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MIRZO ULUGBEK'S ASTRONOMICAL AND MATHEMATICAL LEGACY: ITS ROLE IN THE DEVELOPMENT OF SCIENTIFIC THOUGHT IN CENTRAL ASIA

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Abstract. Mirzo Ulugbek (1394–1449) was a prominent scholar, mathematician, astronomer, and statesman of Central Asia in the 14th–15th centuries. His activities combined scientific research with administrative responsibilities, creating favorable conditions for the development of science and education in the region. The most significant achievements of Ulugbek include the construction of the Samarkand Observatory (1428–1429) and the compilation of the star catalog Zij-i-Sultani, containing over 1,000 stars with precise coordinates. This catalog had a profound impact on the development of astronomy in Central Asia and was used by both Eastern and European scholars for several centuries. In addition to astronomy, Ulugbek contributed to mathematics, geometry, and trigonometry, developing methods for accurate calculations and observations. His approach to organizing scientific work, integrating an observatory, educational institutions, and libraries, became a model for future academic centers. This article analyzes the life, scientific activity, and educational legacy of Mirzo Ulugbek, emphasizing his contribution to the formation of scientific traditions in Central Asia and his influence on global science.

Keywords: Mirzo Ulugbek, Samarkand Observatory, astronomy, mathematical sciences, star catalog, medieval science, education.

Introduction. Mirzo Ulugbek is one of the key figures in the history of science in Central Asia and the wider Islamic world of the fourteenth and fifteenth centuries. Born in Samarkand as the grandson of the great conqueror Amir Timur, he demonstrated from an early age a profound interest in the natural sciences, mathematics, astronomy, and philosophy. A distinctive feature of his personality was the combination of high political authority with active scientific engagement, which enabled him to create unique conditions for the development of education and scholarship in the region.

At a time when scientific research often depended on the patronage of rulers, Ulugbek successfully combined administrative responsibilities with the organization of large-scale scholarly projects. He initiated the construction of the Samarkand Observatory one of the most significant scientific centers in Central Asia established educational institutions and libraries, and invited prominent scholars of his time. Through these efforts, he contributed to the formation of an intellectual environment comparable to the major scientific centers of the period.

The activities of Mirzo Ulugbek were not limited to organizational efforts alone. He personally participated in scientific observations and research, developing methods for precise measurement and systematic observation that enabled the achievement of remarkably accurate results for his time. His work constituted a significant contribution to the development of

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astronomy, mathematics, and the scientific method in Central Asia. The scholarly legacy of Ulugbek continues to attract the attention of modern historians of science and astronomers, remaining an important subject of academic study.

Mirzo Ulugbek (1394–1449) was born into the family of Shah Rukh, a ruler of the Timurid dynasty, which provided him with privileged access to education and to the intellectual environment of the Timurid era. From an early age he received systematic instruction in mathematics, astronomy, philosophy, and the humanities, laying the foundation for his future scientific activity. Despite his high status as a member of the ruling dynasty and the administrative responsibilities entrusted to him, Ulugbek successfully combined the roles of statesman and scholar, demonstrating a unique synthesis of political authority and scientific inquiry.

In 1411, Mirzo Ulugbek established a scientific center in Samarkand that soon became the core of the region's intellectual life. He actively invited leading scholars of his time, including astronomers, mathematicians, and philosophers, thereby creating an environment conducive to the exchange of knowledge and collaborative research. Within the framework of his state activities, he initiated the construction of the Samarkand Observatory, equipped with the most advanced instruments for astronomical observations of that era, as well as educational institutions and libraries. These initiatives made it possible to systematize education and preserve knowledge for future generations.

Under the leadership of Mirzo Ulugbek, Samarkand developed into a major center of science and culture, comparable to the leading scholarly centers of the period in both Asia and Europe. His approach to organizing scientific work was notably systematic: he not only created the necessary infrastructure for research but also personally participated in observations and calculations, ensuring scientific accuracy and the practical applicability of the results. Thus, the life and activities of Ulugbek demonstrate a remarkable integration of state authority and scientific progress, making him a unique figure in the history of science in Central Asia.

The scientific activity of Mirzo Ulugbek occupies a central place in his biography and represents an outstanding contribution to the development of astronomy and mathematics in Central Asia and the broader Islamic world of the fourteenth and fifteenth centuries. His most significant achievement was the establishment of the Samarkand Observatory in 1428–1429, which at the time of its foundation was one of the largest and most technically advanced scientific observatories in the world. Under his leadership, the observatory was equipped with advanced instruments for measuring astronomical parameters, including large sextants and astrolabes, which made it possible to conduct systematic and highly accurate observations of the motion of celestial bodies.

Within the framework of the observatory's activities, Ulugbek compiled the renowned star catalogue Zij-i-Sultani, which contained the coordinates of more than one thousand stars. This work had fundamental significance for medieval astronomy: it not only became a standard of precision for astronomers in Central Asia but was also used by both European and Eastern scholars for several centuries. The catalogue made it possible to refine stellar positions, identify inaccuracies in earlier observations, and systematize data on the celestial sphere, thereby contributing to the development of both practical astronomy and theoretical models of planetary motion.

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In addition to astronomy, Mirzo Ulugbek was deeply engaged in mathematics, including geometry and trigonometry. He developed methods for precise calculation, such as the use of improved trigonometric tables, which significantly increased the accuracy of astronomical measurements. His approach combined empirical observation with theoretical analysis, demonstrating an early application of the scientific method in astronomical research. Moreover, Ulugbek was actively involved in teaching, encouraging young scholars to participate in scientific work and creating an intellectual environment for the transmission of knowledge to future generations.

Thus, the scientific activity of Ulugbek was characterized by systematic organization, high precision, and an interdisciplinary approach that integrated astronomy, mathematics, and the organization of scientific research. His studies marked an important milestone in the development of astronomy and exerted a lasting influence on subsequent generations of scholars both in Central Asia and beyond.

The scientific legacy of Mirzo Ulugbek had a profound and long-lasting impact on the development of world astronomy, mathematics, and educational systems. His systematic approach to observational astronomy which included careful calibration of instruments, regular measurements, and methodical recording of data became a model for later generations of scientists. The star catalogue Zij-i-Sultani that he compiled remained a standard of precision for several centuries and was used by both Eastern and European astronomers, thereby contributing to the further advancement of both theoretical and practical astronomy.

In addition to his specific scientific achievements, Mirzo Ulugbek made a significant contribution to the organization of scientific work and the educational system. His approach to establishing a scientific center in Samarkand—integrating a research laboratory, library, and educational institutions—served as a prototype for modern academic institutes. In this way, his activities exemplify the effective integration of science and state policy, where governmental support enabled the attainment of outstanding scientific results.

In the contemporary scientific and educational context, Mirzo Ulugbek is regarded as a symbol of Central Asia's intellectual potential and as a model of the successful combination of administrative and scholarly activity. His legacy continues to inspire researchers and educators, emphasizing the importance of a systematic approach to teaching, research, and knowledge transfer. The significance of his work lies not only in precise observations and theoretical discoveries but also in the creation of a sustainable scientific tradition that influenced the development of astronomy and mathematics for several centuries.

Conclusion

Mirzo Ulugbek serves as a striking example of a scholar-statesman who successfully combined administrative responsibilities with active scientific engagement. His contributions to astronomy, mathematics, and the organization of educational processes provide a unique illustration of how personal initiative, scientific rigor, and state support can interact to achieve outstanding results.

Ulugbek's scientific legacy—particularly the establishment of the Samarkand Observatory the star catalogue Zij-i-Sultani—remains an invaluable resource for historians of science and contemporary researchers. His systematic approach to knowledge organization and the

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management of scientific work continues to serve as a model for the creation of academic centers and educational programs.

Thus, the activities of Mirzo Ulugbek demonstrate not only the high level of scientific thought in fifteenth-century Central Asia but also universal principles of scientific organization and education that remain relevant today. His legacy continues to inspire new generations of scholars and constitutes an important part of the global history of science.

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