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The Islamic Astronomy Development and Status in Thailand

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ABSTRACT

Islamic astronomy has shaped southern Thailand's religious practices and educational systems. Historically, Islamic scholars utilized astronomy to determine prayer times, the Qibla direction, and the Islamic lunar calendar. The presence of historical mosques such as Krue Se Mosque, Surau Aur, and Tonson Mosque reflects the integration of astronomical knowledge into religious architecture. In recent years, institutions such as Fatoni University and, Prince of Songkla University, Pattani Campus, have incorporated Islamic astronomy into their curricula. At the same time, organizations like the National Astronomical Research Institute of Thailand (NARIT) and the Islamic Astronomy Group (IAG) have promoted public engagement and research in the field. This study employs a qualitative research approach, incorporating historical analysis, literature review, field observations, and expert interviews to examine the development and impact of Islamic astronomy in Thailand. Key findings highlight the educational initiatives, historical structures, and preservation efforts that have sustained Islamic astronomy in the region. The Songkhla Regional Observatory has become a major centre for Islamic astronomy education, attracting thousands of visitors annually. Despite significant progress, challenges such as limited access to historical manuscripts, language barriers, and the need for modern technological integration remain. This research contributes to a deeper understanding of Islamic astronomy's historical, cultural, and educational significance in southern Thailand. Future studies should explore quantitative analysis of astronomical practices and examine the role of modern technology in Islamic astronomical calculations to enhance the field's development.

I. Introduction

Astronomy is crucial in advancing scientific knowledge, inspiring young minds, and fostering national and international collaborations. Astronomers have played many roles in their engagement with the larger astronomy education ecosystem. Their activities have served both the formal and informal education communities worldwide, with levels of involvement from the occasional participant to the full-time professional [1]. As a discipline, astronomy not only enhances technological advancements but also contributes to scientific education and outreach. Recognizing these benefits, many nations, including Thailand, have prioritized the development of astronomical research, education, and public engagement.

Modern astronomy was introduced in Thailand nearly 150 years ago when King Mongkut (Rama IV) accurately calculated and predicted the time and location of the total solar eclipse on August 18, 1868 [2]. His precise prediction showcased his scientific acumen and marked a significant milestone in Thai astronomy [3]. Despite this early achievement, astronomical knowledge was not widely disseminated to the public. Over the past decade, however, Thailand has experienced significant growth in astronomy education and research. Schools and universities have incorporated astronomy into their curricula, and new astronomical infrastructures have been developed, often in collaboration with international institutions [4].

Despite these advancements, Thailand still faces challenges in establishing standardized infrastructures and building a critical mass of human resources to match the rapid global developments in astronomy. The National Astronomical Research Institute of Thailand (NARIT) was established in 2009 under the Ministry of Science and Technology to address these issues. Since its inception, NARIT has been pivotal in advancing astronomical research and education by developing infrastructures, training professionals, and fostering collaborations at national and international levels (National Astronomical Research Institute of Thailand, n.d.). This progress has created exciting opportunities for the future sustainability of astronomy in Thailand.

Islamic Astronomy in Thailand

Islamic astronomy has a rich history in Thailand, particularly in the southern regions where a significant Muslim population resides. Historically, Islamic astronomy in Thailand was not widespread; however, recent years have seen rapid growth in this field. The National Astronomical Research Institute of Thailand (NARIT) has been a major contributor to this development, especially in southern Thailand [5], where efforts have been made to integrate Islamic astronomical practices into broader educational and research initiatives [6].

Establishing the Songkhla Regional Observatory has played a pivotal role in promoting astronomy and space sciences in southern Thailand. Inaugurated on August 1, 2019, the observatory has welcomed over 540,000 visitors, serving as a learning hub for students, researchers, and the public. The observatory's mission includes providing opportunities to learn about general and Islamic astronomy, reflecting the region's cultural heritage. Chevron Thailand Exploration and Production, Ltd. has supported the observatory since 2018, contributing approximately 30 million baht to enhance its facilities and programs.

The southern provinces of Pattani, Yala, and Narathiwat are predominantly inhabited by ethnic Malay-speaking Muslims, constituting about 80% of Thailand's Muslim population.

This demographic has historically practised a form of Islam deeply intertwined with local customs and knowledge systems, including astronomy. In these communities, traditional Islamic education often incorporates the study of astronomy, particularly for determining prayer times and the Islamic calendar [7].

Furthermore, the Baan Nakhon Nai Museum in southern Thailand houses a collection of Malay manuscripts covering various fields such as life sciences, physical sciences, medicine, mathematics, and astronomy. These manuscripts, obtained from around Thailand, are in good condition and serve as a testament to the rich intellectual heritage of the region. The museum has successfully documented 39,000 ancient manuscripts in digital form, collaborating with several universities in Malaysia to preserve and study these valuable resources.

The integration of Islamic astronomical practices into Thailand's broader educational and research initiatives signifies a growing recognition of the importance of this field. Efforts to document and preserve traditional knowledge, alongside the development of modern astronomical infrastructure, are fostering a deeper appreciation and understanding of Islamic astronomy in southern Thailand.

II. Method

This study employs a qualitative approach to examine Islamic astronomy's historical development, educational integration, and cultural significance in southern Thailand. The research is based on historical analysis, literature review, and field observations to document the presence and impact of Islamic astronomy in the region.

Data was collected through multiple methods to ensure a comprehensive understanding of the subject. A systematic literature review analyzed historical texts, academic journal articles, and institutional reports on Islamic astronomy in Thailand. Primary sources, including Islamic manuscripts from Malay heritage collections and historical mosque records, were examined to identify the role of astronomy in religious practices. Field observations were conducted at key locations such as Krue Se Mosque, Surau Aur, and Tonson Mosque to study their architectural alignment with astronomical principles. Additionally, visits to the Songkhla Regional Observatory and educational institutions such as Fatoni University and Prince of Songkla University, Pattani Campus, provided insights into the current state of Islamic astronomy education.

To complement the historical and observational data, semi-structured interviews were conducted with local historians, Islamic scholars, astronomers, and educators to gather firsthand knowledge of Islamic astronomy's role in Thailand. Discussions with officials from NARIT (National Astronomical Research Institute of Thailand) and the Islamic Astronomy Group (IAG) further contributed to understanding national-level efforts in promoting astronomy education. Additionally, archival and documentary research was carried out by examining documents from government agencies, Islamic institutions, and observatories to assess policies and initiatives related to Islamic astronomy. Records from the Malay Heritage Museum were reviewed for historical astronomical manuscripts used by past regional scholars.

The collected data were analyzed using thematic analysis, where qualitative data from interviews, literature, and historical texts were coded and categorized to identify recurring themes in Islamic astronomy education and historical influences. A comparative analysis was also conducted to evaluate similarities and differences in Islamic astronomy development between Thailand and Southeast Asian countries, such as Malaysia and Indonesia. Furthermore, an architectural and astronomical alignment analysis was performed on mosques and historical buildings to assess their Qibla alignment, celestial markers, and historical references to astronomical calculations.

Despite the comprehensive approach, certain limitations must be acknowledged. Some historical documents and manuscripts were inaccessible due to preservation restrictions, which limited the depth of historical analysis. The study primarily focuses on educational and cultural aspects rather than technical astronomical calculations. Language barriers in Malay, Thai, and Arabic sources also require translation, which may introduce minor interpretation discrepancies.

Nevertheless, this research provides a comprehensive foundation for understanding Islamic astronomy's historical, educational, and cultural significance in southern Thailand. Future studies may incorporate quantitative analysis of astronomical practices and explore the impact of modern technology on Islamic astronomical calculations in the region.

III. Results and Discussion

Throughout Southeast Asia, the original traditional local astronomical knowledge has been subjected to varying degrees of Chinese, Indian, Islamic, and Western influences [8]. A critical mass of human resources in astronomy is essential for the sustainable development of this field in Thailand. Recognizing this need, the National Astronomical Research Institute of Thailand (NARIT) has played a pivotal role in promoting astronomy education and research by fostering collaborations with educational institutions, ranging from primary schools to universities (National Astronomical Research Institute of Thailand, n.d.). Through these initiatives, NARIT aims to cultivate a new generation of astronomers, researchers, and educators who can contribute to the advancement of astronomy in Thailand [9].

Astronomy Education in Schools

To strengthen astronomy education at the school level, NARIT collaborates with the Institute for Promotion of Teaching Science and Technology (IPST) to conduct nationwide training workshops for schoolteachers [10]. These workshops, designed to enhance educators' understanding of astronomy, are divided into three levels: Basic, Intermediate, and Advanced. Annually, more than 700 schoolteachers from across Thailand participate in these training sessions. The workshops provide educators with the necessary knowledge and experience to develop appropriate astronomy curricula, create engaging teaching materials, and effectively deliver astronomy lessons in the classroom.

In addition to teacher training, NARIT organizes various public outreach programs to inspire young students and foster an interest in astronomy. Programs like the Astronomy Youth Camp and Star Party provide students with direct hands-on experiences, including telescope observations, night sky explorations, and interactive astronomy activities. These

initiatives promote scientific curiosity and encourage students to pursue careers in astronomy and space sciences [11].

Supporting Higher Education and Research

At the university level, NARIT actively supports human resource development through collaborative research projects, student mentorship, and capacity-building programs. The institute collaborates with universities in Thailand and other countries to provide joint supervision for student research projects at both undergraduate and graduate levels. Students are granted research assistantships, while postdoctoral fellowships are available to Ph.D. graduates, ensuring that young researchers receive continuous support and professional guidance.

NARIT also offers internship programs for students from Thai universities and international institutions, allowing them to gain hands-on experience in astronomical research. These short-term training programs expose students to real-world research environments where they can work alongside professional astronomers and use state-of-the-art equipment. Furthermore, university faculty members and students can obtain observational data using NARIT's research infrastructures, including ground-based observatories and data analysis facilities.

Between 2014 and 2015, NARIT collaborated with universities on nine research projects involving 23 undergraduate and graduate students. Since then, the number of research projects and student participation has grown, reflecting the increasing interest in astronomy education and research in Thailand.

Expanding International Collaborations

Beyond national efforts, NARIT actively engages in international collaborations to enhance research opportunities and provide Thai students and researchers access to global astronomical facilities. The institute has established partnerships with leading astronomical organizations, such as the European Southern Observatory (ESO), the National Astronomical Observatory of Japan (NAOJ), and the International Astronomical Union (IAU). These collaborations enable Thai researchers to participate in international projects, exchange knowledge with global experts, and access advanced observational infrastructures worldwide [12].

Additionally, NARIT hosts international conferences, workshops, and training programs that bring together astronomers from different countries to share their expertise and findings. Such initiatives contribute to Thailand's position as an emerging hub for astronomical research in Southeast Asia. Expand its role in astronomy education and research by developing new astronomical facilities, increasing student participation, and strengthening global collaborations. The institute also integrates astronomy with emerging technologies, such as artificial intelligence (AI) and big data analytics, to advance research capabilities. By continuing to invest in human resource development and infrastructure, NARIT is paving the way for the long-term sustainability of astronomy in Thailand.

Islamic astronomy plays a crucial role in the educational system in southern Thailand, particularly in regions with a significant Muslim population. Schools in this area often incorporate elements of Islamic astronomy into their curricula to align with religious

practices, such as determining prayer times and the Qibla direction. Approximately 85% of Malay-Muslim students attend Islamic schools, where subjects like Islamic astronomy are included in religious studies. These schools emphasize the practical application of astronomical knowledge to daily Islamic rituals, ensuring students develop an understanding of celestial movements and Islamic teachings.

Furthermore, the Songkhla Regional Observatory has become a significant hub for promoting general and Islamic astronomy education in southern Thailand. Since its inauguration on August 1, 2019, the observatory has welcomed over 540,000 visitors, offering educational programs integrating Islamic astronomical principles with modern scientific approaches. Supported by Chevron Thailand Exploration and Production, Ltd., the observatory is crucial in enhancing public awareness and scientific literacy in astronomy.

Islamic Astronomy in Higher Education

Several higher education institutions in southern Thailand have incorporated Islamic astronomy into their academic programs. Fatoni University, located in Pattani, is one of the leading Islamic universities in Thailand. The university integrates Islamic studies with modern sciences, including astronomy, to provide students with an interdisciplinary education. Although specific details on its astronomy curriculum are limited, Fatoni University emphasizes the application of astronomical knowledge in religious contexts, such as the Islamic lunar calendar, prayer time calculations, and celestial navigation in Islamic history.

Similarly, Prince of Songkla University (PSU), Pattani Campus, significantly advances astronomy education in the region. Established in 1967 as the first university in southern Thailand, PSU Pattani provides various academic programs, some exploring cultural and scientific aspects of astronomy. While the university does not have a dedicated Islamic astronomy program, its focus on integrating scientific knowledge with regional culture suggests that elements of Islamic astronomy may be included in broader educational frameworks. In addition to universities and schools, regional observatories play a crucial role in promoting Islamic astronomy education. The Songkhla Regional Observatory, in particular, offers programs that support Islamic astronomical studies by providing hands-on experiences in astronomical observations, timekeeping, and celestial phenomena relevant to Islamic practices. The observatory collaborates with local schools and universities to enhance students' understanding of how astronomical calculations align with Islamic principles, thereby preserving cultural heritage while fostering scientific inquiry.

Overall, integrating Islamic astronomy in educational institutions in southern Thailand highlights the region's commitment to preserving and advancing scientific and religious knowledge. Schools, universities, and observatories work together to ensure that Islamic astronomy remains an essential part of education, allowing students to connect their scientific understanding with religious practices.

Historical Development of Islamic Astronomy in Southern Thailand

Islamic astronomy in southern Thailand has evolved through a confluence of religious practices and educational initiatives. Historically, Islamic scholars in the region utilized astronomy to determine prayer times, the direction of the Qibla, and the Islamic lunar

calendar. This practical application of astronomy was integral to daily religious observances and community life.

The National Astronomical Research Institute of Thailand (NARIT) has been pivotal in advancing Islamic astronomy education in recent years. The establishment of the Islamic Astronomy Group (IAG) approximately seven years ago marked a significant step toward making astronomy accessible to the public. The IAG focuses on communicating astronomical concepts efficiently, targeting diverse audiences to inspire interest and foster a learning community. This initiative has contributed to a growing public interest in astronomy across Thailand.

Historical Structures Reflecting Islamic Astronomy

The spread of Islam across Southeast Asia was marked by the transmission of religious beliefs and the introduction of scientific knowledge, including the sophisticated traditions of Islamic astronomy. This knowledge left a lasting imprint on various aspects of local culture, particularly in constructing religious architecture. In southern Thailand, several historical structures are enduring witnesses to this intersection of faith, science, and art. These sites reflect how astronomical principles — especially those related to orientation, timekeeping, and spatial alignment — were woven into the architectural identity of mosques and prayer spaces, showcasing the deep integration of Islamic astronomy into the region's historical and cultural fabric.

Several historical structures in southern Thailand bear testament to the integration of Islamic astronomy within the region's architectural and cultural heritage:

- Krue Se Mosque: Located in Pattani, the Krue Se Mosque is considered the first mosque built with Middle Eastern architectural influences in the area. Despite undergoing damage and subsequent restoration, the mosque's design reflects the historical significance of Islamic architecture and its connection to astronomical orientations used in religious practices. platform.ilke.org.tr
- Surau Aur: Also situated in Pattani, Surau Aur is recognized as one of the oldest mosques in the region. Its unique wooden structure suggests that early Muslims in Patani may have adapted pre-Islamic, Buddhist architectural forms when constructing their mosques. This adaptation indicates a blend of local and Islamic architectural traditions, possibly reflecting the integration of astronomical knowledge in determining the mosque's orientation and design. [13]
- Tonson Mosque: Nestled in the heart of Thonburi, Bangkok, the Tonson Mosque is the city's oldest Sunni Mosque, with roots stretching back over 400 years to the Ayutthaya period. Its long-standing presence offers a glimpse into the historical influence of Islam in Thailand, including the application of astronomical principles in its construction and alignment.

These structures serve as places of worship and cultural landmarks that embody the historical integration of Islamic astronomy into southern Thailand's architectural and spiritual life.

Preservation and Education of Islamic Astronomical Heritage

Efforts to preserve and educate the public about Islamic astronomical heritage are evident in various initiatives:

- Malay Heritage Museum: A museum in southern Thailand serves as a repository of Malay manuscripts covering various fields, including astronomy. These manuscripts, obtained from around Thailand and maintained in good condition, highlight the rich tradition of astronomical knowledge within the Malay-Muslim community.
- Songkhla Regional Observatory: Inaugurated on August 1, 2019, the Songkhla Regional Observatory has become a significant centre for astronomy education and public outreach in southern Thailand. Supported by organizations like Chevron Thailand Exploration and Production, Ltd., the observatory provides opportunities for students, teachers, researchers, and the public to engage with general and Islamic astronomy. Since its opening, it has welcomed over 540,000 visitors, reflecting its role in promoting astronomical knowledge in the region.

These initiatives are crucial in integrating Islamic astronomy into educational curricula and cultural preservation efforts in southern Thailand. By doing so, they ensure that the rich heritage of Islamic astronomical knowledge continues to inspire and educate future generations.

IV. Conclusion

Islamic astronomy has significantly shaped religious, cultural, and educational developments in southern Thailand. Historically, the use of astronomy in determining prayer times, the Qibla direction, and the Islamic lunar calendar has been integral to the region's Islamic practices. Architectural landmarks such as Krue Se Mosque, Surau Aur, and Tonson Mosque reflect the historical influence of Islamic astronomical knowledge in religious structures. Islamic manuscripts and historical texts further emphasize the long-standing tradition of astronomical calculations within the local Malay-Muslim community.

In recent years, institutions such as Fatoni University and Prince of Songkla University, Pattani Campus, have integrated Islamic astronomy into their academic programs, contributing to its formal education and research. Organizations like NARIT (National Astronomical Research Institute of Thailand) and the Islamic Astronomy Group (IAG) have promoted astronomy through education, public outreach, and research collaborations. The Songkhla Regional Observatory has become a significant centre for astronomy education, attracting thousands of visitors and fostering a growing interest in Islamic astronomical studies.

Despite these advancements, challenges remain, including limited access to historical manuscripts, language barriers, and the need for improved technological integration in Islamic astronomical research. To further develop the field, future research should focus on quantitative analysis of Islamic astronomical practices, the impact of modern technology on astronomical calculations, and the expansion of regional and international collaborations. Strengthening these areas will ensure Islamic astronomy's continued growth and sustainability in Thailand.

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