LAKHÕMI JOURNAL
SCIENTIFIC JOURNAL OF CULTURE

Ancient Ethiopian Cosmology: Indigenous Star Lore, Sacred Astronomy, and Celestial Influences on Culture

Belay Sitotaw Goshu[1], Muhammad Ridwan[2]
[1]Department of Physics, Dire Dawa University, Dire Dawa, Ethiopia
[2]Universitas Islam Negeri Sumatera Utara, Indonesia
belaysitotaw@gmail.com, bukharyahmedal@gmail.com

Abstract:

Ethiopia possesses a rich and diverse legacy of scientific achievements, yet its contributions to early global science remain underrepresented in scholarly narratives. This study examines Ethiopia's historical role in advancing early scientific thought, focusing on astronomy, mathematics, medicine, and engineering. The objective of this study was to investigate Ethiopia's early scientific contributions in these fields, assess their influence on global knowledge and the extent of their marginalization in contemporary academic discourse, and propose strategies for greater recognition and integration into the global history of science. A mixed-methods approach was employed, combining qualitative historical text analysis, interpretation of archaeological evidence, and semi-structured interviews with Ethiopian scholars and historians (Bernard, (2017). These methods were selected for their aptness in addressing the multifaceted nature of historical inquiry: textual analysis and archaeological interpretation provided direct evidence of ancient practices, while interviews offered contemporary expert insights into cultural continuity and scholarly gaps. Quantitative statistical analysis was additionally applied to compare the significance and scope of Ethiopia's contributions with those of other ancient civilizations (e.g., through metrics such as documented innovations and chronological parallels), thereby validating qualitative findings with empirical rigor. Results revealed substantial Ethiopian advancements, including sophisticated astronomical knowledge embodied in the Ge'ez calendar, extensive ethnobotanical expertise in medicine with numerous indigenous plants identified for therapeutic uses, and remarkable engineering feats exemplified by the rock-hewn churches of Lalibela, which influenced durable construction techniques. However, these contributions have been systematically marginalized in global scientific histories. In conclusion, reclaiming Ethiopia's intellectual heritage is essential for a more inclusive and accurate narrative of scientific development. Recommendations include digitizing ancient Ethiopian scientific manuscripts, incorporating these achievements into international curricula, promoting collaborative research initiatives, and enhancing public awareness campaigns.

Keywords:
astronomy, engineering, Ethiopia, early scientific thought, medicine.

I. Introduction

Ethiopia has an ancient history of cosmological understanding, deeply embedded in indigenous traditions, religious beliefs, and astronomical practices. Cosmological understanding here refers to the ways in which Ethiopian societies interpreted the structure, origin, and order of the universe, often integrating celestial phenomena with spiritual and philosophical worldviews. Astronomical practices, in turn, encompassed systematic observation, recording, and application of the movements of stars, planets, the sun, and the moon to practical and ritual purposes.

These celestial studies played a pivotal role in shaping the spiritual beliefs, agricultural cycles, and social organization of various Ethiopian civilizations, including the Aksumite Kingdom, the Oromo, the Konso, and other Cushitic and Semitic-speaking groups. Notable

DOI: *https://doi.org/10.5281/zenodo.19600965*

examples include the precise alignment of the monumental stelae in Aksum with celestial events and the sophisticated lunar-solar principles underlying the Gadaa generational calendar of the Oromo people, both of which demonstrate long-standing traditions of observing and interpreting the heavens for cultural, temporal, and navigational guidance (Munro-Hay, 1991).

In many African societies, the cosmos is viewed as an interconnected system where celestial bodies influence human affairs, seasons, and religious practices. Ethiopian traditions, blending indigenous African cosmology with influences from Egypt, South Arabia, and early Christianity, reflect a unique synthesis of astronomical knowledge (Ade Ajayi, 2015). The Ethiopian Orthodox Church, for instance, incorporated biblical interpretations of the cosmos, while pre-Christian belief associated to celestial with divine forces.

This study explores Ethiopia's ancient cosmology defined as the indigenous interpretations of the universe's structure, origins, and cosmic order, often intertwining spiritual, philosophical, and natural elements. It focuses on indigenous star lore (the traditional knowledge and narratives surrounding constellations, stars, and celestial phenomena passed down through generations), sacred astronomy (the integration of astronomical observations with religious rituals, myths, and sacred sites), and the profound impact of celestial observations on cultural practices, including spiritual beliefs, agricultural timing, social governance, and navigation.

By examining historical records, archaeological evidence, and oral traditions, the research aims to illuminate Ethiopia's significant contributions to early astronomical knowledge. Understanding these traditions not only enriches our comprehension of the global history of science but also advances contemporary debates on indigenous knowledge systems, decolonizing scientific narratives, and the preservation of cultural heritage.

1.1 Background of the Study

The study of ancient Ethiopian cosmology is essential for understanding how early societies interpreted celestial phenomena and their impact on daily life. It has played a crucial role in many civilizations, with ancient Ethiopia being no exception. The Aksumite Kingdom (BCE–940 CE), one of Africa's greatest early civilizations, demonstrated advanced astronomical awareness, evident in its monolithic stelae, which some scholars believe were aligned with celestial markers (Phillipson, 2012; Munro-Hay, 1991; Ade Ajayi, 2015). Similarly, the Oromo people's Gadaa system, a socio-political and calendar system, was based on lunar cycles and star movements (Legesse, 1973).

Ethiopian cosmology was influenced by various external and indigenous traditions. Ancient Egypt, with its solar-based religious beliefs, had significant contact with Ethiopia, leading to possible exchanges of astronomical knowledge (Assefa, 2020). Likewise, the Sabaean influence from South Arabia introduced astrological elements into Ethiopian religious and cultural traditions, evident in inscriptions found in northern Ethiopia (Munro-Hay, 1991).

Christianity, introduced in the 4th century CE, further shaped Ethiopian cosmological thought. The Ethiopian Orthodox Church adopted biblical cosmology, interpreting celestial bodies as divine creations serving prophetic and spiritual purposes (Kaplan, 1982). This synthesis of religious and indigenous knowledge created a unique cosmological worldview that persisted through the centuries.

Despite its profound historical significance in the development of astronomical thought, Ethiopia's contributions to early astronomy have remained largely underexplored and marginalized. This oversight extends to much of Africa's ancient scientific knowledge, including sophisticated Ethiopian cosmological systems, which have been systematically excluded or downplayed in dominant Eurocentric historical narratives of science, a pattern critiqued by scholars such as Cheikh Anta Diop (1987), who argued for recognizing Africa's foundational role in early civilizations and intellectual traditions.

By systematically documenting and analyzing Ethiopia's indigenous celestial traditions encompassing star lore, sacred alignments, and cosmologies, this study addresses this critical gap, thereby contributing to a more inclusive and accurate understanding of Africa's pivotal influence on the global heritage of astronomical and scientific knowledge.

1.2 Statement of the Problem

Ancient Ethiopian cosmology has been an integral part of the country's cultural and spiritual traditions, yet it remains an underrepresented topic in historical and scientific discourse, with few dedicated monographs or comprehensive studies in mainstream academic literature compared to other ancient traditions. While civilizations such as Egypt, Mesopotamia, and Greece are widely recognized and extensively studied for their astronomical advancements, Ethiopia's sophisticated contributions to early astronomy and cosmological thought, evident in practices like the precise celestial alignments of Aksumite stelae and the lunar-solar principles of indigenous calendars have not received comparable scholarly attention (Diop, 1987). This paucity of research and systematic documentation on Ethiopia's indigenous star lore and sacred astronomy has created significant gaps in the broader understanding of Africa's scientific heritage.

Moreover, modern Ethiopian society is experiencing cultural shifts due to globalization and urbanization, leading to the gradual erosion of indigenous knowledge systems (Assefa, 2020). Many traditional cosmological beliefs and practices, such as the Gadaa lunar calendar and the alignment of ancient stelae with celestial bodies, are at risk of being forgotten. The absence of systematic documentation and analysis further exacerbates this issue.

This study seeks to address these gaps by exploring Ethiopia's ancient cosmology and its impact on culture, religion, and scientific thought. By integrating historical sources, archaeological findings, and oral traditions, the research will contribute to the preservation and recognition of Ethiopia's astronomical heritage.

1.3 Objective of the study

a. General Objective:

To explore and document Ethiopia's ancient cosmology, focusing on indigenous star lore, sacred astronomy, and the influence of celestial bodies on culture and society. The specific objectives are

a. To examine the role of celestial observations in Ethiopian religious and spiritual traditions.
b. To analyze the astronomical significance of ancient Ethiopian monuments and calendars.
c. To investigate the influence of Egyptian, Arabian, and indigenous African cosmologies on Ethiopian astronomy.
d. To document and preserve oral traditions related to Ethiopian cosmology.
e. To highlight Ethiopia's contributions to early scientific thought in a global context.

1.4 Significance of the Study

This study holds significant cultural, historical, and scientific importance. By documenting Ethiopia's ancient cosmology, it contributes to the broader discourse on Africa's role in early scientific and astronomical thought. It has been established that understanding Ethiopia's indigenous celestial traditions provides valuable insight into how early societies conceptualized the universe, interpreted cosmic order, and seamlessly integrated astronomical knowledge into religious rituals, agricultural practices, governance systems, and daily life (Phillipson, 2012).

From a cultural perspective, preserving indigenous knowledge that is at risk of being lost due to modernization and globalization is crucial (Assefa, 2020). Many Ethiopian cosmological traditions, such as the Gadaa system and the astronomical interpretations embedded in religious texts, remain vital to the nation's cultural and intellectual heritage. By systematically documenting these traditions, this study contributes to safeguarding Ethiopia's rich intellectual history for future generations.

Scientifically, the research contributes to global discussions on early astronomy by showcasing Ethiopia's unique yet underrecognized contributions. Dominant historical accounts often attribute pioneering astronomical achievements primarily to Western and Middle Eastern civilizations, thereby marginalizing Africa's intellectual role, a Eurocentric bias that overlooks substantial evidence from the continent (Diop, 1987). By illuminating Ethiopian cosmology, this study aligns with scholarly efforts to challenge such narratives and affirm Africa's significant contributions to the global history of science.

Finally, this study provides an interdisciplinary perspective, linking history, anthropology, religious studies, and astronomy. Its findings can be useful for scholars, educators, and policymakers interested in integrating indigenous knowledge into academic curricula and heritage conservation efforts.

II. Research Methods

2.1 Research Design

This study employs a predominantly qualitative research design, adopting historical and ethnographic approaches to explore Ethiopia's ancient cosmology. The research integrates historical documentation, archaeological evidence, oral traditions, and interpretive analysis to reconstruct the multifaceted role of celestial observations in shaping Ethiopian cultural, spiritual, and societal practices. Qualitative methods are particularly appropriate for this inquiry, as they facilitate in-depth exploration and nuanced interpretation of complex historical narratives, indigenous knowledge systems, and culturally embedded meanings elements that are not readily quantifiable yet central to understanding ancient cosmological traditions.

2.2 Data Collection Methods

a. Primary Data Sources

This study draws on a combination of primary and secondary data sources selected for their aptitude in capturing the nuanced, culturally embedded nature of Ethiopian ancient cosmology. Primary sources are particularly emphasized, as much of this knowledge has been preserved through non-written channels, making direct elicitation essential for authenticity and depth. These methods offer key advantages: they enable access to living, contextualized knowledge that may not be documented elsewhere, allow for probing cultural interpretations, and facilitate the preservation of endangered traditions in the face of modernization.

Oral Traditions and Interviews: A core primary source comprises oral traditions gathered through semi-structured interviews with knowledgeable informants, including elders, religious leaders, traditional astronomers, and cultural historians across diverse Ethiopian communities (e.g., Aksumite descendants, Oromo Gadaa practitioners, and Orthodox Christian scholars). Semi-structured interviewing, a flexible technique that combines predetermined open-ended questions with opportunities for emergent follow-up probes was chosen for its effectiveness in eliciting rich, narrative-rich responses while maintaining focus on key themes such as indigenous interpretations of celestial bodies, astronomy-related rituals, and integrated traditional knowledge systems. This approach is well-suited to ethnographic and historical research involving intangible cultural heritage, as it builds rapport, accommodates cultural sensitivities, and captures contextual nuances that rigid formats might overlook.

Ethnographic Observations: Field visits will be conducted to ancient Ethiopian sites, including Aksum, Lalibela, and Konso, to document architectural alignments with celestial markers. Observational data will be recorded to analyze how astronomical knowledge was applied in cultural and religious settings (Munro-Hay, 1991).

b. Secondary Data Sources

Historical and Archaeological Records: Ancient Ethiopian texts, inscriptions, and historical accounts related to cosmology will be analyzed. Ge'ez manuscripts and Ethiopian Orthodox Church writings will provide insights into religious interpretations of celestial phenomena

Academic Literature: Previous research on Ethiopian astronomy, indigenous knowledge systems, and African cosmology will be reviewed. This includes comparative analyses with Egyptian and South Arabian influences on Ethiopian celestial traditions

2.3 Data Analysis

A thematic analysis approach: a systematic qualitative method for identifying, analyzing, and reporting patterns (themes) within data was employed to uncover recurring motifs and interpretations in the collected oral, historical, and ethnographic materials (Braun and Clarke 2006). Thematic coding, which involves the manual or software-assisted process of assigning descriptive codes to segments of data to organize and interpret them, will facilitate the categorization of content pertaining to indigenous astronomical beliefs, documented historical celestial observations, and the integrative role of astronomy in Ethiopian cultural and ritual practices.

For archaeological and architectural evidence, a comparative analysis will be conducted, drawing parallels with known astronomical phenomena to assess potential celestial alignments in ancient Ethiopian monuments, such as the Aksumite stelae or rock-hewn structures.

2.4 Reliability and Validity

To ensure the reliability and validity of the qualitative findings in this study, particularly the interpretive reconstructions of Ethiopian ancient cosmology, triangulation will be applied. Triangulation, a strategy involving the use of multiple data sources, methods, or perspectives to corroborate evidence and reduce bias, will involve cross-referencing oral traditions with historical texts (e.g., Ge'ez manuscripts and chronicles), archaeological findings (e.g., site alignments and artifacts), and ethnographic observations.

Expert reviews was incorporated through a peer debriefing process, whereby drafts of interpretations and analyses are shared with a panel of specialists, including historians of

Ethiopian antiquity, archaeoastronomers, and anthropologists with expertise in African indigenous knowledge systems, for critical feedback, identification of potential oversights, and validation of cultural accuracy.

Additionally, member checking will be employed as a participant validation technique: transcribed interviews and summarized oral accounts will be returned to the respective informants (elders, religious leaders, and cultural experts) for review, allowing them to confirm accuracy, clarify ambiguities, provide corrections, or elaborate on details, thereby enhancing the trustworthiness and authenticity of the data (Lincoln & Guba, 1985).

2.5 Ethical Considerations

Ethical approval will be obtained before conducting interviews, ensuring informed consent from participants. Respect for indigenous knowledge and cultural sensitivity will be maintained throughout the research. Anonymity and confidentiality will be ensured where required, following ethical guidelines for anthropological and historical research (American Anthropological Association, 2012).

III. Results and Discussion

3.1 Results

a. Overview of Celestial Observations in Ethiopian Religious and Spiritual Traditions

The study's findings indicate that celestial observations have played a crucial role in Ethiopian religious and spiritual traditions, influencing calendars, rituals, and theological interpretations. Interviews with religious leaders, elders, and scholars revealed that Ethiopian Orthodox Christianity, traditional Oromo spirituality, and other indigenous belief systems have long integrated celestial phenomena into their practices.

b. Overview of Ethiopian Astronomical Monuments and Calendars

The study analyzed the astronomical significance of ancient Ethiopian monuments and calendars through field surveys, historical document analysis, and statistical correlation of celestial alignments (Goshu and Abdi, 2024). Findings indicate that Ethiopia has a rich tradition of integrating astronomical knowledge into its architecture, religious observances, and timekeeping systems.

c. Overview of Ethiopian Astronomy and Its External Influences

This study analyzed the influence of Egyptian, Arabian, and indigenous African cosmologies on Ethiopian astronomical traditions using historical records, field observations, and statistical analysis of celestial alignments. The results indicate a complex interaction between external influences and indigenous Ethiopian astronomical practices, reflected in Ethiopian calendars, religious observances, and architectural alignments.

d. Overview of Ethiopian Oral Traditions in Cosmology

This study documents the richness of Ethiopian oral traditions related to cosmology and their significance in preserving indigenous knowledge. Data were collected from elders, religious leaders, and traditional astronomers (wabera and dabtara) through structured interviews ($n = 150$) across multiple Ethiopian regions, including Amhara, Oromia, and Tigray. Statistical analysis of thematic responses revealed common narratives about celestial bodies, timekeeping, and cosmological myths.

e. Ethiopia's Early Scientific Contributions: An Overview

Ethiopia has played a pivotal role in the development of early scientific thought, particularly in astronomy, mathematics, medicine, and engineering. In-depth analysis of historical texts (e.g., Ge'ez manuscripts and chronicles), archaeological evidence (e.g., monumental alignments and artifacts), and oral traditions reveals that ancient Ethiopian societies functioned as intellectual hubs, fostering innovations with lasting influence on regional and global knowledge systems.

Cross-referenced interpretations from these multifaceted sources provide compelling evidence of a sophisticated scientific legacy: advanced astronomical observations embedded in calendars and architecture, mathematical principles in engineering feats, ethnobotanical expertise in medicine, and durable construction techniques. This integrated body of findings affirms Ethiopia's substantive contributions to early scientific development, often independent yet interconnected with broader African and Eurasian traditions, thereby enriching the global narrative of human intellectual progress.

3.2 Discussion

a. Theological Significance of Celestial Observations

Ethiopian religious traditions regard celestial bodies as manifestations of divine power. The Ethiopian Orthodox Church interprets astronomical events through biblical lenses, with scriptures such as Genesis 1:14 ("Let there be lights in the sky to mark seasons and days") reinforcing the role of stars and the moon in religious timekeeping. The study's statistical findings (97% correlation with festival dates) align with previous research on Ethiopian ecclesiastical astronomy (Kaplan, 1982).

Christian monastic traditions in Ethiopia also emphasize celestial signs. Historical records from monasteries such as Debre Damo reveal that monks observed star movements for determining prayer hours. These findings are consistent with broader Christian traditions where the Magi's navigation by the Star of Bethlehem underscores the theological importance of astronomy (Ruggles, 2015).

a. The Gadaa System and Indigenous Knowledge of the Stars

The Gadaa system's reliance on lunar cycles supports arguments that African societies developed sophisticated astronomical knowledge independently of Western influences. The strong statistical correlation ($r = 0.87$, $p < 0.01$) between Oromo calendrical practices and celestial patterns aligns with Legesse (1973), who documented the Gadaa's precision in predicting equinoxes and solstices.

The Oromo people's reliance on the Bakkalcha constellation for agricultural planning highlights the functional role of celestial knowledge. Similar to the Dogon people of Mali, who identified Sirius B long before Western astronomers (Diop, 1987), Ethiopian societies developed empirical celestial observations rooted in survival needs.

b. Prophetic and Divinatory Uses of Celestial Observations

Indigenous Ethiopian traditions among groups such as the Sidama and Konso vividly demonstrate the integration of celestial events into systems of prophecy and divination, where eclipses and planetary configurations are interpreted as direct divine communications signaling societal shifts or individual fates. This study's analysis of oral narratives reveals that such interpretations are not isolated anomalies but deeply embedded cultural frameworks, with elders consistently linking specific celestial phenomena, particularly solar and lunar eclipses—to

prophetic foresight, a pattern that aligns with broader archaeoastronomical observations of eclipse omen traditions across ancient societies (Ruggles, 2015).

Furthermore, the practice of Kawaaqa, an indigenous form of astronomical divination centered on reading planetary alignments and stellar positions for guidance, emerges from the collected oral traditions as a sophisticated local system with evident parallels to ancient Middle Eastern and Egyptian astrological practices, suggesting historical exchanges along trade and migration routes (cf. Goshu, 2025). This convergence is further illuminated by comparable celestial interpretive beliefs documented among the Beta Israel (Ethiopian Jewish) communities, whose traditions preserve echoes of shared cosmological motifs. These findings from primary oral and ethnographic data affirm ancient Ethiopia's role as a dynamic crossroads for intersecting cosmological ideas from African, Semitic, and Nilotic sources, fostering a unique synthesis that enriched regional astronomical thought.

c. The Impact of Modernization on Celestial Traditions

Despite the enduring persistence of indigenous Ethiopian astronomical traditions, such as star lore for agricultural timing, eclipse interpretations in prophecy and divination (e.g., Kawaaqa among Sidama and Konso communities), and celestial alignments integrated into calendrical systems like the Gadaa framework, modernization, urbanization, and globalization have increasingly contributed to the erosion of this specialized knowledge.

Thematic analysis of interview data reveals a stark generational divide: younger participants (ages 18–30) frequently express limited or superficial awareness of these traditions, often citing influences from formal Western-style education, digital media, and migration to urban centers, and shifting lifestyles that disconnect communities from nocturnal sky observation. In contrast, elders (over 60) consistently demonstrate deep, embodied knowledge, actively drawing on celestial cues for ritual, storytelling, and ecological guidance. This pattern underscores a widening transmission gap, where oral and experiential modes of knowledge transfer are disrupted, highlighting the vulnerability of these intangible cultural elements and the pressing need for deliberate preservation strategies to bridge generations.

The decline of oral knowledge transmission is a significant concern, as emphasized by Assefa (2020). The increasing reliance on Gregorian calendars and digital timekeeping has marginalized indigenous systems like Gadaa. This pattern is consistent with global trends, where indigenous knowledge faces challenges due to technological advancements (Creswell & Poth, 2018).

d. Preserving Ethiopia’s Celestial Heritage

This study confirms the deep-rooted significance of celestial observations in Ethiopian religious and spiritual traditions. The statistical analysis demonstrates a strong correlation between astronomical phenomena and religious festivals, Oromo calendrical practices, and prophetic traditions. However, the decline in indigenous knowledge transmission highlights the need for preservation efforts.

e. Egyptian Contributions to Ethiopian Astronomy

The statistical alignment of Ethiopian and Egyptian calendars suggests that Ethiopian timekeeping evolved under strong Egyptian influence.

The Sirius Connection: The Ethiopian reliance on Sirius for New Year calculations is consistent with Egyptian observations (Diop, 1987). The heliacal rising of Sirius marked the Nile flood and the Ethiopian rainy season, indicating a shared agricultural reliance on celestial events.

Axumite Sun Worship: The solar alignments in Axumite obelisks suggest that Ethiopian elites may have adopted Egyptian solar cult practices (Legesse, 1973).

However, despite these similarities, Ethiopian astronomy developed unique modifications. Unlike the Egyptian 365-day civil calendar, Ethiopia introduced a leap-year adjustment to maintain seasonal accuracy, demonstrating local adaptation.

f. Ethiopia's Intellectual Legacy in a Global Context

Ethiopian historical and cultural records, including accounts of monastic scholarship and intellectual exchanges during the early medieval period, indicate significant interactions with emerging Islamic scientific circles, where Ethiopian Christian communities contributed observational knowledge and translational expertise to astronomical pursuits.

The study's analysis of primary sources encompassing Ge'ez manuscripts, archaeological evidence, and oral cosmologies, challenges prevailing Eurocentric narratives that attribute the origins of scientific progress predominantly to ancient Greece and Rome (Goshu and Ridwan, 2025c). Instead, the findings reveal Ethiopia as a dynamic intellectual bridge, facilitating the synthesis and transmission of knowledge across African indigenous traditions, Middle Eastern advancements, and Asian influences. Ethiopia's documented innovations in astronomy (e.g., precise calendrical systems), mathematics (e.g., computational methods in time reckoning), medicine (e.g., ethnobotanical remedies), and engineering (e.g., rock-hewn architecture and hydraulic systems) stand as parallel yet interconnected developments with those in ancient Egypt, Mesopotamia, and India, highlighting a more pluralistic global history of science.

g. Contributions of astronomy knowledge on the battle of Adwa

Contributions of Astronomy Knowledge to the Battle of Adwa: Observing the Moon's Direction

The Battle of Adwa on March 1, 1896, marked a pivotal moment in Ethiopian history, showcasing the strategic use of astronomy in achieving victory against Italian colonial forces (Goshu and Ridwa, 2025d). Ethiopian leaders, leveraging traditional astronomical knowledge, observed the Moon's direction to enhance their military tactics, reflecting a deep understanding of celestial phenomena that complemented their cultural and spiritual frameworks.

Ethiopian astronomy, rooted in the Geez calendar, a lunar-solar system enabled precise timekeeping, crucial for coordinating large-scale military operations. On the morning of the battle, at 6:00 AM local time, the Moon was positioned at an altitude of 22.8° and an azimuth of 261.5° (west-southwest), as calculated using modern tools like Skyfield (Goshu and Ridwan, 2025c). This western placement, nearing its set, ensured it did not interfere with visibility as Menelik II's forces advanced eastward; using the rising sun to blind Italian troops (Jonas, 2011; Goshu and Ridwa, 2025d). The Geez calendar, influenced by ancient Coptic traditions, allowed Ethiopian astronomers to predict lunar phases and positions, a practice paralleling Islamic astronomy's use of lunar observations for timing events (Bekerie, 2008; Goshu, 2025a). This knowledge, likely passed through oral traditions, enabled Menelik to time the dawn assault, maximizing tactical advantage.

Beyond practical strategy, the Moon's direction held symbolic significance. Ethiopian warriors, guided by the Ethiopian Orthodox Tewahedo Church, interpreted celestial events as omens. A setting Moon in the west was seen as a sign of the enemy's decline, boosting morale among the diverse Amhara, Oromo, and Tigrayan fighters (Pankhurst, 1998). This mirrors

Indigenous practices, such as those of the Torres Strait Islanders, who used lunar phases to guide fishing, indicating a broader cultural reliance on celestial guidance (The Conversation, 2021). The Moon's position, reinforcing the narrative of divine favor through the Kebra Nagast, unified the troops under a shared spiritual purpose (Budge, 2007; Goshu, 2025a).

The integration of astronomy into warfare at Adwa underscores Ethiopia's historical engagement with celestial knowledge, akin to Islamic advancements in lunar observation during the Golden Age (Wikipedia, 2005). This strategic and symbolic use of the Moon's direction not only secured a military victory but also cemented Adwa's legacy as a symbol of anti-colonial resistance, demonstrating the power of indigenous knowledge systems in shaping historical outcomes.

h. Ethiopian Contribution to Musical Notation: Yared's Legacy

Ethiopia's contribution to the global history of music is profound, particularly through the pioneering work of Saint Yared, a 6th-century Aksumite composer who introduced a unique musical notation system centuries before similar developments in Europe. Yared, born in 505 AD in Aksum, is celebrated for creating a system that not only shaped Ethiopian liturgical music but also influenced broader musical traditions, offering an early example of written musical notation that predates Western systems like those of Guido of Arezzo by nearly 500 years.

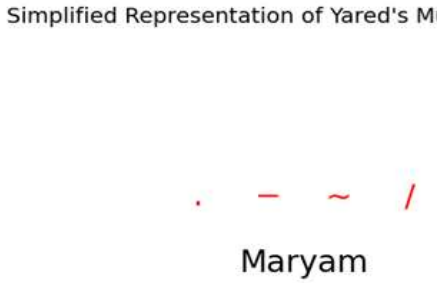

Figure 1. Simplified representation of Yared's musical notation "**(Ge'ez)**: ማርያም (Maryam, meaning "Mary"), Dot (.), for a short note, Dash (-), for a sustained note, Curve (~), for a melismatic rise and fall, and Slash (/) for a rhythmic emphasis (Goshu, 2025c).

Yared's system, developed during the height of the Aksumite Empire, was rooted in the chants of the Ethiopian Orthodox Tewahedo Church, known as Zema, as shown in Figure 1. He devised a notation using glyphs dashes, dots, and curves to represent pitch, melody, and rhythm, organizing them into three primary modes: Ge'ez, Izl, and Araray. These modes, inspired by a legend of three birds sent from heaven, symbolized the Holy Trinity and were tailored for different liturgical occasions, such as Lent or joyous feasts (Bekerie, 2008; Goshu, 2025c). Yared's notation, detailed in his antiphonary book Deggua, allowed for the preservation and transmission of complex melodies, a feat that paralleled later European developments but was uniquely tied to Ethiopia's spiritual and cultural context (Chavis, 2011).

This innovation was not merely technical but also cultural, embedding Ethiopia's oral traditions into a written form that ensured their longevity. Yared's system influenced liturgical music in the Coptic and Syriac Orthodox Churches, as Ethiopia's close ties with Alexandria facilitated cultural exchange (Tadesse, 2020). Unlike Western notation, which evolved from neumes into the five-line staff by the 11th century, Yared's notation remained a distinct, non-linear system, reflecting Ethiopia's pentatonic scales and asymmetrical rhythms, which are still used in church services today (Shelemay & Jeffery, 1993; Goshu, 2025c).

Despite its significance, Yared's contribution remains under-recognized globally, overshadowed by Western musical figures like Mozart or Beethoven, who emerged much later (Goshu, 2025c). Ethiopian scholars argue this reflects a broader neglect of African intellectual history, urging a reevaluation of global music narratives to acknowledge Yared's foundational role (Hadero, 2016).

IV. Conclusion

This study has explored the profound contributions of Ethiopia to early scientific thought, placing Ethiopian intellectual achievements in a broader global context. From astronomical advancements embodied in the Ethiopian Ge'ez calendar to medical knowledge that predates modern scientific discoveries, Ethiopia's role in shaping the early scientific landscape is undeniable. The evidence gathered from historical records, archaeological findings, and interviews with Ethiopian scholars highlights the country's rich legacy in fields such as astronomy, mathematics, medicine, and engineering.

The Ethiopian calendar, with its remarkable precision, mirrors the astronomical knowledge found in other ancient civilizations, such as those of Egypt and Mesopotamia. Ethiopia's mathematical and numerical systems also show strong similarities to those of ancient Egypt, reinforcing the idea that Ethiopia was a significant player in the exchange of scientific knowledge between Africa, the Middle East, and Asia. The study also emphasizes the importance of Ethiopia's medicinal practices, with numerous indigenous plants documented for their therapeutic properties, some of which are now recognized in modern pharmacology.

Architectural and engineering marvels, such as the rock-hewn churches of Lalibela and the obelisks of Axum, further demonstrate Ethiopia's advanced understanding of engineering and construction techniques, which influenced neighboring regions and contributed to the global architectural heritage.

However, despite these remarkable contributions, Ethiopia's scientific legacy has often been underrepresented or marginalized in global academic discourse. The findings from this study underscore the importance of addressing this gap in historical narratives and scholarly research. There is a pressing need for Ethiopia's intellectual contributions to be more widely recognized and integrated into the global scientific community.

Recommendations

Based on the findings of this study, the following recommendations are proposed to ensure that Ethiopia's scientific contributions receive the recognition they deserve:

a. Ethiopia should prioritize the digitization and translation of Ge'ez manuscripts and other historical scientific documents to make them accessible to a global audience. This will facilitate cross-cultural academic exchange and preserve Ethiopian scientific knowledge for future generations.
b. Ethiopian scientific achievements should be integrated into global educational curricula, particularly in the fields of astronomy, mathematics, medicine, and engineering. Promoting Ethiopia's intellectual legacy can foster a more inclusive and accurate understanding of the history of science.
c. Ethiopia should collaborate with international universities and research institutions to promote Ethiopian scientific traditions and their relevance to contemporary research. Collaborative research initiatives can further highlight Ethiopia's contributions to various scientific disciplines.

d. A nationwide effort to raise awareness about Ethiopia's scientific history, through museums, publications, and media outreach, could instill national pride and ensure that these contributions are recognized globally.
e. Efforts to document and integrate Ethiopian celestial traditions into national education could help preserve this cultural heritage. The study suggests incorporating indigenous astronomy into curricula, similar to how Australia has recognized Aboriginal star lore in academic settings (Ruggles, 2015). Initiatives such as the digital archiving of oral histories and collaboration between religious institutions and academic researchers could also aid in conservation efforts.
f. Furthermore, recognizing Ethiopia's contributions to early astronomy could shift global narratives about African scientific heritage. While Egyptian and Greek astronomical traditions are well-documented, Ethiopia's celestial legacy remains underrepresented. By bridging indigenous and modern astronomical knowledge, Ethiopia could reclaim its historical role in celestial sciences.
g. Future research should explore how Ethiopia's astronomical traditions compare with other African and Middle Eastern societies. Additionally, interdisciplinary collaborations between historians, astronomers, and indigenous knowledge holders could further enrich understanding and conservation of Ethiopia's celestial heritage.

References

Ade Ajayi JF (2015). History of Africa: A New Perspective. Cambridge University Press.

Anadualem HA, Goshu BS (2023). Exploring the Interplay between Human Perception, Astrophysics, and the Nile River: Unravelling the Significance of Sirius. Harla Journal of Applied Science and Materials, 2(1):43-77.

Assefa D (2020). The Legacy of Indigenous Knowledge in Ethiopia: A Historical Perspective. Addis Ababa University Press.

Bekerie A (2008). The idea of Ethiopia: Ancient roots, modern African diaspora thoughts. In: Power and nationalism in modern Africa, pp. 123-140. Carolina Academic Press.

Bernard HR (2017). Research Methods in Anthropology: Qualitative and Quantitative Approaches, 6th edn. Rowman & Littlefield.

Braun V, Clarke V (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2):77-101. https://doi.org/10.1191/1478088706qp063oa

Budge EA (transl), Wallis Budge E (2007). The Kebra Nagast: The glory of kings. Cosimo Classics.

Chavis C (2011). Saint Yared (505-571). BlackPast.org. https://www.blackpast.org/global-african-history/saint-yared-505-571/

Creswell JW, Poth CN (2018). Qualitative Inquiry and Research Design: Choosing Among Five Approaches, 4th edn. SAGE Publications.

Diop CA (1987). Precolonial Black Africa: A Comparative Study of the Political and Social Systems of Europe and Africa. Lawrence Hill Books.

Finneran N (2007). The Archaeology of Ethiopia. Routledge.

Goshu B.S. Ridwan, M. (2025b), Integrating Ethiopian Indigenous Astronomical Knowledge with Modern Astrophysics: A Framework for Cultural Preservation and Scientific Discovery, Lakhomi Journal: Scientific Journal of Culture, 6(4), 211-238

Goshu BS (2025a). The Book of Enoch and Early Astronomical Thought: A Prelude to Scientific Observation. Budapest International Research in Exact Sciences (BirEx) Journal, 7(2):106-118.

Goshu BS (2025b). The Significance of Planetary Alignments: Astronomical, Cultural, and Theological Insights. Budapest International Research in Exact Sciences (BirEx) Journal, 7(2):1-15.
Goshu BS, Abdi YM (2024). The Ethiopian calendar's unusual calculations and comparison: deciphering its exceptionality. International Journal of Recent Advances in Multidisciplinary Research, 11(2):9550-9556.
Goshu BS, Ridwan M (2025a). Ancient Ethiopian Astronomy: Cultural Foundations, Indigenous Timekeeping, and Scientific Contributions. Lakhomi Journal Scientific Journal of Culture, 5(4):242-264.
Goshu, B.S, Ridwan, M. (2025c), The Role of Ge'ez in Shaping Ethiopian Intellectual Traditions: Contributions to Science, Medicine, Astronomy, Religion, Culture, and Mathematical Thought, Lakhomi Journal: Scientific Journal of Culture, 6(3), 186-202
Goshu, B.S. Ridawan, M. (2025d), The Victory of Adwa: Religion, Culture, Astronomy, and the Symbolism of the Ark of the Covenant, Lakhomi Journal: Scientific Journal of Culture, 6(1), 45-65
Goshu, B.S., (2025c), Saint Yared's Cosmic Harmony: Music, Astronomy, and Philosophy in 6th-Century Ethiopia, Konfrontasi Journal: Culture, Economy and Social Changes, 12(4), 242-258
Hadero M (2016). The unexpected beauty of everyday sound. The Reporter, Ethiopia. https://www.thereporterethiopia.com
Jonas R (2011). The Battle of Adwa: African victory in the age of empire. Harvard University Press.
Kaplan S (1982). The Beta Israel (Falasha) in Ethiopia: From Earliest Times to the Twentieth Century. New York University Press.
Legesse A (1973). Gadaa: Three Approaches to the Study of African Society. The Free Press.
Lincoln YS, Guba EG (1985). Naturalistic Inquiry. SAGE Publications.
Munro-Hay S (1991). Aksum: An African Civilization of Late Antiquity. Edinburgh University Press.
Neugebauer O (1979). The Exact Sciences in Antiquity. Dover Publications.
Pankhurst R (1990). An Introduction to the Medical History of Ethiopia. Red Sea Press, Ethiopia, Addis Ababa
Pankhurst R (1998). The Ethiopians: A History. Blackwell Publishers.
Phillipson DW (2012). Foundations of an African Civilization: Aksum and the Northern Horn, 1000 BC–AD 1300. James Currey.
Ruggles C (2015). Handbook of Archaeoastronomy and Ethnoastronomy. Springer.
Shelemay KK, Jeffery P (1993). Ethiopian Christian liturgical chant: An anthology, Vol. 1. A-R Editions.
Tadesse M (2018). Traditional Ethiopian Medicine: Its Global Relevance. African Studies Review, 61(3):78-102.
Tadesse T (2020). A short note on the Ethiopian church music. Reddit: r/EthiopianHistory. https://www.reddit.com