

THE IX-XII CENTURIES RENAISSANCE SCIENTIFIC DISCOVERIES IN MATHEMATICS AND ASTRONOMY

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Abstract: The Central Asian Renaissance, spanning from the 9th to the 12th centuries, represents a monumental era of intellectual awakening that transformed the cultural and scientific landscape of the medieval world. During this epoch, the cities of Bukhara, Samarkand, Khwarazm, and Fergana emerged as radiant centers of knowledge and civilization, where science, literature, philosophy, and theology flourished under the patronage of enlightened rulers and scholars. Distinguished polymaths such as Al-Khwarizmi, Al-Farghani, Al-Farabi, Al-Biruni, Ibn Sina, Al-Bukhari, and Omar Khayyam laid the foundational stones of modern mathematics, astronomy, medicine, and philosophy. Their groundbreaking discoveries, empirical methodologies, and philosophical rationalism not only advanced the frontiers of knowledge but also profoundly influenced the intellectual transformation of Europe during the later Renaissance. The Central Asian Renaissance thus stands as a vital bridge between the classical civilizations of antiquity and the modern scientific era, embodying humanity's universal quest for truth, wisdom, and enlightenment.

Keywords: Central Asian Renaissance; Al-Khwarizmi; Al-Farghani; Al-Farabi; Al-Biruni; Ibn Sina; Al-Bukhari; Mahmud al-Kashghari; Yusuf Khas Hajib; Omar Khayyam; Scientific Heritage; Cultural Flourishing

The period between the 9th and 10th centuries witnessed an extraordinary intellectual resurgence across Central Asia — a region that became the beating heart of the Islamic Golden Age. This Renaissance was not limited to artistic revival but extended deeply into science, philosophy, and education. The flourishing of Bukhara,

Samarkand, Khwarazm, and Fergana as centers of learning marked the birth of a new epistemological era founded upon observation, experimentation, and reason. Scholars from these cities cultivated a synthesis of ancient Greek philosophy, Indian mathematics, and Persian thought, fusing them into a uniquely Central Asian scientific tradition. This vibrant intellectual movement redefined the understanding of nature, the cosmos, and the human intellect. The scientific institutions of the time — libraries, madrasahs, and observatories — became sanctuaries of learning, where mathematics, medicine, logic, and astronomy were systematically developed. The transmission of these ideas through translations and scholarly exchanges formed the cornerstone of the later European Renaissance. Thus, the Central Asian Renaissance was not merely a regional phenomenon; it was a civilizational dialogue that shaped the destiny of global knowledge.

The Importance of the Renaissance in Central Asia: The Central Asian Renaissance holds immense importance as it symbolized a cultural and scientific revolution that merged faith with reason and tradition with innovation. It marked the birth of modern scientific inquiry, where scholars began to rely on empirical observation, logical deduction, and mathematical precision. During this period, education was highly esteemed, and scholars were regarded as the architects of civilization. The translation of Greek and Sanskrit works into Arabic underpinned the development of mathematics, astronomy, medicine, and philosophy. Central Asian thinkers not only preserved this heritage but also expanded it through creative innovation and rigorous experimentation. Their legacy influenced later scientists like Copernicus, Galileo, and Newton, who built upon the foundations laid by Islamic scholars.

In essence, the Central Asian Renaissance was the intellectual bridge between the ancient and modern worlds, guiding humanity from speculative philosophy to scientific rationalism.

Muhammad ibn Musa al-Khwarizmi (c. 780–850) Born in Khwarazm (present-day Khiva, Uzbekistan), Al-Khwarizmi was one of the greatest mathematicians and astronomers of his era. His treatise “Kitab al-Jabr wal-Muqabala” (The Compendious Book on Calculation by Completion and Balancing) introduced the systematic study of algebra — a term derived from “al-jabr.” He also authored works on arithmetic using Hindu–Arabic numerals, which revolutionized mathematics in Europe after being translated into Latin. Al-Khwarizmi’s name gave rise to the modern term “algorithm.”

As a leading scholar at the Bayt al-Hikma (House of Wisdom) in Baghdad, he contributed to geography and astronomy, compiling accurate maps and astronomical tables. His innovations became the cornerstone of modern algebra, trigonometry, and computation. Ahmad ibn Muhammad al-Farghani (Alfraganus) (c. 797–865) Born in the Fergana Valley, Al-Farghani was a preeminent astronomer, mathematician, and

engineer. His magnum opus, “Kitab fi Harakat as-Samawiyyah wa Jawami‘ Ilm an-Nujum” (The Book of Celestial Motions and Compendium of Astronomy), provided precise data on the diameter of the Earth and celestial bodies. He supervised the construction of Nilometers in Egypt — instruments for measuring the Nile’s water level — showing his mastery in engineering. His works, translated into Latin as Alfraganus, were used in European universities until the 15th century.

His astronomical insights directly influenced Copernicus and Dante Alighieri’s cosmological imagination in *The Divine Comedy*.

Abu Nasr al-Farabi (870–950) Known as “The Second Teacher” after Aristotle, Al-Farabi was born in Farab (Otrar, Kazakhstan). He was a philosopher, logician, and political theorist whose works integrated Greek philosophy with Islamic theology.

His masterpiece “Al-Madina al-Fadila” (The Virtuous City) envisions an ideal society governed by virtue and wisdom, comparable to Plato’s *Republic*.

He classified knowledge in his *Enumeration of the Sciences*, contributing to epistemology and pedagogy. Al-Farabi emphasized rationalism, logic, and harmony between religion and reason, influencing both Ibn Sina and medieval Christian thinkers such as Thomas Aquinas.

Abu Rayhan al-Biruni (973–1048) A polymath born in Khwarazm, Al-Biruni excelled in astronomy, physics, mathematics, geography, and anthropology. He calculated the Earth’s radius with near-modern accuracy and proposed the Earth’s rotation long before Copernicus.

His encyclopedic work “Al-Qanun al-Mas‘udi” (The Mas‘udian Canon) details astronomical and mathematical principles. Another monumental work, “Kitab al-Hind” (The Book of India), is a comparative study of Indian philosophy, religion, and science — a masterpiece of early ethnography. Al-Biruni’s scientific method was based on observation, experimentation, and critical reasoning, making him a pioneer of empirical science.

Abu Ali ibn Sina (Avicenna) (980–1037) Born near Bukhara, Ibn Sina was a physician, philosopher, and scientist whose intellect shaped the course of medicine and philosophy.

His “Al-Qanun fi al-Tibb” (The Canon of Medicine) served as the primary medical textbook in both the Islamic world and Europe for more than 500 years. It described infectious diseases, pharmacology, and clinical diagnosis with remarkable precision.

His philosophical treatise “Kitab al-Shifa” (The Book of Healing) presented a comprehensive system of logic, physics, and metaphysics. Ibn Sina synthesized Aristotelian philosophy with Islamic thought, laying the groundwork for rationalism and scientific medicine.

Imam Muhammad al-Bukhari (810–870) Born in Bukhara, Imam al-Bukhari devoted his life to collecting and authenticating the sayings of the Prophet Muhammad (Hadith).

His monumental collection, “Sahih al-Bukhari”, is regarded as the most reliable Hadith compilation in Sunni Islam. He spent decades traveling across the Islamic world to verify narrations with rigorous scholarly methodology, establishing standards of source criticism and academic integrity that later influenced Islamic historiography and jurisprudence.

Mahmud al-Kashghari (1008–1105) A native of Kashgar, Mahmud al-Kashghari was a linguist, lexicographer, and ethnographer. His renowned work “Divanu Lughat at-Turk” (Compendium of the Turkic Dialects) is the first dictionary of Turkic languages, accompanied by a world map — the oldest known Turkic cartographic representation. He meticulously documented the dialects, poetry, and cultural practices of Turkic tribes, preserving their linguistic heritage and contributing to Turkology, historical linguistics, and anthropology.

Yusuf Khas Hajib (XIth century) Born in Balasaghun (Kyrgyzstan), Yusuf Khas Hajib was a political philosopher and poet. His celebrated work “Kutadgu Bilig” (Wisdom of Royal Glory) serves as a mirror for princes, offering ethical and political advice to rulers.

It promotes justice, wisdom, and moral responsibility, reflecting a fusion of Turkic traditions and Islamic ethics. The text remains one of the most significant monuments of Turkic written culture. Omar Khayyam (1048–1131) Born in Nishapur (Khorasan), Omar Khayyam was a mathematician, astronomer, philosopher, and poet. He solved cubic equations using geometric methods and contributed to Pascal’s Triangle centuries before Pascal. As head of the royal observatory in Isfahan, he reformed the Persian calendar — the Jalali calendar, which is more accurate than the Julian calendar. His Rubaiyat (quatrains) are celebrated worldwide for their existential depth, lyrical beauty, and philosophical insight, exploring themes of fate, mortality, and divine mystery.

Abu Mansur al-Maturidi (853–944) Born in Samarkand, Al-Maturidi was a major theologian and founder of the Maturidi school of Islamic thought, emphasizing the compatibility of reason and revelation. His principal work, “Kitab al-Tawhid,” established a rational theological framework, balancing faith and intellect. Maturidi theology played a crucial role in shaping Sunni orthodoxy and the intellectual landscape of Central Asian Islam.

Abu Abdullah Rudaki (858–941) Known as the father of Persian poetry, Rudaki was born near Samarkand. He composed more than 100,000 verses, though only fragments survive today. He served in the Samanid court and used poetry to express philosophical and moral ideas, laying the foundations of classical Persian literature.

Rudaki's poetry celebrates human emotion, wisdom, and the harmony of nature.

Abu al-Qasim Firdawsi (940–1020) The great Persian poet Firdawsi, born in Tus, wrote the monumental epic “Shahnameh” (Book of Kings) — over 60,000 verses chronicling the mythical and historical past of Iran. By composing it in pure Persian, he revived the language and preserved pre-Islamic heritage. The Shahnameh became a source of national identity for Persian-speaking cultures and influenced literature across Central Asia.

Burhan al-Din al-Marghinani (1130–1197) Born in Marghinan (Fergana region), Al-Marghinani was one of the most respected jurists of the Hanafi school. His seminal work “Al-Hidayah” (The Guidance) systematically codified Islamic jurisprudence.

It remains an authoritative legal reference in the Islamic world, studied in madrasahs for nearly 900 years, reflecting the enduring legal scholarship of Central Asia.

Conclusion: The Renaissance of the IXth to XIIth centuries in Central Asia stands as one of the most luminous epochs in the intellectual history of humankind. It was not merely a regional awakening but a universal reformation of thought, where knowledge transcended geographical, linguistic, and cultural boundaries. Through the tireless pursuit of truth, the scholars of Bukhara, Samarkand, Khwarazm, and Fergana transformed the region into a radiant nexus of scientific, philosophical, and literary innovation. Figures such as Al-Khwarizmi, Al-Farghani, Al-Farabi, Al-Biruni, Ibn Sina, and Omar Khayyam did not only preserve the intellectual heritage of antiquity but redefined it through empirical precision, rational inquiry, and creative synthesis. Their pioneering works in mathematics, astronomy, philosophy, medicine, and linguistics laid the conceptual foundations for the later European Renaissance and the emergence of modern science. The Central Asian Renaissance emphasized the principles of reason, observation, and universal humanism, revealing that intellectual progress flourishes where curiosity and tolerance coexist. The achievements of these scholars demonstrate that the pursuit of knowledge is a sacred and timeless human endeavor — one that unites civilizations across centuries. Ultimately, the scientific and philosophical legacy of the Central Asian Renaissance remains a beacon of enlightenment, inspiring future generations to bridge tradition with innovation, and faith with reason. It reminds us that the progress of civilization depends not merely on technological advancement, but on the moral and intellectual elevation of humankind — a truth first illuminated in the golden laboratories, observatories, and academies of medieval Central Asia.

References

1. Al-Margilani. Al-Hidaya. Islamic Texts Society, 1995.

2. Al-Biruni, Abu Rayhan. The Chronology of Ancient Nations. Translated by Sachau, 1879.
3. Firdawsi. Shahnameh. Penguin Classics, 2007.
4. Gutas, D. Greek Thought, Arabic Culture. Routledge, 1998.
5. Ibn Sina. The Canon of Medicine. Translated by Gruner, 1930.
6. Mahmud al-Kashgari. Compendium of the Turkic Dialects. Harvard University Press, 1982.
7. Nasr, S.H. Science and Civilization in Islam. Harvard University Press, 1968.
8. Nafisa, T. (2023). The USA Economy, Industry, Manufacturing and Natural Resources of Great Britain. *International Journal of Multidisciplinary Scientific Researcher's Theory*, 1(9), 94–97.
9. Nafisa, T. (2023). THE EDUCATION SYSTEM OF THE USA: PRESCHOOL EDUCATION, SECONDARY AND HIGHER EDUCATION, SCHOOL FORMS. *The Role of Exact Sciences in the Era of Modern Development*, 1(6), 53–57.
10. Teshaboyeva, N., & Davlatboyeva, O. (2024). Modern Trends in Teaching Foreign Languages. *Молодые ученые*, 2(35), 108–111.
11. Teshaboyeva, N., & Pardayeva, R. (2025). The Role of Fluency and Accuracy in Speaking. *ACUMEN: International Journal of Multidisciplinary Research*, 2(5), 280–286.
12. Umedovich, M. Y. (2023). The Significance of Intercultural Competence and Its Usage in Education. *Models and Methods for Increasing the Efficiency of Innovative Research*, 2, 241–247.
13. Teshaboyeva, N., & Durdiyev, O. (2024). Cultural Influences on Listening Comprehension. *ACUMEN: International Journal of Multidisciplinary Research*, 1(4), 252–254.
14. Teshaboyeva, N., & O'ngarova, O. (2024). The Role of Vocabulary Knowledge in Listening Comprehension. *ACUMEN: International Journal of Multidisciplinary Research*, 1(4), 255–257.
15. Teshaboyeva, N. (2023). Compound sentences in the English language. *Yangi O'zbekiston taraqqiyotida tadqiqotlarni o'rni va rivojlanish omillari*, 2(2), 68-70.
16. Teshaboyeva, N. Z. (2023). Modifications of Consonants in Connected speech. In *Conference on Universal Science Research* (Vol. 1, No. 11, pp. 7-9).
17. Teshaboyeva, N. Z., & Niyatova, M. N. (2021). General meanings of the category of tenses. *International Journal of Development and Public Policy*, 1(6), 70-72.
18. Zubaydulla, T. N. (2023). THE CLASSIFICATION OF SYNONYMS AND THEIR SPECIFIC FEATURES." *XXI ASRDA INNOVATION TEXNOLOGIYALAR, FAN VA TA'LIM TARAQQIYOTIDAGI DOLZARB MUAMMOLAR" nomli respublika ilmiy-amaliy konferensiyasi*, 1(12), 126-131.
19. Teshaboyeva, N., & Yakubova, N. (2023). CHANGES OF MEANING OF WORDS. *Центральноазиатский журнал образования и инноваций*, 2(12), 126-129.