

UDC 52:39(575.1)

THE TUGAL CALCULATION AND UZBEK FOLK ASTRONOMY: A TRADITIONAL CALENDRIAL SYSTEM BASED ON THE MOON–HULKAR CONJUNCTION

Sarimsokov Abdilatip Abdiraximovich

Candidate of Historical Sciences

Professor, Department of Social and Humanitarian Sciences,
Kimyo International University in Tashkent, Namangan Branch.

abdulsarimsokov@gmail.com +998 93 926 01 18

<https://orcid.org/0009-0001-3685-8012>

<https://doi.org/10.5281/zenodo.19599596>

Annotatsiya. This study examines the role of the Hulkar (Pleiades) star cluster in Uzbek folk astronomy and analyzes the traditional calendric system known as the Tugal calculation. It explores how ancient Central Asian societies relied on observations of celestial bodies to determine time, seasonal changes, and weather patterns. The research demonstrates that the Tugal system is based on the conjunction of the Moon with Hulkar and follows a sidereal lunar cycle of approximately 29 days, including a distinctive 40-day period of invisibility. The findings highlight that this system was especially significant for pastoral communities, providing a practical framework for organizing agricultural and livestock activities. The study concludes that Uzbek folk astronomy represents a complex and empirically grounded knowledge system with strong cultural and scientific value.

Kalit so‘zlar: Hulkar star, Tugal calculation, folk astronomy, lunar cycle, Central Asian calendar, ethnoastronomy, celestial bodies, seasonal change, weather forecasting, sidereal month.

Throughout the course of human development, the calculation of time and the understanding of natural cycles have occupied an important place in the life of society. Especially in primitive and traditional societies, human daily activities were closely connected with the laws of nature and the movement of celestial bodies. For this reason, since ancient times, people have sought to determine time by observing the Sun, the Moon, and the stars. As a result of this process, distinctive astral-calendar systems emerged among different peoples[1].

In the territory of Central Asia, including in the traditional culture of the Uzbek people, folk astronomy has held significant importance. Observations of the sky served not only for timekeeping, but also as a primary source for planning agricultural activities, determining the change of seasons, and forecasting weather conditions. As Abu Rayhan al-Biruni emphasized, humans observed the regular movement of celestial bodies and adapted their labor activities accordingly [2].

One of the celestial objects that occupies a special place in Uzbek folk astronomy is the “Hulkar star cluster.” Its visibility throughout the year, especially its first appearance at dawn (heliacal rising) and its periods of invisibility, served as important criteria in folk calendrical calculations. The approach or “conjunction” of Hulkar with the Moon gave rise to a specific system of time reckoning known as the “Tugal calculation” [3].

Modern studies show that such a lunar–stellar calendar existed not only among the Uzbeks, but also among other Central Asian peoples such as the Kyrgyz, Kazakhs, and mountain Tajiks.

According to scholarly sources, in this calendar the duration of the month was determined by observing the conjunction of the Moon with Hulkar, and it is based on the sidereal month (approximately 29 days) [4].

An interesting aspect is that this calendar is believed to have developed primarily in a nomadic pastoralist environment. This is because it was sometimes inconvenient for agriculture, as the beginning of the year did not always correspond to the solar calendar.

However, for pastoralists, determining time through observations of the sky was more practical. For this reason, systems such as the Tugal calculation were widely used in practice [5].

Ancient peoples, including the inhabitants of Central Asia, understood these processes not through abstract theoretical concepts, but through direct observation of the sky. For example, the annual cycle was determined by such indicators as the changing points of the Sun's rising and setting, and the variation in the length of day and night. This demonstrates the empirical character of folk astronomy [6].

Among the ancestors of the Uzbeks, there existed distinctive beliefs associated with celestial bodies such as Hulkar, Yeti qaroqchi, Temir qoziq, the Milky Way, Mirrix, Utorud, Mushtariy, Zuhra, and Zuhal. As a result of observing the celestial movements of such stars and planets, the "Tugal calculation" emerged. This method of reckoning was known among Uzbek, Kyrgyz, and Kazakh pastoralists by names such as "Qambar Tugal," "Qo'ziboy Mayriq calculation" [7], "tog'is" [8], "tokush" [9], "tugol" [10] and "tukovul". Nevertheless, they also had their own distinctive differences. For example, Qambar Tugal occurred on the 23rd day of one month and on the 21st day of the following month, and so on. Usually, the Tugal was identified through the eclipse of the Moon. It was believed that there were eight stars, and when the Moon passed directly between two of them, an eclipse occurred; that is, certain changes in weather conditions were observed.

According to the folklorist scholar M. Jo'rayev, on the 11th night of Jadiy, the 9th night of Dalv, the 7th night of Hut, the 5th night of Hamal, the 3rd night of Savr, and the 1st night of Javzo, the Hulkar star was believed to set simultaneously with the Moon. It is said that on such nights, a natural phenomenon would occur, such as rain or wind. If it rained, it was interpreted as a good sign, whereas drought accompanied by hot winds was regarded as a bad omen [11].

According to the researcher F. Rakhmonov, the Hulkar star consists of seven stars, three of which resemble a set of scales. It is said to pause at these stars. Hulkar may also appear on the 9th, 11th, or 12th day of each month. If the Hulkar star becomes invisible at the beginning of May, it is considered a sign of rainy days; or if rain falls after Hulkar becomes invisible, the year is believed to be prosperous. When Hulkar begins to move toward the horizon, warm days start and vegetation begins to grow. If Hulkar begins to appear at dawn, a drop in temperature is expected soon. In general, on the day of Hulkar Tugali, signs of atmospheric disturbance begin to appear before the weather deteriorates [12].

Among the Kazakhs, the "tog'is" consists of 13 months, each lasting 28 days, whereas in the "Tugal" calculation used in the Fergana Valley, there are 11 months, each consisting of 29 days, and Hulkar's "remaining underground" for 40 days during the summer period is not taken into account, that is, it is referred to as "yo'q tugal" [13]. Hulkar descends to the earth during Saraton and remains underground for forty days, and the reckoning begins after it returns to the

surface [14]. The months of the “Tugal calculation” are named as follows: 21 Tugal, 19 Tugal, 17 Tugal, 15 Tugal, 13 Tugal, 11 Tugal, 9 Tugal, 7 Tugal, 5 Tugal, 3 Tugal, 1 Tugal, and 0 Tugal.

According to this system, on the specified days of the months, the Moon “pairs” with the Hulkar star [15], that is, it comes into conjunction with it. The name “Tugal” itself denotes the pairing of the Moon with Hulkar. According to observations, during the days of “Tugal” as well as the “interval of the Moon”, that is, the period between the old and new lunar phases, changes in weather occur; therefore, agricultural activities were planned on this basis.

According to the Tugal calculation, the months consist of 29 days and differ from each other by two days; sometimes the Moon and Hulkar do not come into conjunction within the indicated period. For example, if they do not coincide on the 7th Tugal but do so on the 8th day, folk timekeepers say, “this month is seven Tugal, but it coincides on the eighth” [16].

When Hulkar comes into conjunction with the Moon, it becomes invisible in the sky.

The Hulkar star cluster appears in different positions at different times throughout the year.

Below is its general appearance according to the seasons:

Season	State of Appearance	Significance
Winter	Visible high in the sky in the evening	Mid-winter
Spring	Gradually shifts toward the west	Approach of spring
Summer	Not visible (disappears in the Sun’s light)	Summer heat period
Autumn	Begins to rise in the east at dawn	Beginning of a new cycle

As can be seen from this table, the visibility of Hulkar played an important role in determining the *смена* of seasons.

The Tugal calculation is based on the relative position of the Moon and Hulkar. Below, this relationship is presented in a simplified form [17]:

Lunar day	Lunar phase	Relationship with Hulkar
1–3 days	Yangi oy	Yaqinlashuv boshlanadi
5–9 days	O’suvchi oy	To‘qnashuv ehtimoli yuqori
10–15 days	To‘lin oy	Uzoqlashish
16–27 days	Kichrayish	Keyingi siklga tayyorgarlik

According to this table, collisions mainly occur during the waxing phase of the moon.

These views related to the reckoning of the year have also been preserved in proverbs:

When Hulkar rises, the dawn becomes cold; when Hulkar rises, soup turns into pilaf; Hulkar has set – the plough lies idle; at nine *tog’al*, not even a felt-like snow remains; at seven *tog’al*, a tethered horse becomes full; at five *tog’al*, a baby in the cradle does not die (from the cold); at three *tog’al*, a hobbled horse left for grazing becomes full; at one *tog’al*, wheat ripens; without Hulkar descending to the earth, the ground does not warm up [18].

Tugal calculation based on the conjunction of the Moon with the Hulkar star cluster

№	Names of the months	Number of days in a month	Correspondence with the months of the Gregorian calendar
1	21 tugal	29	5 August – 2 September
2	19 tugal	29	3 September – 31 September

3	17 tugal	29	1 October – 29 October
4	15 tugal	29	30 October – 28 November
5	13 tugal	29	29 November – 27 December
6	11 tugal	29	28 December – 25 January
7	9 tugal	29	26 January – 23 February
8	7 tugal (8)	29	24 February – 24 March
9	5 tugal	29	25 March – 22 April
10	3 tugal	29	23 April – 21 May
11	1 tugal	29	22 May – 19 June
12	0 tugal	40 (yozgi chilla)	26 June – 4 August

The Tugal calculation, which embodies the astrological views of ancient pastoralists, is considered one of the invaluable treasures of the Uzbek people's calendrical knowledge and occupies a worthy place in ethnocultural development.

In this study, the Hulkar star and the Tugal calculation, which hold an important place in Uzbek folk astronomy, have been comprehensively analyzed. The analysis shows that folk astronomy is not a set of random observations, but rather a complex system of knowledge based on specific astronomical regularities.

Such lunar–stellar calendars existed not only among the Uzbeks, but also among the Kyrgyz, Kazakhs, and mountain Tajiks. This confirms that this system represents a common Central Asian cultural phenomenon. The calculation of time through togus (conjunctions), the 13-month cycle, and the 40-day period of Hulkar's invisibility indicate that this calendar has a precise astronomical basis.

At the same time, the Tugal calculation was widely applied in agriculture and pastoralism. Processes such as sowing, harvesting, and livestock care were closely connected with observations of the sky. Thus, this system represents a vivid example of practical astronomy.

REFERENCES

1. Головач А.Г. Фенологические наблюдения в садах и парках. – М., 1951; Цыбульский В.В. Современные календари стран Ближнего и Среднего Востока. Синхронистические таблицы и посвения. – М., 1964; Цыбульский В.В. Календарь и хронология стран мира. – М., 1982; Цыбульский В.В. Лунно-солнечный календарь страна Восточной Азии с переводом на даты европейского календаря (с 1 по 2019 г. н.э). – М., 1987; Селешников С.И. История календаря и хронология. – М., 1972; Бикерман Э. Хронология древнего мира. Ближний Восток и античность. – М., 1976; Никонов В.А. Материалы по космологии Средней Азии // Ономастика Средней Азии. – Фрунзе, 1980; Календарные обычаи... 1983; Володомонов Н.В. Календарь: ўтмишда, ҳозир, келажакда. – Т., 1976. – 70 б. Календарь: Прошлое, настоящее, будущее. – М., 1987, 2- изд.; Элиаде М. Космос и история. – М., 1987.
2. Беруний А. Р. Қадимги халқлардан қолган ёдгорликлар. – Тошкент: Фан, 1957. – Б. 283.

3. Жўраев М. Ўзбек халқининг астрал-тақвимий анъаналари. – Тошкент, 2008.
4. Kolganova G. Yu., Nikiforov M. G. Notes on the Question of Account of Time in Central Asia. – 2020.
5. Куфтин Б. А. Календарь и первобытная астрономия киргиз-казацкого народа // Этнографическое обозрение, 1916.
6. Цыбульский В. В. Календари и хронология стран мира. – М.: Просвещение, 1982.
7. Боболардан қолган нақллар (афсона, ривоят, ирим-сирим ва халқ тақвими). Тошкент, 1998. – Б. 77–79; Жўраев М. Ўзбек мавсумий маросим фольклори. – Тошкент, 2008. – Б. 6.
8. Абишев Х. Элементы астрономии и погоды устном народном творчестве казахов. – Алма-Ата, 1949. – С. 226–228; Традиционная культура жизнеобеспечения казахов. Очерки теории и истории. – Алматы, 1998. – С. 174.
9. Андреев М.С. Таджики долины Хуф. – Сталинабад, 1958, вып. 2. – С. 174.
10. Юдахин К.К. Киргизско-русский словарь. – Москва, 1965. – С. 740.
11. Жўраев М. “Сеҳрли” рақамлар сири. – Тошкент, 1991. – Б. 36.
12. Раҳмонов Ф.Ш. Ўзбек халқининг космогоник қарашлари (Қашқадарё воҳаси мисолида) / “Ўзбек этнологиясининг долзарб муаммолари” мавзусидаги IV Республика илмий-назарий анжумани материаллари. – Тошкент-Наманган, 2007. – Б. 217-221.
13. Sarimsokov A.A. O‘zbeklarning samoviy jismlar va fenologik kuzatuvlar bilan bog‘liq taqvimiy tasavvurlari // Xorazm Ma‘mun akademiyasi axborotnomasi. – Хива, 2023. 6/3. – Б. 52.
14. Абишев Х. Элементы астрономии и погоды устном народном творчестве казахов. Алма-Ата, 1949. С. 206; Андреев М.С. Таджики долины Хуф. – Сталинабад, 1958, вып. 2. – С. 272.
15. Хулкар, Сурайё Савр юлдузлар туркумидаги бир гуруҳ юлдузлар номи. Ўзбек тилининг изоҳли луғати. Ж.Ш. – Тошкент, 2006. – Б. 590.
16. Абишев Х. Элементы астрономии и погоды устном народном творчестве казахов. – Алма-Ата, 1949. – С. 22.
17. Куфтин Б. А. Календарь и первобытная астрономия киргиз-казацкого народа // Этнографическое обозрение, 1916.
18. Sarimsokov A.A. Uzbek views on the calendar of the year // EPRA International journal of Socio-Economic and Environmental Outlook (SEEO) Monthly Peer Reviewed & Indexed International Journal. Volume: 7 Issue: 2 September 2020. ISSN: 2348-4101. SJIF Impact Factor (2020): 7.005. Journal DOI: 10.36713/epra0314. P. 30.
19. Мавлонов, А. А. (2024). ТИЛ МАСАЛАСИ–МАЪНАВИЙ МУСТАҚИЛЛИКНИНГ АСОСИЙ ШАРТИ СИФАТИДА. *Вестник магистратуры*, (6-1 (153)), 42-46.
20. Мавлонов, А. А., & Раҳимжонова, И. (2023). ЎРТА ОСИЁГА ФОТОГРАФИЯНИНГ КИРИБ КЕЛИШИ ТАРИХИ. *Вестник магистратуры*, (5-3 (140)), 44-45.
21. Мавлонов, А. А., & Абдулҳафизов, М. (2023). ФИҚҲ ЁКИ ИСЛОМ ҚОНУНШУНОСЛИГИНИНГ ВУЖУДГА КЕЛИШ ТАРИХИ. *Вестник магистратуры*, 46.

22. Kudratkhodja, S., Alptekin, M. Y., Altinboyev, N., Pulatova, D., Mavlonov, A., & Aripov, M. (2026). DISAPPEARING WEDDING RITES OF PASSAGE IN UZBEKISTAN: MODERNIZATION AND FUNCTIONALIST PERSPECTIVES.
23. Anvarxanovich, M. A., & Safoxon, M. (2023). QADIMGI DUNYO TARIXIDA O'RTA OSIYO XALQLARINING MILLIY ISTIQLOL OZODLIK HARAKATLARI. *Вестник магистратуры*, (5-3 (140)), 42-43.
24. Mavlanov, A., & Mirzohidov, S. (2024). THE CULT OF WATER IN THE ANCIENT BELIEFS OF THE UZBEKS OF THE FERGANA VALLEY. *Science and innovation*, 3(C1), 5-7.
25. Mavlonov, A., & Mirzohidov, S. (2024). USE OF INNOVATIVE TECHNOLOGIES IN HISTORY TEACHING METHODOLOGY. *Science and innovation*, 3(B8), 26-28.
26. Mavlonov, A., & Mirzohidov, S. Uzbek Cultural Heritage: Preserving Traditional Songs Importance AND Methods. *Galaxy International Interdisciplinary Research Journal*, 12(8), 20-26.
27. Mavlonov, A. (2021, June). WATER CULT IN ANCIENT RELIGIOUS BELIEFS (Based on materials from the Fergana Valley). In *Конференции*.
28. Niyozov, J. (2026, January). DEVELOPING HISTORICAL THINKING OF PRE-SERVICE HISTORY TEACHERS THROUGH MUSEUM PEDAGOGY. In *International Conference on Science, Education & Law* (Vol. 2, No. 1, pp. 4-7).
29. Niyozov, J. (2026, February). DEVELOPING THE AXIOLOGICAL COMPONENT OF HISTORICAL THINKING IN PRE-SERVICE HISTORY TEACHERS BASED ON MUSEUM PEDAGOGY. In *International Conference on Culture & History* (Vol. 2, No. 2, pp. 8-12).
30. Niyozov, J. (2026, February). MUSEUM PEDAGOGY AS A TOOL FOR DEVELOPING SOURCE-CRITICAL AND INTERPRETATIVE SKILLS IN PRE-SERVICE HISTORY TEACHERS. In *International Conference on Social Sciences & Humanities* (Vol. 2, No. 2, pp. 11-15).
31. Niyozov, J. (2026, January). DEVELOPING HISTORICAL THINKING THROUGH THE INTEGRATION OF MUSEUM PEDAGOGY AND INFORMATION TECHNOLOGIES. In *International Conference on Arts, Society & Humanities* (Vol. 2, No. 1, pp. 24-27).
32. Niyozov, J. Educational Potential OF Museum Pedagogy AND Criteria for Its Application in Developing Historical Thinking OF Pre-Service History Teachers. *Maktabgacha va Maktab Ta'limi Jurnali*, 676773.
33. Niyozov, J. Bo 'lajak Tarix O 'qituvchilarini Muzey Pedagogikasi Vositasi Orqali Tarixiy Tafakkurini Rivojlantirishning Modeli. *Maktabgacha va Maktab Ta'limi Jurnali*, 675308.
34. Арифханова, З. Х., Абашин, С. Н., & Алимова, Д. А. (2011). Узбеки.
35. Саримсоков, А. А. (2014). Ўзбекларнинг тақвимий маросимлари (Фарғона водийси материаллари асосида). *Тошкент: Yangi Nashr*.
36. Саримсоков, А. А. (2010). Календарные обряды узбеков (на основе материалов Ферганской долины).
37. Abdiraximovich, S. A., & Tursunpulotovich, M. M. (2025, September). O'ZBEKISTON VA KOREYA RESPUBLIKASI MUNOSABATLARI YANGI BOSQICHDA

- (NAMANGAN VILOYATI MISOLIDA). In *Partner conferences of the International Scientific Journal Research Focus* (Vol. 1, No. 2, pp. 369
38. Abdiraximovich, S. A. (2025, August). NAMANGAN VILOYATI QORAQALPOQLARIDA HUNARMANDCHILIK AN'ANALARI. In *Partner conferences of the International Scientific Journal Research Focus* (Vol. 1, No. 1, pp. 135-139).
39. Abdiraximovich, S. A. (2025, August). O 'ZBEKLARNING TAQVIMIY MAROSIMLARI: BAHORIY SAYILLAR. In *Partner conferences of the International Scientific Journal Research Focus* (Vol. 1, No. 1, pp. 152-156).
40. Саримсоков, А. А. (2024). The ritual of "qo'sh chiqarish" among Uzbeks and its territorial features (on the example of the Fergana Valley). *Историческая этнология*, 9(2), 214-223.
41. Sarimsokov A. A. Navruz: Customs and Ceremonies //Central Asian Journal of Social Sciences and History. – 2024. – Т. 5. – №. 2. – С. 14-20.
42. Sarimsokov A. A. IMAGINATIONS OF UZBEK PEOPLE RELATED TO" GOOD" AND" BAD" TIME //Asian Journal of Multidimensional Research. – 2022. – Т. 11. – №. 8. – С. 66-69.
43. Саримсоков А. А. Традиционные календарные взгляды узбеков // Ученый XXI века. – 2020. – №. 1 (60). – С. 24-29.
44. Egamberdiyev, B. (2026). O'ZBEKISTONDA MAHALLIY ODATLAR VA MAROSIMLARNING SHAKLLANISHI VA ULARNING FALSAFIY-TARIXIY MOHIYATI. *Ижтимоий-гуманитар фанларнинг долзарб муаммолари Актуальные проблемы социально-гуманитарных наук Actual Problems of Humanities and Social Sciences.*, 6(1), 75-82.
45. Ваходир о'г'ли, Е. В. (2025, December). O'ZBEK XALQINING AN'ANAVIY MAROSIM VA URF-ODATLARINING TARIXIY ASOSLARI VA RIVOJLANISH FALSAFIY TAHLILI (QADIMGI DAVR, ISLOM DAVRI MISOLIDA). In *Partner conferences of the International Scientific Journal Research Focus* (Vol. 1, No. 1, pp. 20-24).
46. Rahimberdiyev, S. (2026). KOREYA RESPUBLIKASIDA O 'ZBEK MIGRANTLARINING MADANIY IDENTIFIKATSIYASI: TRANSMILLIY JARAYON VA KUNDALIK HAYOT DINAMIKASI. *Universal xalqaro ilmiy jurnal*, 3(3.1), 434-440.
47. Bekmurod o'g'li, R. S. (2025, December). KOREYADAGI O 'ZBEKISTONLIK MEHNAT MIGRANTLARINING IJTIMOYIY HOLATI VA MADANIY IDENTIFIKATSIYA JARAYONLARI. In *Partner conferences of the International Scientific Journal Research Focus* (Vol. 1, No. 1, pp. 108-111).
48. Yusupov, D. S. O. (2021). The stages of creation smart clothing and electronic garments. *Science and Education*, 2(4), 163-165.
49. Gulbaxor, M., & Bahodir, S. (2025). TIL O 'RGANISHDA CHATGPT, TARJIMA TIZIMLARI VA ULARNING SAMARADORLIGI. *TADQIQOTLAR*, 76(3), 17-21.
50. Muzaffar, G., & Bahodir, S. (2025). INSON ORGANIZMIDA UCHRAYDIGAN ICHKI KASALIKLAR. *TADQIQOTLAR*, 76(2), 71-74.

51. Bakhodir, S., & Dilshoda, R. (2025). EASTERN THINKERS OF THE ERA OF THE FIRST RENAISSANCE. *Global Science Review*, 8(1), 682-687.
52. Zebo, N., & Bahodir, S. (2025). О 'RTA ASRLARDA ANGLIYA (V-XV ASRLAR). *Global Science Review*, 11(1), 85-90.
53. Шамсиддинов, Б., & Гуламов, М. (2023). ЛОГИЧЕСКИЕ СООТНОШЕНИЯ ФИЛОСОФИИ С ЛИТЕРАТУРОЙ. *Oriental Art and Culture*, 4(3), 332-335.
54. Rahimberdiyev Sardorbek Bekmurod ugli, ETHNOLOGICAL ANALYSIS: MIGRATION OF UZBEKISTAN STUDENTS TO THE REPUBLIC OF KOREA , Web of Discoveries: Journal of Analysis and Inventions: Vol. 3 No. 4 (2025): WOD
55. Rahimberdiyev Sardorbek Bekmurod o'g'li, & Homidova Mubina Nabijon qizi. (2025). ETNOLOGIK TAHLIL: O'ZBEKISTON VA KOREYADAGI AN'ANAVIY JAMIYAT . *Ta'lim Innovatsiyasi Va Integratsiyasi*, 44(3), 191-196. <https://scientific-jl.com/tal/article/view/12016>
56. Jamolova Oyshakhan Jamoliddin kizi, Rahimberdiyev Sardorbek Bekmurod ugli, THE ROLE OF UZBEK CITIZENS IN THE LABOR MARKET OF SOUTH KOREA , Web of Discoveries: Journal of Analysis and Inventions: Vol. 3 No. 6 (2025): WOD
57. Rahimberdiyev Sardorbek Bekmurod ugli, ETHNOLOGICAL RESEARCH: THE CASE OF UZBEKS IN SOUTH KOREA. (2024). *American Journal of Research in Humanities and Social Sciences*, 26, 37-41. <https://americanjournal.org/index.php/ajrhss/article/view/2276>