, Romania) on October 13, 1913.

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