

REVIEW ON THE TECHNIQUES OF DIRECTIONAL IDENTIFICATION THROUGH THE CELESTIAL OBJECTS AMONG ANCIENT MUSLIM ASTRONOMERS IN NORTHERN NIGERIA

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Abstract

This article aims to reconstruct the old science adopted by ancient Muslim astronomers at that time due to the absence of technology to guide on sea and land. This paper adopts a qualitative method to describe the precise technique and strategy of its application for direction identification through the selection of several Stars, Satellites, Constellations and Coordinate which are visible both from the northern and southern parts of the northern Nigeria sky. On the other hand, several challenges were identified to affect the development of science in different dimensions such as total dependence on artificial innovative devices which may very well have limitations. This article recommends awakening to Astronomers, especially Nigerian Astronomers, to pay more attention to scientific aspects as the basis for the use of modern astronomical technology in every observation of celestial bodies.

Keywords: astronomers, direction, technology, Northern Nigeria

Abstrak

Artikel bertujuan untuk merekonstruksi ilmu pengetahuan kuno yang diadopsi oleh para astronom Muslim kuno saat itu akibat ketiadaan teknologi untuk memandu di

laut dan darat. Artikel ini menggunakan metode kualitatif untuk menggambarkan teknik dan strategi yang tepat dari penerapannya untuk identifikasi arah melalui pemilihan beberapa bintang, satelit, rasi bintang, dan rumah yang terlihat baik dari bagian utara dan selatan langit Nigeria Utara. Di sisi lain, beberapa tantangan diidentifikasi mempengaruhi perkembangan ilmu di dimensi yang berbeda seperti ketergantungan total pada perangkat inovatif buatan yang mungkin sangat memiliki keterbatasan. Artikel ini merekomendasikan kebangkitan kepada para astronom, khususnya astronom Nigeria, untuk lebih memerhatikan aspek keilmuan sebagai dasar dari penggunaan teknologi astronomi modern dalam setiap pengamatan benda langit. *Kata Kunci:* astronom; arah mata angin; teknologi; Nigeria Utara.

A. Introduction

Directional identification of any location or structure relied upon the use of visible signs of the world that person could see within the horizon or gaze over the heavenly bodies of the sky, adopted from the techniques of the ancient Muslim Astronomers of the northern Nigeria in the course of their travel by land or voyage in the water prior to the innovative devices of the newly born science and technology. The techniques are found relevant for the everlasting existence of the celestial objects and visibility at whatever side of the world, and does not require formal directives or long time studies at any institution of learning, hence; could be applied by anybody irrespective of his background, religion, gender, age, status of knowledge, talk less of spending any amount to have access for their application. The paper attempts to guide for the identification of these objects, proper techniques of utilization, time of visibility and other alternative methods in case of their hideout in the course of their apparent movement across the sky within the context of northern Nigeria.

Successful living of the ancient people of the northern Nigeria under the everlasting celestial objects and identification of various localities of their time brought about several wonders that lead to the flow of several questions on attempt to solve the mysterious efforts of the ancient people to identify and arrive locality of their target without being lost on the way, Were they aware of the cardinal points?; How did they identify them on land and in the sea?; When did they adopt the techniques in the course of their journey?; What are the techniques of using celestial objects in directional identification?; How will these techniques be revived for contemporary utilization?

Astronomical studies in Nigeria dates back to the ancient time, that many devoted much and published books, papers and articles to have shared common concern to the subject

matter of this paper (astronomy) in one way or the other; hence most relevant are reviewed to trace point of relativity and diversion to fish out its relevance and significance in the domain of astronomical science in northern Nigeria as follows:

Ibrahim (2010)¹ was written by one of the northern Nigerian prominent scholars on mathematical astronomy to explain various issues in the aspect of astronomy, ranging from the techniques of calculating the calendar system of *Hijrah*, Gregorian and Coptic calendar that are both applicable in northern Nigerian for different purposes. He identified the strategies of calculating leap year and regular year of both *Hijri* and Gregorian calendar,² historical background of the calendars,³ conversion of years to days and identification of the beginning of the lunar months⁴ among others which are all discussed in the book. The book is related to the paper on the aspect of astronomy and was highly dedicated on the mathematical calculations for the identification of the aforementioned topics, hence this made it not have captured nature and distance of the celestial objects which the entire astronomical science relied on, as such the paper is made to cover the aspect of the heavenly bodies not to have been touched by the book, most especially its application for directional guide.

Salihu and Bilyaminu (2018)⁵ discussed various techniques initiated by the northern Nigerian astronomers for the identification of time, starting from the historical trace⁶ of its development right from the ancient time to the era of literary publications for local uses, through the draft of mathematical strategies of converting *Hijri* calendars (solar and lunar) to Gregorian calendar and vice versa.⁷ They further drafted formulas for the identification of beginning of year, month and trace of the unknown date in either of the subject calendars. Constellations and mansions of the Sun and Moon⁸ are discussed to some extent by the authors to guide for their trace in the midst of each and every year through the mathematical

¹ S. Ibrāhīm, *Al-Ḥisāb Al-Falakī li Tahdīd Al-Ḥāliyah wa Al-Sinīn Al-Bāsiṭah wa al-Khabis* (Mayduguri: Mu'assasah Ṣāhib al-Kutub, 2010).

² Ibrāhīm, 6.

³ Ibrāhīm, 8.

⁴ Ibrāhīm, 15-21.

⁵ Salihu L and Muhammad Bilyaminu, "Review of Some Astronomical Calculations for the Identification of Time in Northern Nigeria," *Kano Journal of Multidisciplinary Studies* 3, no. 1 (2018): 119-39.

⁶ Salihu L and Muhammad Bilyaminu, 120-122.

⁷ L and Bilyaminu, "Review of Some Astronomical Calculations for the Identification of Time in Northern Nigeria," 123-24.

⁸ L and Bilyaminu, 130-33.

calculation to track their movement across the celestial sphere to mark seasonal changes⁹ within each and every year of personal choice. The paper attempts to discuss the aspect of directional identification through gaze at some celestial objects, which was identified as a gap left by the article despite its relevance in the limited area of study. The article is very relevant to the current paper for sharing common concern on the astronomy in northern Nigeria through highlighting the astronomical innovations of the local astronomers to satisfy the necessary demand of their people at variant generations. However, great diversion existed in the targeted point of the two literature, as the earlier focused on the astronomical calculations to identify time, while the latter stared at the celestial objects at different angles for the purpose of directional identification among the ancient astronomers of northern Nigeria.

Salisu (2011)¹⁰ was a researcher to have written wonderful paper on the significance of Astronomical literary works utilized and written by northern Nigerian scholars in both Arabic and *Ajami* manuscripts, where he traced the historical development of the *Ajami* literature that served as language of inscription in the ancient northern Nigeria for a very long period of time. He made wide study in the public and private archives to assess the condition of the Astronomical manuscripts of the northern Nigerian scholars, where he was able to present short preamble of nine books which seven of them were purely astronomical written by scholars such as: *Masā'il Sha'n Najm Ṭala'a fī Safar* (written by Shaykh Muhammad Bello Ibn Shaykh 'Uthmān Ibn Fodio [1781-1837]), *Taqrīb al-Naẓam li Shaykhinā Ibn Fodio* (written by Shaykh Muḥammad Raji Ibn Aliyu), *Tanbīh al-Fāhim 'alā Ḥukm Tā'rikh Muddat al-Dunya wa-Khalq al-Ālam* (Shaykh 'Uthmān Ibn Fodiyo [1754 - 1817]) etc. The paper is related to the current in the aspect of astronomy as he traced history of the science and presented some outstanding figures in the area such as Shaykh 'Uthmān Ibn Fodiyo (d.1817), Shaykh 'Abdullāhi Ibn Fodiyo (d.1829) and Shaykh Muḥammad Bello (d.1837)¹¹ that written aforementioned books to have served as astronomical foundation of the northern Nigeria. However, the author did not go deep in discussion on the subject matter of this paper, which

⁹ L and Bilyaminu, 129-30.

¹⁰ Salisu Bala, "The Significance of Astronomy in the Ancient Arabic Manuscripts of Northern Nigeria," *Arewa House Center for Historical Documentation and Research*, 2011.

¹¹ Bala, 92.

is viewed as a gap to be abridged by the current work on the aspect of directional guide through the celestial objects adopted from the practices of the ancient astronomers of northern Nigeria.

Suleiman (2015)¹² wrote his paper as an appeal for the inculcation of the astronomical scheme and courses in the curriculum of the Islamic universities of Nigeria for its relevance and significance towards the development of the science and transformation of the knowledge to have existed for many centuries in the area of study. The paper discussed issues relevant to the subject of the current article in the aspect of the history of astronomy from the prehistoric time¹³ to the golden period of the Islamic civilization when many Muslim astronomers focused much on the area glimpsed by Qur'an in various verses, among them were Umar Al-Khayyam, Ahmad al-Faghani, Abdal-Rahman Al-sufi, Ibn Al-Haytham¹⁴ and the rest to have made tremendous contribution for the development of the science in the world.¹⁵ The article remained as motivational and appeal to the federal educational ministry of Nigeria for its development hence; had not discussed anything pertaining to its strategic application in the ancient time, which the current paper aimed to guide on its utilization in the ancient period and fill the other gaps left by the paper in the relevant issues of astronomy in Nigeria.

The review is restricted to the only analyzed books and papers to avoid lengthiness of the paper on the topic known to have been discussed by others, only that will cover the gap left untouched by the prior literature in one way or the other.

B. Result and Discussion

B.1 Astronomy in Northern Nigeria

Astronomical science in northern Nigeria started from unpredictable time when its earliest citizens got on torch to the heavenly bodies through religious service, as evidently traced from the Hausa language children's poems:

*Rana-rana bude-bude,
In yanka miki ragon baba,
Ki sha jini shar-shar-shar.*

¹² Suleiman Iguda Ladan, "The Relevance of Studying Astronomy in Islamic Universities of Nigeria with Particular Reference to Al-Qalam University, Katsina," *European Scientific Journal* 11, no. 5 (2015): 59-73.

¹³ Ladan, 60.

¹⁴ Ladan, 63-65.

¹⁵ Ladan, 63-64.

*Shine, Shine! oh sun!
So, I can sacrifice a special ram for you,
So, you can drink the oozing blood¹⁶*

The act of ram sacrifice to the sun to have its shine confirmed its position as deity to the ancient Hausa people of the period; subsequently the religion was abandoned with the arrival and adoption of the Islamic Religion as early as 11c. and 13c¹⁷ century at Borno and other Hausa community of west Africa. The arrived religion (Islam) refined the outlook of the people from heavenly bodies worship to proper utilization on daily purposes guided by various statements of the Qur'an for the counting of years and calculations,

And We have appointed the night and the day as two Ayat (signs etc.). Then, we have made dark the sign of the night while We have made the sign of day illuminating, that you may seek bounty from your Lord, and that you may know the number of the years and the reckoning. And We have explained everything (in detail) with full explanation¹⁸

And the rest of the verses, this brought about the study of astronomy in the Muslim communities of northern Nigeria. Further arrivals of the astronomical books and scholars from Asia, Andalusia and other intellectual communities of Africa advanced the science to be studied at some ancient educational institutions of the area (Such as Gobarau school of Katsina) that graduated some notable scholars to have published books on the field such as: *Al-Dūrr al-Manzūm wa khulasāt al-Sirr al-Maktum fī 'Ulūm al-Talāsim wa al-Nujūm*, *Kitāb Bahjah wa Ida al-Lubs wa al-Ighlaq fī Ulūm Hurūf wa al-Awfaq*, *'Adad Ayyām al-Shahr*, *Ma'rifāt al-Burūj*, *Nubdha 'an al-Sinin Tarḥīl al-Shams*, and *al-Nujūm wa Fuṣūl al-Sanna*.¹⁹

The study continued at some individual schools of Borno, Kano, Katsina and Sokoto that bred outstanding scholars to have participated in the *jihād* of Sokoto caliphate and publication of books on the field in various languages of the community such as Hausa, *Fulfulde* and Arabic languages,²⁰ that spread the knowledge to the subsequent generations to

¹⁶ Furera Adamu Garba, "Endangered Language In Nigeria: A Case Study Of Gera Language Of Bauchi State" (Kenyatta University, 2018).

¹⁷ L and Bilyaminu, "Review of Some Astronomical Calculations for the Identification of Time in Northern Nigeria," 121.

¹⁸ Al-Qur'an 10:05 and 17:12

¹⁹ L and Bilyaminu, "Review of Some Astronomical Calculations for the Identification of Time in Northern Nigeria," 120.

²⁰ Mainly through 'Ajami inscriptions

educate people on its daily uses and generation of professionals²¹ that wrote books, pamphlets and papers published at some printing presses and unrecognized computer centers especially at Kano State of Nigeria. Moreover; Kano state radio allotted airtime for the Malam Ibrāhīm Falaki²² to state the movement of the sun and moon on the constellations and mentions together with seasonal changes and time of prayers on daily basis in the early morning.

Even though the ancient science was neglected in the area as no formal school inculcated the subject in its curriculum of education whether at primary, secondary or tertiary institution. Likewise further misconception was attached to the field by its consideration as mere astrology despite the fact that clear barrier existed between them, thank God some people realized the problem and started calling for its revival and establishment of the astronomical departments in the tertiary institution of the region²³ such as the relevance of studying astronomy in Islamic universities of Nigeria with particular reference to al-qalam university, katsina.

B.2. Direction

Direction is the information contained in the relative position of one point with respect to another point without the distance information.²⁴ In this seance; astronomical directions in respect to the ancient Muslim astronomers relied on the four cardinal points that were described as East, West, Northern and Southern point of the universe, which they gaze over celestial objects in respect to the direction of their appearance over the sky on effort to ascertain the direction of movement towards the targeted location. Those celestial objects known to appear in each and every direction in the course of their apparent movement are considered to be guiding poles to the direction they appeared, as indicated by the clear statement of the Qur'an:

*It is He Who has set the stars for you, so that you may guide your course with their help through the darkness of the land and the sea. We have (indeed) explained in detail Our Ayat (proofs, evidences, verses, lessons, signs, Revelations, etc.) for people who know.*²⁵

²¹ Such as Adam Abdullahi Zabarmari Hussai Bakar and their likes.

²² Kano states-based astronomer

²³ Ladan, "The Relevance of Studying Astronomy in Islamic Universities of Nigeria with Particular Reference to Al-Qalam University, Katsina."

²⁴ A geo-knowledge company Directions in Gis <https://gsdl.org.in/pdf/present/DirectionsInGis.pdf>

²⁵ AlQur'an 6:97

This verse stated one of the purposes of their appearance which was the subject matter of this paper with special reference to northern Nigeria.

B. 3 Celestial objects

Celestial objects are heavenly bodies having mass and forming special structure within the celestial sphere such as; galaxies, stars, nebulae, planets, satellites, asteroids, meteor and meteoroid, comets etc. that could either be visible to the unaided eyes or through other viewing equipment. Hence; ancient astronomers of northern Nigeria identified stars, satellites, constellations and mansions associated to the direction of the northern and Southern hemispheres to adopt guide to the direction of their targeted locations, for their visibility all over in the course of their apparent movement from the east and west along the celestial sphere of the universe.

a. Sun

Sun is a yellow dwarf star²⁶ composed of burning gases at the center of the solar system situated at the outer part of the milky way galaxy,²⁷ having the radius of 695,508 kilometers²⁸ and stationed at a distance of 92.92²⁹ million miles from the habitable planet called earth. The subjective movement of sun across the sky from the east and west made people to identify its direction of rise and set, which was adopted by the ancient astronomers of the northern Nigerians to identify each and every cardinal direction easily both in the morning and evening time through the following guidelines:

- 1) **Morning period:** they directly face the direction of the sun and observe the point it appears for the justification of the undoubted location of the east, while their back side remained to be at the western side, right hand side pointed to the south and left-hand side indicated the northern section of the cardinal directions.³⁰

²⁶ Amanda Barnett, "Our Sun," 2021, <https://solarsystem.nasa.gov/solar-system/sun/overview/>.

²⁷Kenneth L. (2021) Sun, Britannica Retrieved on 23/02/2021 from <https://www.britannica.com/place/Sun/Internal-structure>.

²⁸Kenneth L.

²⁹ Equivalent to 149.60 million kilometers

³⁰Shehu A. (aged 93). Caravan leader, interviewed at his hose Kofar Arewa Kurfi local government Katsina State, on 25/04/2021, 4:00 pm

- 2) **Evening period:** Relative direction at the evening hours depends on the rightful face on the direction of the sun at the western side while backside points the eastern direction, right hand side indicates the north and left-hand side sticks to the south.³¹
- 3) **Hour's identification:** identification of hours in respect to the day time relied on the length of the personal shadow under the sun, as they coined a special formula to measure the length of the shadow by the number of footsteps³² in the morning and afternoon hours.

a) **Morning Hours**

The trend of hour identification through the length of the shadow was adopted by the ancient northern Nigerian astronomers from the clear statement of Allah (SWT) in the Qur'an;

Have you not seen how your Lord spread the shadow. If He willed, He could have made it still then We have made the sun its guide [i.e. after the sunrise, it (the shadow) squeezes and vanishes at midnoon and then again appears in the afternoon with the decline of the sun, and had there been no sunlight, there would have been no shadow]. Then We withdraw it to Us a gradual concealed withdrawal.³³

First hour is starting at the sport of sun rise when the length of human shadow reached fortieth footstep and ends at the decrease of its length to thirty ninth footstep, while the twentieth step marked the beginning of the second hour, tenth foot step marked the start of the third hour, sixths foot step marked the start of fourth hour, third foot step marked the beginning of the fifth hour, to the period when shadow decrease to only two footsteps for marking the noon, as illustrated in the following table.

³¹ Shehu A.

³² Uba K., *Hisabi a Sauqaqe* (Kano Nigeria: t.p., 1999), 52.

³³ Al-Qur'an 25:45 and 46.

Table 1. The Mourning Hours Illustration

Hour	Number of footsteps	Represented Arabic letter
1	40	م
2	20	ك
3	10	ي
4	6	و
5	3	ج
6	2	ب

b) Afternoon Hours

Afternoon hours are starting by the noon when shadow faces eastern direction and reached the length of two footsteps, the third one marked the beginning of the eighth hour which is to end by fifth footstep, sixth footsteps tells the ninth hour, tenth footstep marked the start of tenths hour, twentieth step traces the start of the eleventh hour, up to the twelfth hour that ends at the length of fortieth footstep at the spot of sunset as annotated in the following table.

Table 2. The Afternoon Hours Illustration

Hour	Number of footsteps	Represented Arabic letter
7	2	ب
8	3	ج
9	6	و
10	10	ي
11	20	ك
12	40	م

b. Moon

Moon is a celestial object and the only natural satellite of earth having the mass of 3456 kilometers³⁴ and orbiting at the distance of 384,400 kilometers,³⁵ within 29 days

³⁴ Abū Ayman Khalīl 'Abd al-Laṭīf, *Mawsū'ah al-Aflak wa al-Awqāt* (Beirut: Book Publisher, 2010), 4.

³⁵ James D. B. (2020). Moon Earth's satellite, Encyclopaedia Britannica. Retrieved from <https://www.britannica.com/place/Moon>, on 20/04/2021

plus 12 hours and 44 minutes³⁶ (due to the extended rotation of the earth)³⁷ that usually shine brightness from the reflected light of the sun

*It is He Who made the sun a shining thing and the moon as a light and measured out its (their) stages, that you might know the number of years and the reckoning. Allah did not create this but in truth. He explains the Ayat (proofs, evidence, verses, lessons, signs, revelations, etc.) in detail for people who have knowledge.*³⁸

The object tends to appear within days of each and every month at distinct structure of development and retardation dependence to the day it appears, as stated in the Qur'an;

"And the Moon, we have measured for her mansions (to traverse) till she returns like the old (and withered) lower part of a date-stalk"³⁹ hence could be leveled as follows:

Table 3. Moon Structures

S/N	Day	Name of the structure
1	Day 0-1	New moon
2	Day 2-6	Waxing crescent
3	Day 7-9	First quarter half moon
4	Day 10-13	Waxing gibbous
5	Day 14-17	Full moon
6	Day 18-21	Waning gibbous
7	Day 22-25	Third quarter half moon
8	Day 26-28	Waning crescent

Ancient astronomers of northern Nigerians adopted the strategies of identifying cardinal directions from the apparent exhibiting shapes of the moon within each and every month.

- 1) **Waxing Crescent;** The pointed horns of the waxing crescent indicate to eastern direction of the cardinal points, while the luminous portion reflects to the western side and the undoubted direction of the sun.

³⁶ 'Abd al-Laṭīf, *Mawsū'ah al-Aflak wa al-Awqāt*, 48.

³⁷ Amsel Sheri, *Phases of The Moon* (www.exploringnature.org, 2005), 1.

³⁸ Al-Qur'an 10:05

³⁹ Al-Qur'an 36:39

- 2) **First quarter and Waxing gibbous;** The dark side of the moon is always in the eastern direction while the brighter side identifies the only side of the sun set.
- 3) **Full moon;** often confuses many as guidance relies on the apparent drawing that appears on the disk of the moon in which they observe the two fingers shapes to have faced the west and cloudy area to have pointed the eastern side of the cardinal directions.
- 4) **Waning gibbous and third quarter of the moon;** Reverse serves the case of these stages when the dark side appears to the west and brighter portion guides to eastern side without much confusion.
- 5) **Waning crescent;** they use to set the luminous portion of the moon at their back and straightened their hands to the edged point of the crescent horns to identify north with the right side of their body and remember the southern side attached to the pointed side of their left- hand side.

c. **Pleiades (Seven sisters)**

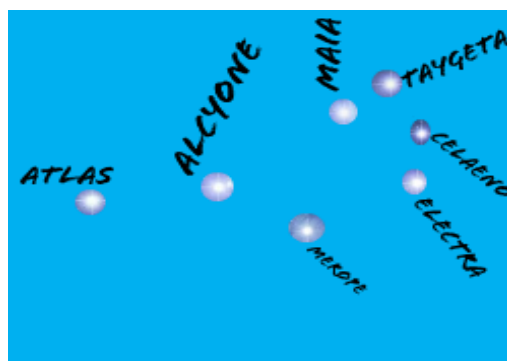
Pleiades is an open star cluster near the constellation Taurus⁴⁰ distant at about 430 light years⁴¹ from the earth and 13 light years across the cluster.⁴² It was said to have contained seven blue stars visible to the unaided eyes, that might further count to a hundred through the binoculars or even three thousand with the aid of a powerful telescope.

⁴⁰ A constellation to have alien between the Aries and Gemini

⁴¹ Wolfgang Z. (2016). Mobile Observatory, (version 2.63) [Mobile app], Freiburg, Germany. Retrieved from <http://mobileobservatory.info>

⁴² N.A (n.d) The Pleiades star cluster. Retrieved 30 January, 2020 <http://www.astro.sunysb.edu/lattimer/AST100/talk5.pdf>. P 2

The cluster appears mostly on the sky from August and disappears in April and presents an apparent angular structure composed of stars at variant distances viz: Atlas,⁴³ Alcyone,⁴⁴ Merope,⁴⁵ Electra,⁴⁶ Celaeno,⁴⁷ Taygete⁴⁸ and Maia.⁴⁹



Figures 1. Pleiades

Directional identification with the star cluster was done by the ancient astronomers of the northern Nigeria through the assigning of the Tygeta, Celaeno and Electra to rest on the left-hand shoulder and made Atlas the straight direction of the phase to gaze direct eastern side of the cardinal points,⁵⁰ while the back side remain at west, right hand shoulder stands at the north and left-hand shoulder pointed the southern cardinal direction.

d. Polaris

Polaris is a yellow supergiant star much close to the northern celestial pole and appears at a distance of 431 light years in the northern hemisphere,⁵¹ representing the tail of the little bear constellation, hence consideration is to be on it, for representation to the entire constellation (little bear).

⁴³ Distant at 381 light years

⁴⁴ Distant at 368 light years

⁴⁵ Distant at 359 light years

⁴⁶ Distant at 371 light years

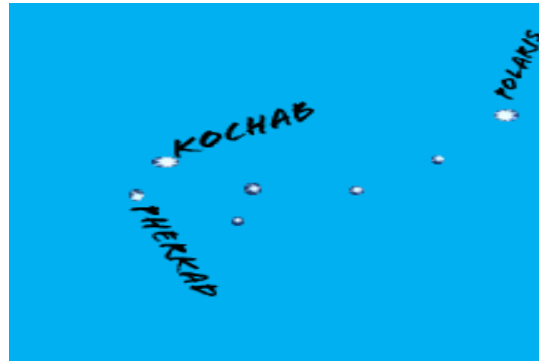
⁴⁷ Distant at 335 light years

⁴⁸ Distant at 373 light years

⁴⁹ Distant at 360 light years

⁵⁰ Isah B. (87 aged) Local astronomer, at his house, Linkawa quarters kurfi L.G.A Katsina state, on 23/04/2021, 11:12 am

⁵¹ Wolfgang Z. (2016). Mobile Observatory, (version 2.63) [Mobile app], Freiburg, Germany. Retrieved from <http://mobileobservatory.info>



Figures 2. Polaris

The star was identified as the 48th brightest in the sky with a calculated radius of 695,800 kilometers,⁵² hence is much visible to the unaided eyes, this could be adopted as a guide to various directions. Al-Qurṭubī described how to identify eastern side for those to have lost direction in the land or voyage in the sea, he said; As for the Qibla, if you lost its direction, identify the pole star (Polaris) and make it lie on your left-hand shoulder and stand straight to face the direction of the Qibla (east).⁵³

Ancients' Northern Nigerian astronomers extended over the guide of al-Qurṭubī to identify that; left hand shoulder is to be made adjacent to Polaris for the identification of the north while right hand side pointed to south, and the front of the face indicates the east while backside of the person sticks to west of the cardinal directions of northern Nigeria.⁵⁴

e. Cassiopeia

Cassiopeia (*zatil kursi*): is a constellation located at the northern hemisphere sky⁵⁵ covering wide range of about 598 square degrees, forming an imagery "W" shape from the apparent visibility of some five stars of the constellation located at variant distances,

⁵² John N. W. (2017) Polaris, Pole Star Facts, Universe Guide. Retrieved on 28/04/2021 from <https://www.universeguide.com/star/11767/polaris>

⁵³ Muḥammad Al-Qurṭubī, *Al-Jāmi' al-Aḥkām al-Qur'ān* (Egypt: Maktabah al-Şafā, 2005), 68.

⁵⁴ Isah B. (87 aged). Op cit

⁵⁵ Admin (2021). Constellations: A Guide to the Night Sky, Cassiopeia Constellation, WordPress. Retrieved on 19/05/2021 from <https://www.constellation-guide.com/constellation-list/cassiopeia-constellation/>

viz: Segin,⁵⁶ Ruchbah,⁵⁷ Gamma,⁵⁸ Schedar⁵⁹ and Caph.⁶⁰ The constellation was first counted by Ptolemy, and was further ranked as the 25th largest of the identified constellations of the sky that often appears visible in the northern celestial sphere of the northern Nigeria for only ten months (from the part of May to February of the following year) and disappears totally in March and April⁶¹ in the cause of its daily revolution in the sky.



Figures 3. Cassiopeia

Direction could be identified through the representation of the *segin* star at the left hand Palm, Ruchbah to be at its shoulder, *Navi* star to be faced with the head, *shedat* at the right hand shoulder and Caph star at the right hand palm to face straight towards the northern cardinal point.⁶² The right hand pointed to the east and the left hand stood at the west, while the backside identified the southern direction without much doubt.

f. **Ursa Major: Big Dipper (*Banat naash kubra*)**

Ursa major is often called great bear as the largest constellation of the northern hemisphere covering 1280 square degree⁶³ of the sky formed through the imaginary

⁵⁶ A bright blue star distant at 442 light years.

⁵⁷ A binary star located at the distance of 99.47 light years.

⁵⁸ A blue Star located at the distance of 613 light years.

⁵⁹ An Orange giant star distant at 229 lights years from the earth.

⁶⁰ A sub giant star located at distance of 54.47 light years.

⁶¹ A sub giant star located at distance of 54.47 light years.

⁶² Isah B. (87 aged). Op cit

⁶³ Admin (2021). Op cit.

structure exhibited by the positions of 22 stars,⁶⁴ but ancient astronomers of northern Nigeria hold to only seven as the most visible viz: Alkaid,⁶⁵ Mizar,⁶⁶ Alioth,⁶⁷ Megrez,⁶⁸ Phecda,⁶⁹ Merak⁷⁰ and Dubhe⁷¹ which are at variant distances.



Figures 4. Ursa Major

Directional guidance could be adopted from the straight look at the constellation to identify the northern hemisphere of northern Nigeria.⁷² Clear look at the sequential queue of Alkaid, Mizar and Alioth from Megrez might not be relied as an indicator to east as it moves round in a clockwise direction from east⁷³ at the spot of its rise to the period of its set at west.

g. Shaula

Shaula is southern hemisphere star and one of the stars to have constituted the oldest Scorpius constellation of the zodiac signs, it was considered to represent the stinger point of the constellation that emitted luminous rays which attracted much attention for further mission that ends up with the discovery of additional two stars

⁶⁴Admin.

⁶⁵ Eastern star and third brightest of the constellation distant at 101 light years.

⁶⁶ Is a binary star distant at 78.17 light year.

⁶⁷ The brightest of the constellation at the distance of 80.94 light years.

⁶⁸ Distant at 81.45 light years.

⁶⁹ Distant at 83.66 light years.

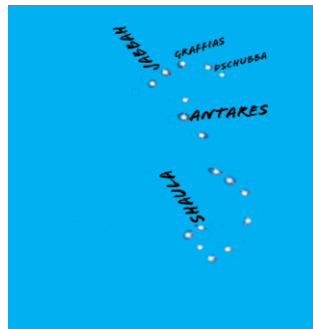
⁷⁰ Distant at 79.43 light years.

⁷¹ Second brightest star of the constellation at the distant of 124 light years.

⁷² Shehu A. (aged 93). Op cit.

⁷³ Kalil S. (60 aged). Local astronomer, at Emir Dikko Juma'at Mosque Katsina, on 05/06/2021, 3:00 pm.

termed as Lambda *Scorpii* B and C in addition to the A⁷⁴ but both could be termed as Shaula.



Figures 5. Shaula

Back to the earliest belief of the ancient astronomers, Shaula was assumed to be a single star located at the distance of 703 light years⁷⁵ confirmed as the second brightest of the constellation⁷⁶ and visible to the unaided eyes. Northern astronomers counted it among the 28 mentions⁷⁷ crossed by the moon⁷⁸ and the first star to mark the beginning of the winter season of the year.

As for the directional guide; northern astronomers assumed right hand shoulder to be set on the side of the *Jabbah*, *Graffias* and *Dschubba* stars serially and face the direction of the *Shaula* to identify the southern direction of the northern Nigeria,⁷⁹ right hand indicated the west, left hand side guided to east and back side tells the northern cardinal point.

B. 4 Significance

The innovated science of the ancient astronomers in the course of directional identification through the celestial objects brought great development towards solving their basic needs in the sport of travel on land or voyage in the sea and has so many significances as follows:

⁷⁴ Admin

⁷⁵ Wolfgang Z. Mobile Observatory.

⁷⁶ Wolfgang Z. Mobile Observatory.

⁷⁷ Uba K. (1999). *Hisabi a Sauqaqe*, book1&2, np. Kano Nigeria. P 34.

⁷⁸ AlQur'an 36:38.

⁷⁹ Shehu A. (aged 93).

- a. Accurate guide to the destination; permanent existence of the celestial objects made it the most reliable source of directional guide (to those having the knowledge) despite generational changes that usually affect most of the road guides and signs that might be removed or fade at any moment of time.
- b. Open access to the objects made it the cheapest guide to the people in contrast to the technology innovative devices that might not be used except after purchase of other utilities to make it operative or spending much from the public fund to install guides for people uses.
- c. Knowledge of its application does not require long period study at the institutions of learning, hence could be imparted anywhere and practicable openly without mandate to be in laboratories.
- d. Reduces the rate of questions and requests for guidance from people that might often mislead at some instances. And a person may even identify his direction of movement in the absence of people to guide him.

B. 5 Challenges

Ancient astronomical science does suffer from many challenges at variant directions that set it in critical condition or even at the risk of being lost or forgotten in the domain of science.

- a. Weather conditions; cloudy atmosphere and unsuitable weather may render the objects inaccessible especially during the rainy season or harmattan period, hence guide through them may not be possible on some days of such periods.
- b. Modern technology and science came up with some achievements and innovative devices that are much more accurate than ancient science such as compasses, Google maps, mathematical processes of bearing identification etc. that could even be installed in author mobile vehicles for direct use, hence people tend to neglect the ancient one.

- c. Misconception on the science made most of the people to consider its practitioners as mere soothsayers or astrologers despite the great barrier to have existed between them, as such some rejected its application in an attempt to escape such misconceptions.
- d. Lack of much publication; oral transmission dominated much of the processes of its dissemination among the people, that is why death of any of its professionals render his knowledge to be lost and consequently reduce the scope of its boundary.

C. Conclusion

Celestial objects are heavenly bodies that cross the celestial sphere in the course of revolutionary movements within the entire period of a year, their permanent movement and directional appearance made ancient astronomers of the northern Nigeria to hold them as compasses for the identification of the cardinal points of the locality at the time of travel by land or voyage in the sea. The guide was adopted from various objects such as stars, satellites, constellations and mansions as discussed one after the other. Science is at the risk of being lost for so many challenges attached to its existence from various dimensions which might not be settled except on some recommended points to follow.

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