Mirzo Ulughbek's "Zij-i Guragani" - a great achievement of Eastern science

Sitora Abduroziq-qizi Samiyeva
Dilnura Otabek-qizi Haqnazarova
Samarkand State Pedagogical Institute

Abstract: *This article analyzes the scientific significance of the famous astronomical work Zij-i Guragani, created by the great astronomer Mirzo Ulughbek. The work presents important information about the star catalog compiled based on astronomical observations conducted at the Samarkand observatory, planetary motion, astronomical coordinates, and methods of time determination. In particular, the inclusion of precise coordinates of 1018 stars represents a major scientific achievement in medieval astronomy. The article highlights the astronomical tables and calculations of Zij-i Guragani, its scientific accuracy, and its influence on the development of later astronomy. It also examines the importance of this work as a valuable source for modern astronomical history and scientific research.*
Keywords: *star catalog, astronomical observations, planetary motion, astronomical tables, celestial coordinates, Samarkand observatory, astronomical calculations, scientific heritage*

Introduction

Astronomy is one of the oldest and most important natural sciences in human history. The study of celestial bodies, their motion, and the determination of time and calendar systems have attracted the attention of scholars since ancient times. Especially during the medieval period, astronomy developed significantly in Eastern countries, leading to the establishment of numerous scientific schools and observatories. In this process, the region of Movarounnahr became one of the major centers of scientific progress.

The scientific activity of the great scholar Mirzo Ulughbek played a crucial role in the development of astronomy. Ulughbek was not only a statesman but also a prominent astronomer and mathematician. Under his initiative, a large observatory was built in Samarkand, where numerous astronomical observations were carried out. This observatory became one of the most advanced scientific centers of its time, producing significant scientific results. As a result of these studies, Ulughbek created his famous astronomical work Zij-i Guragani, which includes a star catalog, planetary motion data, astronomical coordinates, and various calculation methods.[1]

The Samarkand Observatory and the Development of Astronomical Observations

In the 15th century, the region of Movarounnahr emerged as an important center of scientific development. During this period, Mirzo Ulughbek devoted great attention to scientific research and transformed Samarkand into a leading center of astronomy. Around the 1420s, a large observatory was constructed in Samarkand. This observatory was an advanced scientific structure equipped with special instruments for observing and accurately measuring celestial bodies. In a short time, it became one of the largest astronomical research centers in the East.[2]

Systematic astronomical observations were conducted at the Samarkand observatory. Scholars studied the positions of stars, planetary motion, solar and lunar eclipses, and other celestial

[1] Ahmedov B. Mirzo Ulughbek and his astronomical heritage. – Tashkent: Akademnashr, 2019.
[2] Abdurahmonov O. Development of astronomy in the Timurid era. – Tashkent: Ma'naviyat, 2020.

phenomena. One of the most important instruments was a giant sextant, used to determine the altitude and coordinates of stars. Thanks to this instrument, highly accurate measurements were achieved, leading to new scientific data on celestial bodies.

Furthermore, the scientific activities carried out at the Samarkand Observatory significantly contributed to the advancement of observational astronomy in the medieval period. The systematic approach to data collection and long-term observations allowed scholars to achieve an unprecedented level of accuracy in determining celestial coordinates. This not only improved existing astronomical knowledge but also laid the foundation for future research in the field. The collaboration of skilled astronomers and mathematicians at the observatory created a strong scientific environment that fostered innovation. As a result, the Samarkand Observatory became a model for later astronomical institutions. Its legacy continues to influence the study of astronomy even in modern times.

Analysis of the Astronomical Content and Scientific Structure of "Zij-i Guragani"

The work Zij-i Guragani is one of the most important scientific sources of medieval astronomy. It was created based on long-term astronomical observations conducted at the Samarkand observatory. The work contains precise calculations and scientific tables describing celestial motions, star coordinates, and planetary orbits. The structure of the work includes several sections devoted to time calculation, calendar systems, trigonometric methods, and planetary motion. Particularly noteworthy is the high accuracy of trigonometric tables and sine values, which represented a major scientific achievement of the time.[3]

The most important part of the work is the star catalog, which provides precise coordinates and descriptions of 1018 stars. This catalog became one of the most accurate and comprehensive astronomical references of the medieval period and significantly influenced later developments in astronomy.[4]

Moreover, the scientific structure of *Zij-i Guragani* demonstrates a high level of methodological organization and precision. The work is systematically arranged, allowing scholars to easily navigate between astronomical tables, mathematical formulas, and observational data. This structured approach reflects the advanced scientific thinking of Ulughbek and his collaborators. The integration of theoretical calculations with empirical observations ensured the reliability of the results presented in the work. Such a combination of theory and practice was rare for its time and marked a significant step forward in scientific methodology. Consequently, *Zij-i Guragani* became not only a reference book but also a model for future astronomical research.

Scientific Significance of "Zij-i Guragani" in World Astronomy

The work Zij-i Guragani occupies an important place in the history of world astronomy. Its data, based on precise observations, contributed greatly to the advancement of astronomical science. The star catalog and astronomical tables were widely used by scholars and served as a reliable scientific reference.

The accuracy of the data was highly appreciated by later astronomers. The work was translated into several languages and spread across both Eastern and European countries, influencing the development of astronomy. Even today, it remains an important source for studying the history of astronomy and celestial mechanics, clearly demonstrating Ulughbek's contribution to science.[5]

In addition, the global scientific significance of *Zij-i Guragani* lies in its lasting impact on both Eastern and Western astronomical traditions. The accuracy of its star catalog and computational

[3] Saidov B. Ulughbek's astronomical research. – Tashkent: Yangi asr avlodi, 2018.
[4] Tursunov Q. History of astronomy and star catalogs. – Tashkent, 2022.
[5] Yuldashev N. Ulughbek's scientific school in astronomy. – Tashkent, 2022.

methods provided a reliable foundation for subsequent astronomical studies across different regions. European astronomers, in particular, benefited from the translation and dissemination of this work, which influenced the development of Renaissance astronomy. The tables and observational data were used for centuries as authoritative references. This demonstrates that Ulughbek's work transcended regional boundaries and became part of the global scientific heritage. As a result, *Zij-i Guragani* remains one of the most important contributions to the history of world astronomy.

Conclusion and Recommendations

The astronomical work Zij-i Guragani created by Mirzo Ulughbek is one of the greatest achievements of medieval science. Based on long-term observations at the Samarkand observatory, it represents a comprehensive scientific source containing star catalogs, planetary motion data, and calculation methods. The high accuracy of its data proves the advanced level of scientific research conducted by Ulughbek and his school.

Today, it is important to study Ulughbek's scientific heritage in depth and connect it with modern research. Comparative analysis of the data in Zij-i Guragani with contemporary astronomy, as well as promoting its scientific significance, can increase interest in astronomy among younger generations. Furthermore, expanding international research on Ulughbek's legacy will contribute to a deeper understanding of the historical development of astronomy.

References

1. Ahmedov B. Mirzo Ulughbek and his astronomical heritage. – Tashkent: Akademnashr, 2019.
2. Abdurahmonov O. Development of astronomy in the Timurid era. – Tashkent: Ma'naviyat, 2020.
3. Abdurahmonov O. Scientific heritage of Ulughbek and Samarkand observatory. – Tashkent: Innovatsiya, 2021.
4. Karimov Sh. Astronomy in the Timurid period and Zij-i Guragani. – Tashkent, 2023.
5. Saidov B. Ulughbek's astronomical research. – Tashkent: Yangi asr avlodi, 2018.
6. Tursunov Q. History of astronomy and star catalogs. – Tashkent, 2022.
7. Xoliqov M. Samarkand observatory and observations. – Samarkand, 2021.
8. Yuldashev N. Ulughbek's scientific school in astronomy. – Tashkent, 2022.