

Ali Kuşçu and His Contributions to Mathematics and Astronomy

Ali Kuşçu ve Ali Kuşçu'nun Matematik ve Astronomiye Katkıları

İlay İleri*

Özet

Ali Kuşçu XV. yüzyıl Türk ve İslam dünyasının en önemli bilginlerinden biridir. Özellikle astronomi ve matematik konularında çok değerli eserler vermiştir. Ünlü Türk bilgini ve devlet adamı Uluğ Bey'in yanında çalışmış ve ondan ders almıştır. Uluğ Bey'in Semerkant'ta öldürülmesi üzerine oradan ayrılmış ve Akkoyunlu hükümdarı Uzun Hasan'ın hizmetine girmiştir. Akkoyunlu hizmetinde iken Uzun Hasan tarafından II. Mehmed'e (Fatih Sultan Mehmed) elçi olarak gönderilmiştir. Elçilik görevini tamamlayınca Tebriz'e dönmüş fakat Fatih'in daveti üzerine tekrar İstanbul'a gelmiştir. Ali Kuşçu hayatının son iki yılını İstanbul'da Osmanlı Devleti hizmetinde geçirmiştir.

Anahtar kelimeler: Ali Kuşçu, Uluğ Bey, Uzun Hasan, II. Mehmet, İstanbul, Semerkant.

Abstract

Ali Kuşçu is one of the most noteworthy and important scientists in Turkish-Islamic world in the XVth century. He wrote invaluable works especially on astronomy and mathematics. He was a student and co-worker of the famous statesman and scientist Uluğ Bey. After Uluğ Bey's assassination Ali Kuşçu left Samarqand and went to Tabriz where he started to work for Uzun Hasan, the ruler of Akkoyunlu. While he had been working for Uzun Hasan, Ali Kuşçu was sent as a good-will ambassador to Mehmed II. Having completed his ambassadorial duty he went back to Tabriz. However, upon Mehmed II's invitation Ali Kuşçu returned to İstanbul continued his studies and spent the last two years of his life in İstanbul working for the Ottoman Empire.

Key words: Ali Kuşçu, Uluğ Bey, Uzun Hasan, Mehmed II, İstanbul, Samarqand.

* Dr., Ankara Üniversitesi Yabancı Diller Yüksek Okulu Öğretim Elemanı, tel. 212 56 56 (Öğretim elemanları odası). E-posta: ilayileri@yahoo.com ve ilayileri@gmail.com (Dr. Lecturer at Ankara University).

Mathematics, medicine and astronomy were the core disciplines of Islamic science in the Ottoman Empire. There have been a number of works written on these subjects and Ali Kuşçu/Kuşçi¹ was the greatest astronomer and mathematician of the fifteenth century. He was born in Samarqand at the beginning of the fifteenth century² and died in 1474 in Istanbul. His father was the falconer³ of the famous ruler and astronomer Uluğ Bey, who was also Timur's grandson.⁴

Ali Kuşçu himself was the student and co-worker of Uluğ Bey. Uluğ Bey, apart from being a successful ruler, was deeply interested in science, mathematics and astronomy. He founded the Samarqand Observatory and invited famous scientists of his time to Samarqand.

Before dealing with Ali Kuşçu and his contributions to mathematics and astronomy, it will be better to give some background information about the important observatories in the 15th and 16th centuries in the Islamic World.

In the 15th and 16th centuries there is a continuation of the tradition of building observatories in Islam. In fact, an important observatory in each one of these two centuries; the Samarqand Observatory in the 15th century and the Istanbul Observatory in the 16th century.

The Samarqand Observatory was of greater importance both as a scientific institution and due to its historical role. Founded in 1429 by Uluğ Bey,⁵ the Samarqand Observatory represents the highest and the most successful stage of Islamic achievement in the field of observatory building. It also constituted an important connection between Islam and Europe in the transmission of the tradition of founding observatories. The Samarqand Observatory was circular in shape and had three storeys. It was over 50 metres in diameter and 35 metres high.

Uluğ Bey invited famous scientists of the time to Samarqand and wanted to turn it into a centre of astronomy and mathematics. Famous contemporary

¹ Molla Alaaddin Ali.

² Ali Kuşçu's exact date of birth is unknown.

³ Şahincibaşı, a falconer is a person who trains wild birds such as falcons to catch preys so his father was given the nickname 'Kuşçu' meaning 'falconer'.

⁴ For more details see, Franz Babinger, *Fatih Sultan Mehmed ve Zamanı*, Trans. Dost Körpe, Oğlak Bilimsel Kitaplar Yayıncılık, İstanbul 2003.

⁵ Gözde Ramazanoğlu, *Ortaasya'da Türk Mimarisi*, Kültür Bakanlığı, Ankara 1998, p. 99. As to the year of foundation of the Samarqand Observatory, some other sources give different dates such as; 1420, 1421, 1428.

scholars such as Ali Kuşçu, El-Kaşi, Kadızade and other mathematicians and astronomers worked at the Observatory.

The fifteenth century was a period of flowering both in the fine arts and in the cultivation of learning in the north eastern parts of Islam. Intellectual activity was fostered (especially in the region of Turkistan) by Timur⁶ and his successors. They encouraged scholars and built important madrasas.⁷ Samarqand had become an important cultural centre of Islam during the reign of Timur, and it was also the scene of the beginning of a 'renaissance' in Islamic art. Scientific activity gained great momentum in Samarqand during the reign of Uluğ Bey,⁸ Timur's grandson.⁹

Istanbul Observatory was founded by Takiyüddin er-Raşid during the reign of Sultan Murad III, in Istanbul and was a venue for important studies and research. Takiyüddin er-Raşid, born in Damascus in 1526, was the founder of the first observatory in the Ottoman Empire. After completing his education in Damascus and Egypt, he served as a judge¹⁰ and professor, during this time he really got into astronomy and mathematics. He arrived in İstanbul in 1570 and in 1571 he became Müneccimbaşı¹¹ After meeting with Sultan Murad III through Sokullu Mehmed Pasha, he proposed to build an observatory to have a better calendar¹² than Uluğ Bey's. The Observatory was partially built in 1577 and Takiyüddin er-Raşid started his observations there. He built a very precise mechanical clock to make measurements. He invented new tools to make various calculations in İstanbul Observatory. He also wrote the first book in the Ottoman Empire about mechanical machines. The instruments in the Observatory were as follows: armillae zodiac, mural quadrant, azimuthal semicircle, triquetrum, dipotra and sextant. However, the Observatory was demolished in 1580 due to political and religious reasons by the order of the Sultan.¹³

⁶ 1369-1405.

⁷ The school of theology and science attached to a mosque.

⁸ 1394-1449.

⁹ Aydın Sayılı, *The Observatory in Islam and Its Place in the General History of the Observatory*, p. 259, 312, 260, Türk Tarih Kurumu, Ankara, 1988.

¹⁰ Qadi.

¹¹ A person whose job was to observe natural events such as; earthquakes, eclipses or passing of a star close to Earth and whose job was to comment about these events.

¹² Zîc.

¹³ For more details see, Kazım Çeçen (Editor), *Osmanlı İmparatorluğu'nun Doruğu, 16. Yüzyıl Teknolojisi*, İstanbul 1999.

As already mentioned above, Ali Kuşçu was a student of Uluğ Bey and Kadızade-i Rumi as well¹⁴. He was deeply interested in the fields of mathematics and astronomy. He completed his education in Samarqand and Kirman. After having been educated by a well-known scientist of his time, Kadızade-i Rumi, Ali Kuşçu became the assistant of Uluğ Bey. After the death of Kadızade, Ali Kuşçu was appointed as the director of Samarqand Observatory. Uluğ Bey appreciated Ali Kuşçu's studies on astronomy. When Ali Kuşçu was in Samarqand, the city was important as a centre of science in the first half of the 15th century. Ali Kuşçu worked hard at the Observatory in order to add new scientific researches to the existing ones. He presented Uluğ Bey with his first written work *Risale-i Hallü'l-Eşkali'l-Kamer*, a treatise on the stages of the moon. And then, Ali Kuşçu and Uluğ Bey collaborated on *Zîc-i Uluğ Bey/Zîc-i Sultani* which was an enormous catalogue of the stars and the most important work of his time¹⁵. In this project, on which he worked on for almost 30 years, Ali Kuşçu accurately discussed the distances between the heavenly bodies and the Earth.

With the assassination of Uluğ Bey by his own son in 1449, Ali Kuşçu stopped working for the Observatory because Uluğ Bey Ali Kuşçu had not only taken mathematics and astronomy lessons from him and but had examined Uluğ Bey's works for a long time, he had also attended Uluğ Bey's lectures and worked as his colleague. Therefore, the assassination of Uluğ Bey was vitally painful for Ali Kuşçu. As a result, he left Samarqand and went to Tabriz in Iran, in 1449. In Tabriz, the ruler of Akkoyunlu state, Uzun Hasan respected him and wanted him to act as a good-will ambassador between himself and the young conqueror of Istanbul, Mehmed II. Ali Kuşçu accepted Uzun Hasan's proposal and went to Istanbul to perform his ambassadorial duty. When he arrived in Istanbul he was admitted to appear before Sultan Mehmed II and was complemented by him more than he had expected. The Sultan was deeply interested in positive sciences and requested Ali Kuşçu to educate young people in the Madrasas in İstanbul¹⁶. The development of Madrasas, the educational and scientific institutions of the Ottomans, in the 15th and 16th centuries greatly influenced the scientific and cultural life. Madrasas brought political stability and economic well-being to the society. All of these encouraged the best scholars from the Islamic world to come and work in Istanbul. Mathematical sciences such as; arithmetic, geometry, algebra, astronomy,

¹⁴ Aydın Sayılı, *op. cit.* p. 268: Muammer Dizer, *Uluğ Bey*, Kültür Bakanlığı, Ankara 1989, p. 49.

¹⁵ Muammer Dizer, *op. cit.*, p. 49.

¹⁶ For more details see, Muzaffer Şerbetçi, *Türk Haritacılığı Tarihi*, İstanbul 1999.

natural sciences, classical physics were taught in the Ottoman Madrasas along with the study of divine philosophy¹⁷ and commentary on the Qur'an (tefsir).¹⁸

Mehmed II's personality, attitude and reign played an important role in shaping the scientific life in the region. Mehmed II had a great interest in religious-philosophical debates and initiated discussions among scholars concerning such subjects.¹⁹

The Ottoman Sultan's proposal for Ali Kuşçu to work in Madrasas was an unexpected hono. Ali Kuşçu said the following concerning The Sultan's proposal.

I would like to go back to Tabriz if you let me. The true reason of my existence here is to be the good-will Messenger of Akkoyunlu Ruler, Sultan Hasan. It is necessary for me before I accept the gracious invitation of my Sultan to turn back and inform the person who sent me here and who trusted me that I carried my duty with a good result...'

Ali Kuşçu's excuse seemed reasonable to the Ottoman Ruler. Therefore, Ali Kuşçu was permitted to return to Tabriz. The distinguished mathematics and astronomy scholar Ali Kuşçu kept his word and He left Tabriz two years later and was welcomed by the Ottoman Ruler in 1472 für Istanbul. It was assumed that some 200 people accompanied Ali Kuşçu on his way to Istanbul.²⁰

His settlement in Istanbul is of great importance because there were no scholars engaged in astronomy there at that time. Upon his arrival, he presented Mehmed II with a book on astronomy written by him in Arabic entitled *Fethiye* so named on account of his having completed it on the day on which Mehmed II won the war against Akkoyunlu Sultan, Uzun Hasan. In Istanbul, Ali Kuşçu established his own school and educated brilliant scholars such as Molla Sarı Lütü, Kıvameddin Kasım, Sinaneddin Yusuf, Hafız Mehmed ibn Ali²¹ and Seydi Ali Reis²². Ali Kuşçu opened a new era of science and scientific development in the history of the Ottoman Empire in the 15th century. His

¹⁷ Hikmet.

¹⁸ For more details see, Ekmeleddin Ihsanoğlu, "The Madrasas of the Ottoman Empire", *Foundation for Science Technology and Civilisation*, Manchester, April 2004.

¹⁹ Mehmet İpşirli, "The Ottoman Ulema (Scholars)", *Foundation for Science Technology and Civilisation*, Manchester, May 2004, p. 6.

²⁰ A. Süheyl Ünver, *Türk Pozitif İlimler Tarihinden bir Babis, Ali Kuşçu Hayatı ve Eserleri*, İstanbul 1948, p. 17.

²¹ A cosmographer

²² He was an Ottoman admiral and geographer.

works were regarded as invaluable sources of information. Even after his death, his works were studied for a long time. Ali Kuşçu was able to work only two years for Mehmed II due to his unexpected death in 1474 which put an end to the development of astronomy in the Empire and deprived the Sultan of his challenging works.²³

Ali Kuşçu's most important works on astronomy and mathematics are as follows:

*** *Risalet-i fi'l-Hey'e*:**

Written in Persian in 1457. This is one of the most important works of Ali Kuşçu on astronomy²⁴.

*** *Risalet-i fi'l-Hisab*:**

Risalet-i fi'l-Hisab is a book about arithmetic written in Persian in Samarqand towards the end of 1472 and it consists of 104 pages. The Persian version of the book is different from that of Arabic which has 194 pages. The book deals with calculations and positions of the stars. As to the part 'Positions of the stars', it was of great importance for the scholars who was interested in stellar calculations.²⁵

*** *Risalet-i Muhammediyye*:**

This is a book on algebra and arithmetic written in Arabic. He wrote this book on his way to İstanbul in 1472. It was presented to the Ottoman Ruler, Mehmed II and therefore was given the name *Risalet-i Muhammediyye*, the exact English translation of which is 'Mehmed's Book'. The title of the book shows the deep respect that Ali Kuşçu had for the Ottoman Ruler. The book consists of an Introduction and five chapters. It has a richer content than Ali Kuşçu's *Risalet-i fi'l-Hisab* which is a book on arithmetic and positions of the stars, because it consists of only three chapters and an Introduction and does not contain the charts that *Risalet-i Muhammediyye* does.²⁶

*** *Risalet-i Fetbiye*:**

This work of Ali Kuşçu is about astronomy and written in Arabic in 1473. This book was also presented to the Ottoman Ruler, Mehmed II on the day of

²³ A. Süheyl Ünver, *op. cit.*, İstanbul 1948, pp. 16, 81; Franz Babinger, *op. cit.*, p. 414.

²⁴ A. Süheyl Ünver, *op. cit.*, p. 36.

²⁵ A. Süheyl Ünver, *op. cit.*, pp. 37-38.

²⁶ A. Süheyl Ünver, *op. cit.* pp. 41-42.

his victory in Otlukbeli against Akkoyunlu Ruler, Sultan Hasan. In *Risâlet-i Fethiye*, Ali Kuşçu calculated ‘the inclination of the ecliptic’ and his calculation of ecliptic shows very little difference from the calculation of ecliptic today. The book contains three chapters. The first chapter deals with the number of planets around the Earth, what they are made of and where they are located.

In the first chapter of the book it is stated that “*the Earth is the only one and there are nine planets that surrounds the Earth. They move in an orbit. The sun is fixed and the other planets and heavenly bodies are in orbit around the sun*”. This chapter also deals with some big and small planets, the shape, the position and the movement of some of the planets, the position of the unfixed stars, the disagreements on the movements of the stars and planets.

The second chapter is about the shape of the Earth and the classification of the climates. In this chapter, the shape of the Earth was said to be almost round. The climate of the Equator, the orbits of the planets, explanations on years and dates, the rising and setting times of the stars were studied.

The third chapter is about heavenly bodies and clouds. This chapter deals with the calculation of the area of the Earth, the calculation of the radius of the Earth, the ratio of the Moon’s diameter to that of the Earth and information about the planets Mercury and Venus.²⁷

Apart from all these, Ali Kuşçu also wrote about theology, religious subjects, linguistics and grammar. When he was working in İstanbul for Mehmed II, Ali Kuşçu calculated and re-controlled the degrees of the latitude and longitude at which İstanbul lies. He found the latitude as 41 and longitude as 59 which are very close to those of today’s calculations. On the order of Mehmed II, Ali Kuşçu also constructed a sundial as well.²⁸

In general, Ali Kuşçu’s works can be categorized under five groups:

1. His works on astronomy

- 1.1. *Şerh-i Zîc-i Uluğ Bey*
- 1.2. *Risâle fî Halli Eşkâli Mu’addili’l-Kamer li’l-Mesîr*
- 1.3. *Risâle fî Asli’l-Hâric Yumkin fî’s-Suflîyyeyn*
- 1.4. *Şerh ‘ale’t-Tuhfeti’ş-Şâhiyye fî’l-Hey’e*
- 1.5. *Risâle der ‘İlm-i Hey’e*
- 1.6. *El-Fethiyye fî ‘İlmi’l-Hey’e*
- 1.7. *Risâle fî Halli Eşkâli’l-Kamer*

2. His works on mathematics

- 2.1. *Er-Risâletü’l-Mubammedîyye fî’l-Hey’e*
- 2.2. *Risâle der ‘İlm-i Hisâb*

²⁷ A. Süheyl Ünver, *op. cit.* pp. 42-46.

²⁸ A. Süheyl Ünver, *op. cit.*, p. 82.

3. His works on Islamic law and the philosophy of Islam

- 3.1. *Eş-Şerbu'l-Cedâd 'ale't-Tecrîd*
- 3.2. *Hâşiye 'ale't-Telvîh*

4. His work on mechanical instruments

- 4.1. *Et-Tezkîre fî Alâti'r-Rubâniyye*

5. His works on language and rhetoric

- 5.1. *Şerbu'r-Risâleti'l-Vad'iyye*
- 5.2. *El-İfsâh*
- 5.3. *El-'Unkâdu'z-Zevâbir fî Nazmi'l-Cevâbir*
- 5.4. *Şerbu's-Şafîye*
- 5.5. *Risâle fî Beyani Vad'i'l-Mufredât*
- 5.6. *Fâ'ide li-Tabkâki Lâmi't-Ta'rîf*
- 5.7. *Risâle mâ Ene Kultu*
- 5.8. *Risâle fî'l-Hamd*
- 5.9. *Risâle fî 'İlmi'l-Me'ânî*
- 5.10. *Risâle fî Babsi'l-Mufred*
- 5.11. *Risâle fî'l-Fenni's-Sânî min 'İlmi'l-Beyân*
- 5.12. *Tefsîru'l-Bakara ve Âli 'Imrân*
- 5.13. *Risâle fî'l-İsti'âre*

There are some other works that are attributed to Ali Kuşçu. However, the copies of these works cannot be affirmed. These are *Târîhu Ayasofya*, *Tefsîru'z-Zehraveyn*, *Mabbûbu'l-Hamâ'il*, *Risâle fî Mevdû'ati'l-'Ulûm*, *Meserretu'l-Kulûb fî Def'i'l-Kurrûb*.²⁹

The astronomers and mathematicians of Islam had a strong feeling for precision. They were preoccupied with astronomical theory; they were not satisfied with rough and approximate results, but aimed at utilizing the mathematical tools and they insisted on the need for basing their results on as accurate observational data as possible³⁰.

Soon after Ali Kuşçu had come and settled in Istanbul upon Mehmed II's invitation, he established the fundamentals of mathematical science; as a result, the famous astronomer and mathematician Ali Kuşçu had an important impact on the development of mathematics and astronomy in the Ottoman Empire. He left invaluable works as sources of information after his death in 1474 in Istanbul. He also produced valuable works on language and rhetoric. Mathematics and astronomy in the Middle Ages was at their peak during the reign of Mehmed II with Ali Kuşçu's studies, works and contributions.

²⁹ Musa Yıldız, *Bir Dilci Olarak Ali Kuşçu ve Risâle fî'l-İsti'âre'si*, Ankara 2002, pp. 10-14.

³⁰ Aydın Sayılı, *op. cit.*, p. 312.

Bibliography

- Babinger**, Franz: *Fatih sultan Mehmet ve Zamanı*, Trans. Dost Körpe, Oğlak Bilmsel Kitaplar Yayıncılık, İstanbul 2003
- Çeçen**, Kâzım (Editor): *Osmanlı İmparatorluğu'nun Doruğu, 16. Yüzyıl Teknolojisi*, İstanbul 1999.
- Dizer**, Muammer: *Uluğ Bey*, Kültür Bakanlığı, Ankara 1989.
- İpşirli**, Mehmet: "The Ottoman Ulema (Scholar)", *Foundation for Science Technology and Civilisation*, Manchester 2004.
- Ramazanoğlu**, Gözde: *Ortaasya'da Türk Mimarisi*, Kültür Bakanlığı, Ankara 1998.
- Sayılı**, Aydın: *The Observatory in Islam and Its Place in the General History of the Observatory*, Türk Tarih Kurumu, Ankara 1988.
- Şerbetçi**, Muzaffer: *Türk Haritacılığı Tarihi*, İstanbul 1999.
- Ünver**, A. Süheyl: *Türk Pozitif Tarihi'nden bir Babis. Ali Kuşçu Hayatı ve Eserleri*, İstanbul 1948.
- Yıldız**, Musa: *Bir Dilci Olarak Ali Kuşçu ve Risâle fî'l-İsti'âre'si*, Ankara 2002.

