



THE VISIONARY ASTRONOMER OF SAMARKAND

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ABSTRACT

This article delves into the life and scientific legacy of Mirzo Ulugbek, a 15th-century Timurid ruler, astronomer, and mathematician, who transformed Samarkand into a center of intellectual and scientific achievement. As the founder of the Ulugbek Observatory, he developed advanced astronomical instruments and compiled the Zij-i-Sultani, one of the most precise star catalogs of its time. Despite political challenges, his work endured, influencing both Islamic and European astronomers.

KEY WORDS: Ulugbek Observatory, Zij-i-Sultani, trigonometry, Islamic Golden Age, scientific legacy, intellectual hub, scholarship

АННОТАЦИЯ

В данной статье рассматривается жизнь и научное наследие Мирзо Улугбека, правителя, астронома и математика XV века из династии Тимуридов, который превратил Самарканд в центр интеллектуальных и научных достижений. Основав обсерваторию Улугбека, он создал передовые астрономические инструменты и составил Зидж-и-Султани, один из самых точных звездных каталогов своего времени. Несмотря на политические трудности, его работы оказали влияние на исламских и европейских астрономов.

КЛЮЧЕВЫЕ СЛОВА: Самарканд, обсерватория Улугбека, Зидж-и-Султани, тригонометрия, Золотой век ислама, научное наследие, интеллектуальный центр, наука.

ANNOTATSIYA

Ushbu maqolada 15-asrning temuriy hukmdori, astronomi va matematik olimi Mirzo Ulug‘bekning hayoti va ilmiy merosi haqida so‘z yuritiladi. Samarqandni ilmiy va madaniy markazga aylantirgan Ulug‘bek, Ulug‘bek rasadxonasi asoschisi sifatida zamonaviy astronomik asboblarni yaratib, o‘z davrining eng aniq yulduzlar kataloglaridan biri bo‘lgan Zij-i Sultonini tuzgan. Siyosiy qiyinchiliklarga qaramay, uning ishlari davom etib, islom va Yevropa astronomlariga ta'sir ko'rsatdi.

KALIT SO‘ZLAR: Ulug‘bek rasadxonasi, Zij-i Sultoni, trigonometriya, Islom Uyg‘onish davri, ilmiy meros, ilmiy markaz, ilmiy izlanishlar.

INTRODUCTION

Mirzo Ulugbek, born on March 22, 1394, in Sultaniyeh, Persia, was not only a powerful Timurid ruler but also one of the most renowned astronomers and mathematicians of the 15th century. He was the grandson of Amir Timur (Tamerlane), the founder of the Timurid Empire, and grew up in a time of cultural and scientific flourishing in Central Asia. Known for his unwavering dedication to knowledge and science, Ulugbek made remarkable contributions to the fields of astronomy and mathematics, cementing his legacy as a pioneer of the Islamic Golden Age.

MAIN PART

Raised in a royal family, Ulugbek was exposed to scholarly influences from a young age. His early education covered a range of subjects, including literature, philosophy, mathematics, and the sciences. Samarkand, his home city, was a center of intellectual and cultural exchange, attracting scholars from across the Islamic world. Under the guidance of prominent teachers, Ulugbek developed a keen interest in astronomy, a field that would define his life's work.

At the age of 16, Ulugbek became the governor of Samarkand, and he later assumed power over much of the Timurid Empire. [5]Rather than focusing solely on conquest, he promoted scholarship and established Samarkand as an intellectual hub. His court became a center for scientists, philosophers, poets, and artists.

One of Ulugbek's most lasting achievements was the establishment of the Ulugbek Observatory in 1428–1429, an advanced scientific institution for its time. Located on a hill outside Samarkand, the observatory was equipped with a massive sextant for observing stars, with a radius of approximately 40 meters. This instrument allowed for precise measurements, setting a new standard in observational astronomy.

Ulugbek's observatory led to the creation of the Zij-i-Sultani, one of the most accurate star catalogs of the time. This catalog included positions for 1,018 stars and offered precise calculations of planetary orbits and eclipses.[4]His measurements of the length of the year and the inclination of the Earth's axis were astonishingly accurate, differing from modern measurements by only a few seconds. The Zij-i-Sultani became a critical reference for astronomers worldwide and is still recognized for its scientific rigor.

Beyond astronomy, Ulugbek also contributed to mathematics. He encouraged the study of trigonometry, developing accurate trigonometric tables and advancing mathematical understanding in Central Asia. His work in mathematics was closely

tied to his astronomical studies, as accurate mathematical calculations were essential for precise star and planetary observations.

Despite his intellectual contributions, Ulugbek faced intense opposition from conservative religious leaders and even within his family. His scholarly pursuits and liberal policies clashed with the traditionalist elements of society, creating political tensions. [1] These conflicts came to a tragic climax when Ulugbek was assassinated in 1449, reportedly orchestrated by his own son. Though his life was cut short, Ulugbek's legacy endured. The observatory in Samarkand fell into ruin after his death, yet his influence persisted in scientific communities around the world. The *Zij-i-Sultani* was translated into several languages and used by European and Islamic astronomers for centuries, contributing to the development of early modern astronomy.

In the 20th century, archaeological excavations in Samarkand uncovered the remains of Ulugbek's observatory, renewing interest in his contributions. Today, Mirzo Ulugbek is celebrated not only in Uzbekistan but globally as a symbol of intellectual curiosity and scientific excellence. His name is honored with various institutions, including universities and research centers, and his work continues to inspire modern scientists.

Ulugbek's rule was marked by an emphasis on enlightenment and education, an unusual focus for a ruler of his time. [2] Unlike many rulers who centered their reigns on territorial expansion, Ulugbek envisioned a society built on knowledge. He established numerous educational institutions, most notably the Ulugbek Madrasa in Samarkand, completed in 1420. The madrasa, one of the earliest universities in Central Asia, offered advanced studies in science, mathematics, astronomy, and philosophy. It attracted scholars from across the Islamic world and fostered an atmosphere where intellectual discourse was encouraged and celebrated.

The Ulugbek Madrasa was unique in its mission and design. The architecture itself reflected Ulugbek's commitment to knowledge, with inscriptions that emphasized the importance of science and education. [3] The madrasa became a hub for scholars and students alike, where advanced education was provided in both religious and secular subjects. Ulugbek's vision for a balanced education system that bridged science and spirituality marked a significant evolution in Islamic learning at the time. Ulugbek recognized the value of collaboration and surrounded himself with leading scholars and scientists, including the mathematician and astronomer Qadi Zada al-Rumi and the scientist and poet Ghiyath al-Din Jamshid al-Kashi. Together, this team produced groundbreaking work in mathematics and astronomy. Their research

led to unprecedented accuracy in astronomical calculations, proving the effectiveness of Ulugbek's collaborative approach to science.

Ulugbek's observatory was one of the most advanced in the world at the time, rivaling those in Europe and the Islamic world. The observatory's central instrument, a massive meridian arc, allowed for the precise observation of celestial bodies. [6] This arc was partially embedded underground to maximize accuracy, reflecting Ulugbek's emphasis on scientific precision. The observatory also included other instruments for measuring time and planetary movement, making it one of the earliest research facilities dedicated to systematic observation and data collection. The observatory was also ahead of its time in fostering a methodical approach to scientific observation. Ulugbek and his team meticulously recorded their findings, creating a database that could be referenced and built upon by future astronomers. The data they gathered through systematic observation laid the groundwork for the field of observational astronomy.

Ulugbek's work had a lasting impact far beyond Central Asia. The Zij-i-Sultani was not only popular in the Islamic world but also influenced European scientists. In fact, Ulugbek's measurements of the obliquity of the Earth's axis (the tilt that causes seasons) and the length of the solar year were among the most accurate measurements of their time. [7] This data was later used by European scientists during the Renaissance, marking Ulugbek as an important figure in the development of global science. His observations were referenced by notable scientists like Tycho Brahe and Johannes Kepler, establishing a link between the Islamic Golden Age and the scientific revolution in Europe.

In the 20th century, archaeologists rediscovered the ruins of the Ulugbek Observatory, sparking a renewed appreciation for his work. Scholars and scientists uncovered artifacts and parts of his astronomical instruments, demonstrating the sophistication of Ulugbek's observatory. This rediscovery emphasized Ulugbek's foresight and the value he placed on scientific rigor, leading to his legacy being revived in the modern era.

In Uzbekistan today, Mirzo Ulugbek's legacy continues to inspire. His dedication to knowledge, education, and scientific progress has become a source of national pride. Institutions such as the Mirzo Ulugbek National University of Uzbekistan carry forward his vision for an enlightened society. His story also teaches valuable lessons on the importance of inquiry, evidence-based knowledge, and the pursuit of learning—a message that resonates as strongly today as it did during his time.

CONCLUSION

Mirzo Ulugbek's life and work exemplify the power of knowledge and intellectual perseverance. As a ruler, he prioritized learning and inquiry, fostering a legacy that transcended the political turbulence of his era. His contributions to astronomy and mathematics established a foundation for future generations, reminding us of the timeless value of science. In remembering Mirzo Ulugbek, we celebrate a visionary who looked to the stars and expanded the boundaries of human understanding.

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