

IN MEMORIAM

Professor BORIS A. ROSENFELD
(30th August 1917 – 5th April 2008)

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Professor Boris Abramovich Rosenfeld, the well-known Russian mathematician and historian of mathematics, and an active member of the International Academy of History of Science (See *Historia Mathematica* 4 (1977), 411–414; 15 (1988), 1–8; *Archives Internationales d’Histoire des Sciences* 57, n° 158 (2007), 178-183), died in the USA on 5th April 2008. Professor Rosenfeld was born on 30th August 1917 in Petrograd (now: Sankt-Petersburg). His father was an engineer-economist and his mother was a surgeon. He was only two months old when the family moved to Moscow. Professor Rosenfeld always considered himself a Muscovite. In 1935 he finished his pre-university education at Moscow’s famous school n° 25, where he studied with many people who would later become famous, such as the poet B. Zakhoder, the historian A. Nekrich, the sculptor V. Tsigal, the lawyer D. Kaminskaya, and Stalin’s children Svetlana and Vasily. After finishing school he studied at the Moscow Power Engineering Institute, where he stayed for four and a half years, and at the same time at Moscow State University, where he graduated from the Mechanico-Mathematical Faculty as a geometrician in 1939, receiving the second prize for scientific study and the grade of “excellent”. Shortly afterwards he also graduated from the Moscow Power Engineering Institute. It is no coincidence that his first mathematical

research paper was published in the journal “Elektrichestvo” (“Electricity”) [1].

The eminent Russian geometrician V.F. Kagan advised him to continue his studies, and from 1939 to 1942 Rosenfeld was a post-graduate student at the Mechanico-Mathematical Faculty. His supervisor was P.K. Rashevsky, but his research later expanded on the subjects of his undergraduate work under the supervision of A.P. Norden, such as the intrinsic geometry of multiplicities of lines and planes of non-Euclidean spaces, of spheres and of other “symmetry figures” of different homogeneous spaces. In 1942 for his “Geometry of spherical manifolds” he was awarded a Ph.D. (“candidate’s”) degree [2] and began teaching mathematics at technical institutes. In 1947 he defended his doctoral thesis “Theory of families of subspaces” [3] in which he constructed a large unitary theory of multiplicities of different “symmetry figures” and developed the differential geometry of congruences and other families of these figures. He studied geometry throughout his life, with great success; indeed, geometry was his first scientific love. Some of his most important books on geometry are “Non-Euclidean geometry” (Moscow, 1955) [7]; “Multidimensional spaces” (Moscow, 1966) [28]; “Non-Euclidean spaces” (Moscow, 1969) [31]; “Stereographic projection” (Moscow, 1973) [39]; “Elie Cartan” (Providence, 1993) [59]; “Geometry of Lie groups. Symmetrical, parabolical, and periodical spaces” (Moscow, 2003) [65]; “Apolonius of Perga” (Moscow, 2004) [67]; “Elie Cartan” (Moscow, 2007) [68].

From 1950 to 1955 Professor Rosenfeld was professor of geometry at Azerbaijan State University in Baku. In 1951 he was invited to read a research course on the history of mathematics. Initially, the Azerbaijani mathematicians encouraged him to study the mathematical works of Naṣīr al-Dīn al-Ṭūsī, and his proof of Euclid’s fifth postulate; al-Ṭūsī had worked in the 13th century in southern Azerbaijan. In 1951 Professor Rosenfeld presented the results of his research at a seminar on the history of mathematics and mechanics at the Mechanico-mathematical faculty of Moscow State University, headed by A.P. Yushkevich and S.A. Yanovskaya. The lecture was a great success and in the same year it was published in the collection “Istoriko-matematicheskie issledovaniya” (IMI) edited by G.F. Rybkin and A.P. Yushkevich.

This was Professor Rosenfeld’s first paper on the history of Arabic mathematics [4], and it established his reputation as a historian of mathematics of the Near and Middle East in the Middle Ages. In 1953 he

published a Russian translation in IMI with commentary by himself and A.P. Yushkevich of three mathematical and mechanical treatises by ‘Umar Khayyām [5]. Later, in 1962, these treatises were published together with the translation of ‘Umar Khayyām’s five philosophical works and treatises on calendar and New Year holidays as a separate book [21]. In 1954, IMI brought out the mathematical treatises of Jamshīd al-Kāshī translated by Professor Rosenfeld with commentary by himself and A.P. Yushkevich [6]; later in 1956 the treatises were published as a separate book [11].

At 1955 Professor Rosenfeld left Baku and for a short time he worked as professor of mathematics in the pedagogical institute in Zagorsk (now: Sergiev Posad). Then, from 1955 up to 1964 he worked at Kolomna pedagogical institute (near Moscow) first as professor and then as holder of the chair of mathematics. After publishing the papers “The interpretations of Lobachevsky’s geometry” (Moscow, 1956) [8]; “The history of interpretations of Lobachevsky’s geometry” (Moscow, 1956) [10]; “Alexander Petrovich Kotelnikov” (Moscow, 1956) [9]; “Geometrical transformations in works of Euler” (Moscow, 1957), “New research in the prehistory of Lobachevsky’s geometry and in the history of its interpretations” (1958) [14]; “Aghanis’s proof of Euclid’s fifth postulate” (Erevan, 1960) [16]; “Theory of relativity and geometry” (Moscow, 1962) [20] Professor Rosenfeld established himself not only as a historian of Arabic mathematics but also as historian of science in general.

In 1964 after his publications of translations with commentaries of the mathematical treatises of Ibn al-Haytham and Gersonides (1958) [15], al-Tūsī and Ulugh Beg (1960) [17], Thābit ibn Qurra (1961, 1963) [19, 24] and al-Bīrūnī (1963) [23] he was invited to join the department of the history of mathematics (headed by A.P. Yushkevich) of the Institute of History of Science and Technology of the Academy of Sciences of the USSR (now S.I. Vavilov Institute of the History of Science and Technology of the Russian Academy of Sciences). Simultaneously Professor Rosenfeld taught geometry at the Moscow State Pedagogical Institute. During the following years he wrote the chapters “Prehistoric times” (together with E.I. Berezkina), “Combinatorics and probability theory” (together with L.E. Maistrov and O.B. Sheynin), “Geometry” (together with A.P. Yushkevich) for the *History of mathematics from the most ancient times to the beginning of the 19th century* (Moscow, 1970–1972, ed. by A.P. Yushkevich) [32 – 34]. He wrote chapters in *The*

history of mechanics (Moscow, 1971–1972, ed. by A.T. Grigorian and I.B. Pogrebyssky) [36]. He compiled the geometrical section of the *Reader on the history of mathematics* (Moscow, 1976, ed. by A.P. Yushkevich) [43]. For the *Dictionary of Scientific Biography* ed. by C. C. Gillispie he wrote biographies of N.I. Lobachevsky (1973), A.I. Maltsev (1974). For the *Mathematics of the 19th century* (Moscow, 1981, ed. by A.N. Kolmogorov, A.P. Yushkevich) he wrote a chapter entitled “Geometry” (together with B.L. Laptev) [46].

Professor Rosenfeld translated into Russian and commented treatises of following authors: al-Bīrūnī, al-Farābī, al-Farghānī, al-Fazārī, Ibn al-Haytham, Muḥammad ibn al-Ḥusayn, al-Kāshī, al-Khwārizmī, al-Nasawī, al-Nayrīzī, al-Rāzī, al-Rudānī, al-Rūmī, Thābit ibn Qurra, al-Sālār, al-Samaw’al, al-Shīrāzī, al-Sijzī, Ibn Sīnā, al-Ṭūsī, and Ulug Beg. After studying the creative works of eminent scholars Professor Rosenfeld started to write their scientific biographies:

‘Umar Khayyām – poet, thinker, scientist (together with S.B. Morochnik) (Dushanbe, 1957) [12]; *‘Umar Khayyām* (together with A.P. Yushkevich) (Moscow, 1965) [27]; *Abū’l-Rayḥān al-Bīrūnī* (together with M.M. Rozhanskaya and Z.K. Sokolovskaya) (Moscow, 1973) [37]; *Abū Rayḥān Bīrūnī (to mark his millenary)* (together with B.M. Kedrov) (Moscow, 1973) [38]; *Thābit ibn Qurra (836–901)* (together with N.G. Khairetdinova) (Moscow, 1994) [60]; *Aḥmad al-Ferghānī. IX century* (together with N.D. Sergeeva) (Moscow, 1998) [62].

Much of Professor Rosenfeld’s research is of a general nature:

The theory of parallel lines in the medieval Orient. 9th –14th centuries (together with A.P. Yushkevich) (Moscow, 1983) [50]; *Mathematicians and astronomers of medieval Islam and their works (8th –17th centuries)*. Three volumes (together with G.P. Matvievsckaya) (Moscow, 1983) [51]; *Mathematicians, astronomers and other scholars of Islamic civilization and their works (7th–19th c.)* (together with E. Ihsanoglu) (Istanbul, 2003) [64].

Professor Rosenfeld wrote many articles for International encyclopaedias: the *Dictionary of Scientific Biography* (New York, ed. by Ch.C.Gillispie), *Scienziati e tecnologi contemporanei* (Milano), *Lexikon des Mittelalters* (München), the *Encyclopaedia of the history of Arabic science* (London–New York), the *Encyclopaedia of the history of science in non-Western cultures* (Dordrecht–Boston–London), the *Encyclopaedia of Islam* (Leiden), *Scienza e storia, rivista del Centro internazionale di*

storia dello spazio e del tempo, and the *Zeitschrift für Geschichte der Arabisch-Islamischen Wissenschaften*.

In 1990 Professor Rosenfeld moved to the USA where for five years he taught history of mathematics and philosophy of space (historical aspect) at the State College of Pennsylvania University.

The memory of Boris Abramovich Rosenfeld will forever remain with his colleagues and disciples.

LIST OF B.A. ROSENFELD'S SELECTED WORKS

1. 1940. "Mathematical theory of the scale of the circular diagram". *Elektrichestvo* 4. 62–64 (Russian).
2. 1942. "Geometry of spherical manifolds". Candidate's (Ph.D.) thesis, Moscow University. *Uchenye Zapiski Moskovskogo Universiteta (Matem.)* 73. 1944. 49–82 (Russian).
3. 1948. "Theory of families of subspaces" Doctor (Sc.) thesis. Moscow University. *Izvestiya Akademii Nauk SSSR (Matem.)* 11. 1947. 283–308; *Matematicheskii Sbornik* 22. 1948. 457–492; 23. 1948. 297–313; 24. 1949. 53–74. 405–428 (Russian).
4. 1951. "On the mathematical works of Naṣīr al-Dīn al-Ṭūsī". *Istoriko-matematicheskie Issledovaniya* 4. 489–512 (Russian); *Scientia Sinica* 7. 1958. 88–100 (Chinese).
5. 1953. "Umar Khayyām. Mathematical treatises". Paper, translation, and commentary (Together with A.P. Yushkevich). *Istoriko-matematicheskie Issledovaniya* 6. 15–172 (Russian).
6. 1954. "Jamshīd Ghiyāth al-Dīn al-Kāshī. Key of arithmetic. Treatise on a circumference". Paper, translation, and commentary (Together with A.P. Yushkevich). *Istoriko-matematicheskie Issledovaniya* 7. 13–449 (Russian).
7. 1955. *Non-Euclidean geometries*. Moscow (Russian).
8. 1956. "Interpretations of Lobachevsky's geometry". *Istoriko-matematicheskie Issledovaniya* 9. 177–216 (Russian).
9. 1956. "Alexander Petrovich Kotelnikov". *Istoriko-matematicheskie Issledovaniya* 9. 317–400 (Russian).
10. 1956. "The history of interpretations of Lobachevsky's geometry". *Proceedings of the 3d All-Union Mathematical Congress* 1. 234 (Russian).

11. 1956. "Jamshīd Ghiyāth al-Dīn al-Kāshī. Key of arithmetic. Treatise on a circumference". Paper, text, translation, and commentary. Moscow (Together with A.P. Yushkevich) (Russian).
12. 1957. 'Umar Khayyām – poet, thinker, scientist. Dushanbe (Together with S.B. Morochnik) (Russian).
13. 1957. "Geometry of rectangular matrices and its application to real projective and non-Euclidean geometry". *Izvestiya Vysshikh Uchebnykh Zavedenii*. 238–247 (Russian); *Scientia Sinica* 6. 1957. 995–1011; *Acta Mathematica Sinica* 8. 1958. 132–145 (Together with Loo-Keng Hua) (Chinese).
14. 1958. "New researches in the prehistory of Lobachevsky's geometry and in the history of its interpretations". Actes du VIII^e Congrès International d'Histoire des Sciences. Firenze–Paris, 1958 I. 138–141 (English).
15. 1958. "Proofs of Euclid's fifth postulate by the medieval mathematicians al-Ḥasan ibn al-Haytham and Levi ben Gerson". *Istoriko-matematicheskie Issledovaniya* 11. 733–782 (Russian).
16. 1960. "Aghanis's proof of Euclid's fifth postulate". *Izvestiya Akademii Nauk Armyanskoi SSR (Phys.-math. sc.)* 13. 153–164 (Together with G.B. Petrosyan) (Russian).
17. 1960. "Naṣīr al-Dīn al-Ṭūsī. Treatise curing the doubt on parallel lines. Paper, translation, and commentary. *Istoriko-matematicheskie Issledovaniya* 13. 475–532 (Together with A.P. Yushkevich) (Russian).
18. 1960. "Qāḍī-zāda al-Rūmī. Treatise on the determination of the sine of one degree". Paper, translation, and commentary *Istoriko-matematicheskie Issledovaniya* 13. 533–556 (Together with A.P. Yushkevich) (Russian).
19. 1961. "Thābit ibn Qurra. Book on the proof of the famous Euclid's postulate. Shams al-Dīn al-Samarqandī. Fundamental propositions (fragment)". Paper, translation, and commentary. *Istoriko-matematicheskie Issledovaniya* 14. 587–602 (Together with A.P. Yushkevich) (Russian).
20. 1962. "Theory of relativity and geometry". *Einstein i Razvitie Fiziko-matematicheskoi Mysli*. Moscow. 10–62 (Russian).
21. 1962. "'Umar Khayyām. Treatises". Paper, texts, translation, and commentary. Moscow (Together with A.P. Yushkevich) (Russian).
22. 1962. "The star catalogue of al-Bīrūnī and the star catalogues of 'Umar Khayyām and al-Ṭūsī". Translation, and commentary. *Istoriko-astronmicheskije Issledovaniya* 8. 33–192 (Russian)
23. 1963. "Al-Bīrūnī. On the determination of chords in a circle. The book on Indian rashikas". Paper, translation, and commentary. *Iz Istorii Nauki i*

- Tekhniki v Stranakh Vostoka* 3. 71–166 (Together with S.A. Krasnova and M.M. Rozhanskaya) (Russian).
24. 1963. “Thābit ibn Qurra. Book on the fact that two lines produced at two angles less than two right angles will meet”. Translation, and commentary. *Istoriko-matematicheskie Issledovaniya* 15. 363–380 (Russian).
 25. 1963. “Naṣīr al-Dīn al-Ṭūsī. Collection on arithmetic using a board and dust”. Translation of the section on binom, and commentary. *Istoriko-matematicheskie Issledovaniya* 15. 432–444 (Together with S.A. Ahmedov) (Russian).
 26. 1964. *Muḥammad al-Khwārizmī. Mathematical treatises*. Translation, and commentary. Tashkent. (Together with Yu.Kh. Kopelevich) (Russian).
 27. 1965. *‘Umar Khayyām*. Moscow (Together with A.P. Yushkevich) (Russian).
 28. 1966. *Multidimensional spaces*. Moscow. (Russian).
 29. 1967. *Abū ‘Alī ibn Sīnā. Mathematical chapters of the Book of Knowledge*. Paper, translation, and commentary. Dushanbe (Together with N.A. Sadovsky and S.U. Umarov) (Russian).
 30. 1968. *Alexander Petrovich Kotelnikov (1865–1944)*. Moscow (Together with T.V. Putyata, B.L. Laptev, B.N. Fradlin) (Russian).
 31. 1969. *Non-Euclidean spaces*. Moscow. (Russian).
 32. 1970. “Prehistoric times. Countries of Islam. Medieval Europe. Epoch of Renaissance”. *History of Mathematics from the Most Ancient Times to the Beginning of the 19th Century* (Ed. by A.P. Yushkevich) 1. 9–15, 205–326 (Together with E.I. Berezkina, A.P. Yushkevich) (Russian).
 33. 1970. “Combinatorics and probability theory. Geometry”. *History of Mathematics from the Most Ancient Times to the Beginning of the 19th Century* (Ed. by A.P. Yushkevich) 2. 81–97, 98–129 (Together with L.E. Maistrov, O.B. Sheynin, A.P. Yushkevich) (Russian).
 34. 1972. “General characteristics of the mathematics of the 18th century. Arithmetics and algebra. Geometry”. *History of Mathematics from the Most Ancient Times to the Beginning of the 19th Century* (Ed. by A.P. Yushkevich) 3. 7–31, 32–100, 153–221 (Together with I.G. Bashmakova, A.P. Yushkevich) (Russian).
 35. 1972. *Al-Farabi. Mathematical treatises*. Paper, translation, and commentary. Alma-Ata (Together with M.F. Bockstein, S.A. Krasnova, A.K. Kubesov) (Russian).

36. 1972. "Theory of screws and non-Euclidean mechanics". *History of Mechanics from the End of 18th Century up to the Middle of 20th Century* (Ed. by A.T. Grigorian and I.B. Pogrebysskii) Moscow. 338–346 (Together with A.T. Grigorian) (Russian).
37. 1973. *Abū'l-Rayḥān al-Bīrūnī*. Moscow (Together with M.M. Rozhanskaya and Z.K. Sokolovskaya) (Russian).
38. 1973. *Abū Rayḥān Bīrūnī (for his millenary)*. Moscow (Together with B.M. Kedrov) (Russian).
39. 1973. *Stereographic projection*. Moscow (Together with N.D. Sergeeva) (Russian, English, Spanish).
40. 1973/1976. "Abū'l-Rayḥān al-Bīrūnī. Masudic Canon". Paper, translation, and commentary. *Selected Works* 5. Part 1. 1973. Part 2. 1976. Tashkent (Together with P.G. Bulgakov, A.A. Ahmedov, M.M. Rozhanskaya, Yu.P. Smirnov) (Russian).
41. 1975. *Al-Farābī. Commentaries to Ptolemy's Almagest*. Paper, translation, and commentary. Alma-Ata (Together with A.K. Kubesov and J. al-Dabbagh) (Russian).
42. 1975. "Abū'l-Rayḥān al-Bīrūnī. The book of instruction in the elements of the science on stars". Paper, translation, and commentary. *Selected Works* 6. Tashkent (Together with A.A. Ahmedov, A.A. Abdurahmanov, M.M. Rozhanskaya, N.D. Sergeeva) (Russian).
43. 1976. *Reader on history of mathematics. Arithmetic and algebra. Theory of numbers. Geometry* (Ed. by A.P. Yushkevich). Translation and commentary. Moscow (Together with A.P. Yushkevich, I.G. Bashmakova, S.S. Demidov) (Russian).
44. 1976. *History of non-Euclidean geometry. The development of the notion of geometrical space*. Moscow (Russian).
45. 1978. "Arabic version of Diophantus's Arithmetic". *Istoriko-matematicheskie Issledovaniya* 23. 191–249 (Together with I.G. Bashmakova, E.I. Slavutin) (Russian).
46. 1981. "Geometry". *Mathematics of the 19th century* (Ed. by A.N. Kolmogorov, A.P. Yushkevich) 2. 9–114. Moscow (Together with B.L. Laptev) (Russian).
47. 1983. "Abū'l-Rayḥān al-Bīrūnī. On ratios between metals and precious stones by volume". Translation and commentary. *Nauchnoe Nasledstvo* 6. 141–160, 309–316 (Together with M.M. Rozhanskaya) (Russian).
48. 1983. "Muḥammad ibn al-Ḥusayn. Letter on the proof of the fact that the sides of two square numbers whose sum is a square cannot be odd".

- Translation and commentary. *Nauchnoe Nasledstvo* 6. 161–174, 316–321 (Russian).
49. 1983. “Qūṭb al-Dīn al-Shīrāzī. Commentaries to the «Treatise on the motion of rolling and on the ratios between plane and curved surfaces»”. Translation and commentary. *Nauchnoe Nasledstvo* 6. 175–228, 321–330 (Together with J. al-Dabbagh) (Russian).
50. 1983. *The theory of parallel lines in the medieval Orient. 9th–14th centuries*. Moscow (Together with A.P. Yushkevich) (Russian).
51. 1983. *Mathematicians and astronomers of medieval Islam and their works (8th–17th centuries)*. 3 volumes. Moscow (Together with G.P. Matvievsckaya) (Russian).
52. 1983. *Muḥammad al-Khwārizmī (ca. 783 – ca. 850)*. Moscow (Together with P.G. Bulgakov and A.A. Ahmedov) (Russian).
53. 1983. *Muḥammad al-Khwārizmī. Mathematical treatises*. Translation and commentary. 2nd edition. Tashkent (Together with Yu.Kh. Kopelevich, G.P. Matvievsckaya, A.P. Yushkevich) (Russian).
54. 1983. *Alfonso. Straightening the curved*. Paper, text, translation, and commentary. Moscow (Together with S.Ya. Luria and G.M. Gluskina) (Russian).
55. 1984. *Thābit ibn Qurra. Mathematical treatises*. Paper, translation of 35 treatises, and commentary. *Nauchnoe Nasledstvo* 8. Moscow (Together with J. al-Dabbagh, L.M. Karpova, G.P. Matvievsckaya, and others) (Russian).
56. 1985. “Abū Sa‘īd al-Sijzī. Book on the measurement of spheres”. Paper, translation, and commentary. *Istoriko-matematicheskie Issledovaniya* 29. 321–333 (Together with R.S. Safarov and E.I. Slavutin) (Russian).
57. 1987. *Abū Rayḥān Bērūnī. Mathematical and astronomical treatises. Selected Works* 7. Translation, and commentary. Tashkent (Together with P.G. Bulgakov) (Russian).
58. 1988. *A History of non-Euclidean geometry. Evolution of the concept of a geometric space*. New York–Berlin–Heidelberg.
59. 1993. *Elie Cartan (1869–1951)*. Providence (Together with M.A. Akivis).
60. 1994. *Thābit ibn Qurra (836–901)*. Moscow (Together with N.G. Khairtdinova).
61. 1998. *Aḥmad al-Ferghānī. IX century*. Moscow (Together with N.D. Sergeeva) (Russian).

62. 1998. *Al-Ferghānī. Astronomical treatises*. Translation and commentary. Tashkent (Together with I.G. Dobrovolsky and N.D. Sergeeva) (Russian).
63. 2002/2003. A mathematical treatise written in the Samarqand observatory of Ulugh Beg. *Zeitschrift für Geschichte der Arabisch Islamischen Wissenschaften*. 15, 25–65 (Together with J.P. Hogendijk).
64. 2003. *Mathematicians, astronomers and other scholars of Islamic civilization and their works (VII–XIX c.)*. Istanbul (Together with E. Ihsanoglu).
65. 2003. *Geometry of Lie groups. Symmetrical, parabolical, and periodical spaces*. Moscow (Russian).
66. 2004. “A Supplement to *Mathematicians, astronomers and other scholars of Islamic civilization and their works (VII–XIX c.)*”. *Suhayl* (Ed. by J. Samsó) 4. 87–139.
67. 2004. *Apolonius of Perga*. Moscow (Russian).
68. 2006. “A Second Supplement to *Mathematicians, Astronomers, and other Scholars of Islamic Civilisation and their Works (7th – 19th c.)*”. *Suhayl* 6. 9-79.
69. 2007. *Elie Cartan (1869–1951)*. Moscow (Together with M.A. Aivis) (Russian).