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Persian Garlands of Stars: Islamicate and Indic Astral Sciences in Seventeenth-Century North India

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Abstract

This paper offers a study of Mullā Farīd and Mullā Ṭayyib, two astronomers active in several North Indian courts in the first half of the seventeenth century. The lives and works of these two brothers illustrate the central role of mathematical astronomy and astrology in the science of the time and its use by Indian Muslim nobility. They also document the familiarity of Indian Muslim scholars with Indic astrology and its practice in Muslim milieux. Mathematical astronomy was very much alive in seventeenth-century Mughal India, and Persian-writing scholars were commenting and revising the astronomical data and mathematics transmitted from the Maragha and Samarqand schools of astronomy. Their intellectual activities are also better understood in the context of the avid interest in occult sciences cultivated by early modern Persianate societies, and more particularly by the Mughal court. Mathematical astronomy was nurtured for the precise purpose of casting horoscopes and creating astrological almanacs. Astrological practices in North-Indian courts, including Delhi, the Mughal imperial capital, were evidently mixed and flavoured with elements from both Islamicate and Indic traditions. Knowledge was widely shared across languages and scientific interests went well beyond religious denominations. Crucially too, the exchange between the Persian and the Sanskrit scholastic worlds was sponsored by Mughal patrons and resulted in scientific translations from one language to the other.

A closer reading of Mullā Farīd and Mullā Ṭayyib's Persian works allows us to see that besides their more classical astronomical works, the two brothers shared a common interest in Indic methods of prognostication, in particular *muhūrtaśāstra*, the

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science of electing an auspicious moment to perform a certain action. In this paper, we elucidate an intricate dossier on the "*bust* hours," an ancient prognostication method popular with Islamicate astrologers. Identified by Islamicate scholars as coming ultimately from India, the source of many features of Islamicate astrology, these *bust* hours were reinterpreted on Indian soil by Mullā Farīd and Mullā Ṭayyib in light of their first-hand knowledge of *muhūrtaśāstra*. In this manner, these *bust* hours came back full circle to the original Indian prognostication practices.

Keywords

Mughal India – astronomy – Islamic astrology – jyotisha – translation

Mullā Farīd al-Dīn Masʿūd Dihlavī is described in several court chronicles as a prominent astronomer active during the reigns of Jahāngīr and Šāh Jahān. According to the *Maʾāṯir-i Raḥīmī* (1025/1616–7), a chronicle written by ʿAbd al-Bāqī Nahāvandī, Mullā Farīd was versed in various sciences such as lettrism (*jafr*), numerology (*aʿdād*), astrology (*nujūm*), mathematics (*riyāżī*), geometry (*handasa*), charms (*nīranjāt*) and talismans.[1] However, his most notable accomplishment remains the *Zīj-i Šāh Jahānī*, a set of astronomical tables (*zīj*) compiled towards the end of his life. Entitled *Kārnāma-yi ṣāḥib-qirān-i ṯānī zīj-i Šāh Jahānī* ("The Great Work of the Second Lord of the Conjunction, the Tables of Šāh Jahān"; *Zīj-i Šāh Jahānī* in short). It was modelled on Uluġ Bīg's famous *Zīj-i jadīd-i Sulṭāni* (also known as *Zīj-i Uluġ Bīg*) but set to an epoch corresponding to the vernal equinox of the regnal year of Emperor Šāh Jahān's enthronement (i.e., an epoch of 21 March 1628, marking the beginning of the *tārīḫ-i ilāhī-yi Šāh Jahānī* "the Divine Era of Šāh Jahān").[2]

1 ʿAbd al-Bāqī Nahāvandī, *Maʾāṯir-i Raḥīmī*, ed. Hidāyat Ḥusayn (Calcutta: Asiatic Society of Bengal, 1910–31), vol. 3, p. 10.

2 The title "Lord of the second conjunction" (*ṣāḥib-qirān-i ṯānī*) given to Šāh Jahān "refers to the auspiscious conjunction (*qirān*) of Jupiter and Venus at the time of his birth on 5 Jan. 1592 in Lahore" (S.M. Razaullah Ansari, "Survey of *Zījes* Written in the Subcontinent," *Indian Journal of History of Science* 50, no. 4 (2015): 584). This title (*ṣāḥib-qirān*) had first been applied to Tīmūr, Šāh Jahān's ancestor, in reference to a conjunction of Mars and Jupiter in the zodiacal sign Taurus in the year of Tīmūr's birth (Eva Orthmann, "Circular Motions: Private Pleasures and Public Prognostication in the Nativities of the Mughal Emperor Akbar," in *Horoscopes and Public Spheres: Essays on the History of Astrology*, ed. Günther Oestmann, H. Darrel Rutkin, and Kocku von Stuckrad (Berlin: Walter de Gruyter, 2005), 111). According to Eva Orthmann, "the date of Tīmūr's birth was likely invented to fall on a good configuration."

Information about his career is otherwise sparse. In the *Maʾāṯir-i Raḥīmī*, Mullā Farīd was given pride of place among the scholars active at the court of the powerful Mughal minister and general ʿAbd al-Raḥīm Ḫān-i Ḫānān (d. 1627).[3] Mullā Farīd was hired in 1006/1597–8 and was evidently still on his payroll in 1616–7. During this time, he seems to have received a position as a high judge or governor (*manṣab-i ṣadārat-i ʿālī*). At a later stage in his career, he attached himself to the service of the Mughal minister Āṣaf Ḫān, who gave him instructions to compose the *Zīj-i Šāh Jahānī*. According to the *Ṭabaqāt-i Šāh Jahānī* (also quoted in the *Nuzhat al-ḫawāṭir*), Mullā Farīd died in 1039/1629–30,[4] but the *Tārīḫ-i Muḥammadī* gives the more precise date of 2 Rabīʿ al-avval 1039 (October 19, 1629).[5] However, according to Ghori, this date is incorrect since the positions of the stars in the *Zīj-i Šāh Jahānī* are calculated for the year 1041/1631–2.[6]

Born in Delhi in a family of scholars,[7] Mullā Farīd benefited from a well-rounded education with some of the foremost scholars of his age. First educated by his father Ibrāhīm Ḥāfiẓ, he was later sent to Narnaul to study under the guidance of the famous Čištī sheykh Niẓām al-Dīn "Ilāhdād" Nārnawlī (d. 1588–9).[8] Later on, Mullā Farīd completed his schooling with the Iranian émigré Fatḥ Allāh Šīrāzī (d. 1589), a famous authority at the Mughal court. Through his connection to these two figures, Mullā Farīd probably found an entry into major religious and scholarly networks, as well as imperial patronage.

Niẓām al-Dīn was a master of the Čištī *ṭarīqa*, a popular Sufi order in North India. Niẓām al-Dīn's credentials were impressive, and at a young age, he had accompanied his father to Gwalior to live in the lodge of the famous Šaṭṭārī sheykh Muḥammad Ġawṯ (d. 1563).[9] After the passing of his master Šayḫ Ḫānū

3 Nahāvandī, *Maʾāṯir-i Raḥīmī*, vol. 3, 14–5.

4 Muḥammad Kašmīrī Hamadānī, *Ṭabaqāt-i Šāh Jahānī: ṭabaqa-yi avval*, ed. Muḥammad Aslam Ḫān (Delhi: Baḫš-i fārsī, dānišgāh-i dihlī, 1990), p. 48; ʿAbd al-Ḥayy b. Faḫr al-Dīn al-Ḥasanī, *Al-Iʿlām bi-man fī tārīḫ al-hind min al-aʿlām al-musammà bi-Nuzhat al-ḫawāṭir wa-bahjat al-masāmiʿ wa-l-nawāẓir* (Beirut: Dār Ibn Ḥazm, 1999), 440.

5 *Tārīḫ-i Muḥammadī*, MS British Library, London, Or. 1824, fol. 162v; also see Rieu, vol. 3, p. 1088.

6 S.A. Khan Ghori, "Development of Zīj Literature in India," *Indian Journal of the History of Science* 20 (1985): 34.

7 See Nahāvandī, *Maʾāṯir-i Raḥīmī*, 3, 9–10.

8 Ḥabīb al-Raḥmān Ḫān Mīvātī, *Taḏkira-yi ṣūfīyān-i mīvāt* (Mewat: Mewat Academy, 1985), 305–311.

9 Besides his *Jawāhir al-ḫamsa*, an influential Arabic compendium on Sufi meditation practices, Muḥammad Ġawṯ penned the unorthodox *Baḥr al-ḥayāt*, a Sufi adaptation in Persian of an earlier Arabic translation of the yogic treatise *Amṛtakuṇḍa*. An illustrated copy of this

Gwāliyārī, Niẓām al-Dīn remained in Narnaul for 40 years as the head of the *ṭarīqa* before his death in the month of Ṣafar 997 (1588–9).[10] Narnaul was an important educational centre where Šēr Šāh Sūrī (r. 1537–45), the founder of the Suri empire, had established a madrasa.[11] Niẓām al-Dīn's reputation earned him a visit from Emperor Akbar, who in his quest for religious enlightenment visited the sheykh in November 1577 but, according to Abū l-Faẓl, was unimpressed.[12] One of Niẓām al-Dīn's most brilliant disciples was Šāh Aʿlà Čištī Pānīpatī, a member of a prominent Čištī family and himself a reputed spiritual master.[13] Interestingly, Šāh Aʿlà's father, Niẓām al-Dīn Pānīpatī,[14] has often been identified with Niẓām Pānīpatī, the author of a well-known Persian translation of the Sanskrit *Laghuyogavāsiṣṭha*.[15]

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text, now at the Chester Beatty Library in Dublin, was produced for prince Salīm, future emperor Jahāngīr (see Debra Diamond, ed., *Yoga: The Art of Transformation* (Washington, DC: Arthur M. Sackler Gallery, Smithsonian Institution, 2013), 150–9). After putting his mystical exploits at the service of emperors Bābur and Humāyūn, Muḥammad Ġawṯ was far less successful at Akbar's court (see A. Azfar Moin, *The Millenial Sovereign: Sacred Kingship and Sainthood in Islam* (New York: Columbia University Press, 2011), chapter 4; Orthmann, Eva. "The Occult Sciences at the Mughal Court During the Sixteenth Century," in *The Empires of the Near East and India: Source Studies of the Safavid, Ottoman, and Mughal Literate Communities*, ed. Hani Khafipour (New York, Columbia University Press, 2019), 384–400).

10 This account is based on two *taḏkiras* (Muḥammad Ġawṯī Šaṭṭārī, *Gulzār-i abrār*, ed. Muḥammad Ḍakī (Patna: Khuda Bakhsh Oriental Library, 1994), 259; al-Ḥasanī, *Nuzhat al-ḫawāṭir*, 440) and ʿAbd al-Qādir Badāʾūnī's chronicle. Notably, Badāʾūnī, who lists Niẓām al-Dīn among the prominent Sufi masters of the realm, notes his predilection for psychotropic drugs for obtaining visions of the next world (ʿAbd al-Qādir Badāʾūnī, *Muntaḵhabu-ʾt-tawārīḵh*, tr. W. Haig (Calcutta: Asiatic Society of Bengal, 1925), 44–5).

11 Šēr Šāh Sūrī's grandfather, Ibrāhīm Ḫān had controlled the area around Narnaul. Around 1540–5, Šēr Šāh Sūrī built a magnificent mausoleum in Narnaul for him.

12 Abū l-Faẓl, *Akbarnāma*, ed. Mawlavī ʿAbd al-Raḥīm (Calcutta: The Urdoo guide, 1877–86), vol. 3, p. 227; Abū l-Faẓl, *The Akbarnāma, vol. 3*, tr. H. Beveridge (Calcutta: Asiatic Society of Bengal, 1939), vol. 3, 321. A more favourable picture of this encounter is found in Niẓām al-Dīn Aḥmad's *Ṭabaqāt-i Akbarī*: remarkably, during this visit, Niẓām al-Dīn and his followers convened for *samāʿ* and fell into a trance (Niẓām al-Dīn Aḥmad, *The Ṭabaqāt-i Akbarī*, transl. B. De (Calcutta: Asiatic Society, 1936), vol. 2, 507).

13 Šāh Aʿlà's colourful account of his encounter with Niẓām al-Dīn is reported in the *Siyar al-aqṭāb*, a seventeenth-century Čištī hagiography (*taḏkira*) by Ilāhdīya Čištī (Ilāhdīya Čištī, *Siyar al-aqṭāb* (Lucknow: Naval Kishore, 1881), 237–42); see also Muḥammad Miyān Ṣāḥib, *Pānīpat ōr buzurgān-i pānīpat* (Lahore: Jamʿīya Publishings, 2000), 297–316).

14 Only a few sources are available on Niẓām al-Dīn Pānīpatī: Ilāhdīya Čištī, *Siyar al-aqṭāb*, 231–232; ʿAbd al-Ḥamīd Lāhōrī, *Bādšāh-nāma*, ed. Kabīr al-Dīn Aḥmad and ʿAbd al-Raḥīm (Calcutta: Asiatic Society of Bengal, 1867–8), vol. 1, p. 455; Miyān Ṣāḥib, *Pānīpat ōr buzurgān-i pānīpat*, 297.

15 The identity of Niẓām Pānīpatī is not settled among scholars: Shankar Nair (*Translating Wisdom: Hindu-Muslim Intellectual Interactions in Early Modern South Asia* (Oakland:

Fatḥ Allāh Šīrāzī, Mullā Farīd's other teacher, was the most prominent Iranian scholar at Akbar's court.[16] Attracted by the prospect of better pay, Fatḥ Allāh, like his fellow-students who had also been studying in Shiraz under the aegis of the great scholar and theologian Ġiyāṯ al-Dīn Manṣūr Daštakī (d. *c.*1541), chose to emigrate to the Deccan. Indeed, from the 16th century onwards, Indian courts boasted a brilliant artistic and literary culture, both in the Mughal realm in the North and the Deccan sultanates in the South. These Indian courts were reputed to provide newcoming scholars with lucrative and prestigious positions. Fatḥ Allāh Šīrāzī started his Indian career in the service of Sultan ʿAlī ʿĀdil Šāh I of Bijapur (d. 1580) before settling in the Mughal capital, Agra.[17] Emperor Akbar appointed him to key positions within the administration and entrusted him with an overhaul of the madrasa curriculum. This reform, inspired by the Šīrāzī intellectual tradition, stressed the importance of the "rational sciences" (*ʿulūm-i ʿaqlīya*)—comprising mathematical and natural sciences, ethics, poetry, and history—to the detriment of the "traditional [Islamic] sciences" (*ʿulūm-i naqlīya*). This reform was also aimed at providing both better staff for the ever growing revenue department as well as incentives for Hindus from scribal and Brahman castes to enrol in madrasas and learn the practical skills needed for the positions offered in the Mughal administrative service.

In Fatḥ Allāh, Mullā Farīd found an ideal master in Islamicate astronomy. Šīrāzī scholars were remarkable mathematicians and astronomers: Fatḥ Allāh Šīrāzī's own teacher Ġiyāṯ al-Dīn Manṣūr Daštakī had written a commentary on the *Zīj-i Uluġ Bīg* entitled *Mafātīḥ al-munajjimīn* as well as a commentary on Ptolemy's *Almagest* entitled *Takmila-yi majisṭī*.[18] One of Daštakī's other students, Muḥammad Muṣliḥ al-Dīn Lārī, had dedicated a commentary on

University of California Press, 2020), 47) seems to consider it a solved case but others such as Muzaffar Alam (*The Mughals and the Sufis: Islam and Political Imagination in India, 1500–1750* (Albany: State University of New York Press, 2021), 223, note 17) are less decided. None of the Persian and Urdu sources I have been able to consult mention the *Yogavāsiṣṭha* in relation to Niẓām al-Dīn Pānīpatī.

16 Ali Anooshahr, "Šīrāzī Scholars and the Political Culture of the Sixteenth-Century Indo-Persian World," *The Indian Economic and Social History Review* 51, no. 3 (2009): 331–52.

17 ʿAlī ʿĀdil Šāh I was known for his deep interest in Indian occult sciences. It is particularly evident in his *Nujūm al-ʿulūm* (1570), a massive Persian treatise describing various Indian occult theories (Emma Flatt, *The Courts of the Deccan Sultanates: Living Well in the Persian Cosmopolis* (Cambridge: Cambridge University Press, 2019), 210–267).

18 Boris Abramovich Rosenfeld and İhsanoğlu Ekmeleddin, *Mathematicians, Astronomers, and Other Scholars of Islamic Civilization and Their Works (7th–19th c.)* (Istanbul: Research Center for Islamic History, Arts and Culture, 2003), 322, no. 963.

ʿAlī Qūšjī's *Risāla fī ʿilm al-hayʾa* to Humāyūn (*c.*1530) before leaving for the Ottoman court.[19] Continuing the legacy of Šīrāzī astronomers, Fatḥ Allāh Šīrāzī was responsible for setting up the Ilāhī calendar, celebrating a brand new era starting with Akbar's reign. This precedent set by his former teacher was probably not lost on Mullā Farīd when the latter was commissioned to design a new calendar for Šāh Jahān, called the "Ilāhī calendar of Šāh Jahān." Fatḥ Allāh was particularly renowned at the Mughal court as being well versed in occult sciences. Amongst his duties as court astronomer, Fatḥ Allāh was casting horoscopes for emperor Akbar[20] and was instructed to supervise a partial translation into Sanskrit of the *Zīj-i Uluġ Bīg* for the imperial library with the help of Abū l-Fażl and several Sanskrit scholars, Kišan Jūšī, Gangādhar and Mahīs Mahānand.[21] This work may have been a model for the later commission to Nityānanda of a Sanskrit translation of Mullā Farīd's *Zīj-i Šāh Jahānī*.[22]

19 MS Vienna, Österreichische Nationalbibliothek, MS mixt. 169; Anooshahr, "Šīrāzī Scholars," 345–6; Ali Anooshahr, "Science at the Court of the Cosmocrat: Mughal India, 1531–56," *The Indian Economic and Social History Review* 54, no. 3 (2017): 305–9; one manuscript is available at the Khuda Bakhsh Library in Patna (MS 1041); the Vienna manuscript can be viewed online at https://digital.onb.ac.at/RepViewer/viewer.faces?doc=DTL_3326613&order=1&view=SINGLE.

20 Orthmann, "Circular Motions," 104, 110.

21 "Kišan Jūšī, Gangādhar and Mahīs Mahānand translated a part from the *'Zīj-i jadīd-i Mīrzā'ī'* from Persian to Hindi with the supervision of Amīr Fatḥ Allāh Šīrāzī and the interpretation (*tarjumānī*) of the writer of this fortunate work [Abū l-Fażl]." *laḫtī-yi zīj-i jadīd-i mīrzā'ī rā ba dīdavarī-yi amīr fatḥ allāh šīrāzī u tarjumānī-yi rāqim-i iqbāl-nāma kišan jūšī gangādhar mahīs mahānand az hindī ba fārsī* [sic] *āvardand* (Abū l-Fażl, *Āʾīn-i Akbarī*, ed. Blochmann (Calcutta: Baptist Mission Press, 1872–7), vol. 1, 115). Although the manuscripts and edited text contain the reading "from Hindi to Persian" (*az hindī ba fārsī*), it must probably be replaced with the more plausible "from Persian to Hindi" (*az fārsī ba hindī*) as in the Japanese translation (Ayako Ninomiya, et al., "アブル・ファズル著『アーイーニ・アクバリー』訳注 (9)" [Translation of Abū l-Fażl's *Āʾīn-i akbarī*]. 神戸大学文学部紀要 [Bulletin of the Faculty of Letters, Kobe University] 48 (2021): 113–4. It is not clear how many Sanskrit scholars are here mentioned. One of them is identified by S.R. Sarma ("Jyotiṣarāja at the Mughal court," in *Studies on Indian Culture, Science, and Literature: Being Prof. K.V. Sarma Felicitation Volume Presented to Him on His 81st Birthday*, ed. Natesa Gangadharan, Krishna V. Sarma, S.A.S. Sarma, and S.S.R. Sarma (Chennai: Sree Sarada Education Society Research Centre, 2000), 367) as a scholar named Kṛṣṇa Daivajña who served Akbar and Jahāngīr and wrote a commentary on Śrīpati's *Jātakapaddhati*, which included a horoscope of ʿAbd al-Raḥīm Ḫān-i Ḫānān (see below).

22 This translation of the *Zīj-i Uluġ Bīg* doesn't seem to be extant. A Sanskrit translation of the *Zīj-i Uluġ Bīg* tables is kept in Jaipur but seems significantly more recent (c. late eighteenth century) (Anuj Misra, personal communication; MS Jaipur, Maharaja Man Singh II Museum, no. Museum 45; David Pingree, *A Descriptive Catalogue of the Sanskrit Astronomical Manuscripts Preserved at the Maharaja Man Singh II Museum in Jaipur, India* (Philadelphia: American Philosophical Society, 2003), 135). Jean Arzoumanov, and Anuj

Mullā Farīd's first known patron was ʿAbd al-Raḥīm Ḫān-i Ḫānān, one of the most important statesmen and patrons of his age. A prolific poet in Hindavi himself, ʿAbd al-Raḥīm Ḫān-i Ḫānān sponsored many Hindavi- and Persian-speaking literati in his multilingual court.[23] He was evidently extremely interested in both Islamicate and Indic astronomy, and his fondness for Mullā Farīd probably reflects the high value he placed in astronomical knowledge and astrological prognostication. He himself is credited with a treatise in Sanskrit on Islamicate astronomy, entitled *Kheṭakautuka*, which contains numerous Arabic and Persian words transcribed in Sanskrit.[24] His Sanskrit horoscope was also reproduced in a contemporary astrological treatise by Kṛṣṇa Daivajña.[25]

Mullā Farīd's second patron, Āṣaf Ḫān Abū l-Ḥasan (1569–1641), was, besides being a powerful statesman, a versatile scholar. Coming from an Iranian family, Āṣaf Ḫān was the father in law of Šāh Jahān.[26] During the last years of Jahāngīr's reign, he had been named *vakīl* (deputy), the highest ministerial rank available at the Mughal court. Upon Jahāngīr's death, Āṣaf Ḫān played a decisive role

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Misra, "Calendars, Compliments, and Computations: A Comparative Survey of the Canon in the Persian *Zīj* of Šāh Jahān and in its Sanskrit Translation, the *Siddhāntasindhu*," *History of Science in South Asia* (forthcoming) contains a comparative survey of Mullā Farīd's *Zīj-i Šāh Jahānī* and its translation by Nityānanda, entitled *Siddhāntasindhu*; see also Anuj Misra, "Persian Astronomy in Sanskrit: A Comparative Study of Mullā Farīd's *Zīj-i Shāh Jahānī* and its Sanskrit Translation in Nityānanda's *Siddhāntasindhu*," *History of Science in South Asia* 9 (2021): 30–127.

23 Corinne Lefèvre, "The Court of ʿAbd-ur-Raḥīm Khān-i Khānān as a Bridge Between Iranian and Indian Cultural Traditions," in *Culture and Circulation: Literature in Motion in Early Modern India*, ed. Thomas de Bruijn and Allison Busch (Leiden: Brill, 2014); ʿAbd al-Raḥīm Ḫān-i Ḫānān was also sponsoring Sanskrit scholars such as Rudrakavi, who dedicated to him the *Khānakhānācarita* (1609), a text praising the amīr. On this text, see Audrey Truschke, "Regional Perceptions: Writing to the Mughal Court in Sanskrit," in *Cosmopolitismes en Asie du Sud. Sources, itinéraires, langues* (*XVI^e–XVIII^e siècle*), ed. Corinne Lefèvre, Ines Županov, and Jorge Flores, (Paris: Editions de l'EHESS, 2015), 259–63; Audrey Truschke also addresses the thorny question of how Sanskrit encomia could have been received by Muslim patrons who had only a very limited knowledge of the language.

24 David Pingree, *Census of the Exact Sciences in Sanskrit: Series 1, Volume 2* (Philadelphia: American Philosophical Society, 1971), 79–80; see edition and translation: ʿAbd al-Raḥīm Ḫān-i Ḫānān, *Star-lore; Being an Account of the Disposition of the Planets of the 12 Houses of the Horoscopes*, ed. and transl. S.D. Udhrain (Delhi: Sagar Publications, 1973).

25 *Jātakapaddhatyudāharaṇa*.

26 Corinne Lefèvre, "Āṣaf Khān," in *Encyclopaedia of Islam, THREE*, ed. by Kate Fleet, Gudrun Krämer, Denis Matringe, John Nawas, Everett Rowson (Leiden: Brill, 2008); his biography is given at length in Šāhnavāz Ḫān, *Maʾāṯir al-umarā*, transl. H. Beveridge and rev. Baini Prashad (Calcutta: Asiatic Society of Bengal, 1941–52), vol. 1, pp. 387–95.

in facilitating Šāh Jahān's smooth accession to the throne and was generously rewarded by the new emperor. Besides his political clout, Āṣaf Ḫān was also famed for his extensive scholarship and received the sonorous title "Kindler of the flame of the character of the Illuminationists, Learner of the temperament of the Peripatetics."[27] To honor Āṣaf Ḫān, the Kashmiri ruler Mukunda Ray commissioned the scholar and court poet Jagannātha Paṇḍitarāja (d. *c.*1670) to write the Sanskrit *Āsaphavilāsa* (*c.*1628–41), a text praising Šāh Jahān's visit to Kashmir in the company of Āṣaf Ḫān.[28] The famous Iranian philosopher and alchemist Mīr Findiriskī visited India at the invitation of Āṣaf Ḫān and was granted audiences with Šāh Jahān in 1037/1627 and 1046/1636.[29] From this voyage, Mīr Findiriskī brought back Niẓām Pānīpatī's translation of the *Laghuyogavāsiṣṭha* on which he wrote a marginal commentary and which became a popular text on Indic philosophy in Iran. It is tempting to imagine an encounter between the famed and aging astronomer and the philosopher.

Despite being less well-known compared to his brother Mullā Farīd, Mullā Ṭayyib was also an esteemed scholar with interests ranging from Islamicate astronomy to Indic prognostication.[30] The most detailed account on Mullā Ṭayyib is also found in the *Maʾāṯir-i Raḥīmī*.[31] It credits "Šayḫ Ṭayyib" with the *Navādir al-iḫtiyārāt*, a work dedicated to ʿAbd al-Raḥīm Ḫān-i Ḫānān. According to the same account, Mullā Ṭayyib also constructed an astrolabe for this same patron, for which he was rewarded with the weight of the instrument in pure gold.

Besides the two *zījes* described below, jointly written with his brother, only two of his works are now extant. The *Risāla dar ḥall-i taqvīm* composed during the reign of Akbar is a short compendium on almanacs and was commissioned

27 *šuʿla-afrūz-i fiṭrat-i išrāqīyān dāniš-āmūz-i ṭabʿīyat-i maššāʾīyān* (Šāhnavāz Ḫān, *Maʾāṯir al-umarā*, ed. ʿAbd al-Raḥīm and Mīrzā Ašraf ʿAlī (Calcutta: Asiatic Society of Bengal, 1888–91), vol. 1, 158).

28 Jatindrabimal Chauduri, *Muslim Patronage of Sanskritic Learning: Part 1* (Calcutta: Prācyavāṇi, 1954), 46–71; Truschke, "Regional Perceptions," 263–6; for the original text and the translation of the *Āsaphavilāsa*, see pp. 112–5; on Jagannātha Paṇḍitarāja, see also Sheldon Pollock, "Sanskrit Literary Culture from the Inside Out," in *Literary Cultures in History: Reconstructions from South Asia*, ed. Sheldon Pollock (Berkeley: University of California Press, 2003), 96–9. During his long career in the service of Mughal grandees, Jagannātha Paṇḍitarāja also worked with prince Dārā Šikōh.

29 Heike Franke, "Die persischen Übersetzungen des *Laghuyogavāsiṣṭha*," in *The Mokṣopāya, Yogavāsiṣṭha and Related Texts*, ed. Jürgen Hanneder (Aachen: Shaker Verlag, 2005), 121.

30 In his three extant works, he calls himself "Ṭayyib Ibrāhīm Dihlavī".

31 Nahāvandī, *Maʾāṯir-i Raḥīmī*, vol. 3, 62–3; his name is misspelt *ṭabīb*; this account is summarized in the *Nuzhat al-ḫawāṭir* (al-Ḥasanī, *Nuzhat al-ḫawāṭir*, 548).

by ʿAbd al-Raḥīm Ḫān-i Ḫānān.[32] Mullā Ṭayyib's objective in this *risāla* is to update the information on almanacs (*taqvīm*) found in earlier treatises. Without mentioning its source, he largely quotes from Niẓām al-Dīn ʿAbd al-ʿAlī Bīrjandī's (d. 934/1527–8) much longer *Bīst bāb dar maʿrifat-i taqvīm*. Among the new materials included, Mullā Ṭayyib describes the Ilāhī calendar, introduced by Akbar. His other work, the *Muntaḫab-i ratan mālā*, is a compendium on Indic catarchic astrology (*muhūrtaśāstra*; see below) also dedicated to ʿAbd al-Raḥīm Ḫān-i Ḫānān. It is described by its author as a "selection" (*intiḫāb*) of "trusted Indian books" (*kutub-i muʿtabara-yi hind*) such as the "*Ratan mālā*" (from Sanskrit *ratnamālā*, "garland of jewels") and several unnamed texts.[33] The title refers to the popular Sanskrit astrological text *Jyotiṣaratnamālā* attributed to Śrīpatibhaṭṭa (11th century). The *Muntaḫab-i ratan mālā* is intended as a practical guide to help in electing (*iḫtiyār*) the auspicious times for a wide range of actions. Notably, the third chapter offers a description of the most auspicious hours for accomplishing a number of actions which are listed following the order of the letters contained in ʿAbd al-Raḥīm Ḫān-i Ḫānān's complete title (*navāb ḫān-i ḫānān mīrzā ḫān bahādur sipah-sālār*).

Scholars have long noted the particular importance of astrology at the Mughal court, where emperors surrounded themselves with astronomer-astrologers.[34] Emperors would have horoscopes cast for their sons[35] and astrologers were pictured in miniatures standing close to the birth-chamber.[36] Astronomers

32 Two manuscripts are kept in Rampur Reza Library: MS 1217 and MS 1221 (Anonymous, *Fihrist-i nusḫahā-yi ḫaṭṭī-yi kitābḫāna-yi riżā - rāmpūr. Jild-i avval* (Rampur: Rampur Reza Library, 1996), 339, 344).

33 One complete manuscript is kept at the Rampur Reza Library: MS 1649 (Anonymous, *Fihrist*, 488); an incomplete manuscript is kept in Aligarh: Maulana Azad Library, Aligarh Muslim University, no. Abdus Salam 478/33.

34 Eva Orthmann, "Ideology and State-Building: Humāyūn's Search for Legitimacy in a Hindu-Muslim Environment," in *Religious Interactions in Mughal India*, ed. Vasudha Dalmia and Munis D. Faruqui (New Delhi: Oxford University Press, 2014), 3–29; Orthmann, "The Occult Sciences"; Moin, *The Millenial Sovereign*, chapter 4; Anooshahr, "Science at the Court of the Cosmocrat"; Stephan Popp, "Mughal Horoscopes as Propaganda," *Journal of Persianate Studies* 9 (2016): 45–59; see Tunç Şen and Fleischer, "Books on Astrology" for a fascinating study of the practice of casting horoscopes and drawing almanacs at the Ottoman court between 1470 and 1510.

35 The tables used to cast horoscopes are unfortunately rarely extant. One exception is a horoscope made on the occasion of the future emperor Šāh Jahān's birth by Fatḥ Allāh b. ʿAbd al-Raḥmān al-Zubayrī al-Burūjī (MS London, British Library, Lansdown 1245; Charles Rieu, *Catalogue of the Persian manuscripts in the British Museum*. London: British Museum, 1879–83, vol. 2, 791).

36 One painting kept at the Chester Beatty Library (Dublin) of the episode of the prince Salīm's birth in the *Akbar-nāma* shows a Muslim astrologer holding an astrolabe (accession number: In 03.143; viewable on https://viewer.cbl.ie/viewer/image/In_03_143/1/LOG_0000/);

also helped determining the auspicious day and hour for enthronments as in the case of Jahāngīr.[37] Indian astrologers regularly cast horoscopes in the Indic art of *jyotiṣa* and offered their advice to emperors on important matters.[38] The birth-horoscope (*janmapatrī*) cast by Viśvanātha, son of Divākara, for prince Ḫurram, the future Šāh Jahān, is still extant.[39] Šāh Jahān's interest in astronomy was apparent from an astrolabe dedicated to him, recently described by S.R. Sarma.[40] Occult sciences more generally held particular significance for Mughal emperors and princes.[41] Muḥammad Ġawṯ, in whose lodge Mullā Farīd's master, Niẓām al-Dīn, resided in his early years, was greatly esteemed by emperor Humāyūn and noted for his expertise on occult subjects, in particular lettrism.[42] Like Muḥammad Ġawṯ and his other mentor Fatḥ Allāh Šīrāzī, Mullā Farīd was a dedicated lettrist as is testified by his royal and princely chronograms. More significantly, the prologue of his masterpiece *Zīj-i Šāh Jahānī* is permeated with Pythagorean and lettrist ideas.[43] Occult sciences, often overlooked by scholars, were indeed central to the Islamicate cosmological vision and formed a substantial part of scientific activity in early modern Persianate societies.[44] Matthew Melvin-Koushki has recently offered groundbreaking

another painting maybe by Bishandas of the same episode kept at the Museum of Fine Art, Boston shows a Muslim astrologer holding an astrolabe alongside a Sanskrit astrologer probably composing a horoscope (accession number: 14.657; viewable on https://collections.mfa.org/objects/148503/birth-of-prince-salim). See also Orthmann, "Circular Motions," 102.

37 Ḫwāja Kāmgar Ḥusaynī, *Maʾāṯir-i Jahāngīrī*, ed. ʿAḏrā ʿAlavī (Aligarh: Asia Publishing House, 1978), 62.

38 Sarma, "Jyotiṣarāja at the Mughal court"; Christopher Minkowski, "Learned Brahmins and the Mughal Court: The Jyotiṣas," in *Religious Interactions in Mughal India*, ed. Vasudha Dalmia and Munis D. Faruqui (New Delhi: Oxford University Press, 2014), 102–34.

39 Anonymous, *A Descriptive Catalogue of Sanskrit Manuscripts, Acquired and Deposited in the Sanskrit University Library* (*Sarasvati Bhavana*)*, volume IX: jyautiṣa MSS*. (Benares: Dept. of Publications, Sanskrit University, 1963), vol. 9, 260–1. no. 37080; the manuscript is dated from 1887.

40 Sreeramula Rajeswara Sarma, "A Monumental Astrolabe Made for Shāh Jahān and Later Reworked with Sanskrit Legends," *Medieval Encounters* 23 (2017): 198–262.

41 On Šāh Jahān's firstborn son Dārā Šikōh's engagement with occult practices, see Supriya Gandhi, *The emperor Who Never Was: Dara Shukoh in Mughal India* (Cambridge, Mass., London: The Belknap Press of Harvard University Press 2020).

42 See Orthmann, "The Occult Sciences" for a partial translation of Muḥammad Ġawṯ's lettrist interpretation of the names of Allāh.

43 Matthew Melvin-Koushki has a forthcoming article contextualizing this aspect of the *Zīj-i Šāh Jahānī* (personal communication).

44 On the influence of Qazwīnī's *Wonders and Rarities* on Islamicate culture and its study of the cosmos interlacing nature and magic, see Travis Zadeh, *Wonders and Rarities:*

explorations into the vast Persian occult-scientific literature, such as that of the Timurid scientist Ibn Turka (d. 835/1431–2).[45]

In India, as in other parts of the Islamicate world, astronomical works composed in Samarqand were held in great esteem, and Mullā Farīd's astronomical works contain extensive citations from Uluġ Bīg's *zīj*. Besides the many copies of the *Zīj-i Uluġ Bīg* itself which are kept in Indian manuscript collections, several commentaries on this text were circulating in India[46] and a few others were composed on Indian soil. Mullā Čānd, astronomer of Humāyūn and later Akbar, wrote a simplified version (*tashīl*) of the *Zīj-i Uluġ Bīg*.[47] In this work, Mullā Čānd inserted a few more explanatory sections and revised several tables to take into account the time elapsed since the compilation of the original. A few decades later, ʿAbd al-Raḥīm b. Ṣāliḥ Muḥammad dedicated a commentary on the *Zīj-i Uluġ Bīg* to Šāh Jahān.[48]

As can be expected, Islamicate *zījes* were part of the holdings of the Mughal Imperial libraries. A front page from a copy of the *Zīj-i Īlḫānī* bears the seals of several Mughal royal librarians from between the reigns of Akbar and Awrangzīb. Remarkably, it bears the seal of the librarian of Šāh Jahān's library, ʿInāyat Ḫān, author of an abridged history of his reign.[49] A manuscript copy of the *Zīj-i Uluġ Bīg* kept in Paris is also reported to originate from the imperial library.[50] These two famous observational *zījes*, the *Zīj-i Īlḫānī* and the *Zīj-i Uluġ Bīg*, provided astrologers with the astronomical data they needed to cast

The Marvelous Book That Traveled the World and Mapped the Cosmos (Cambridge, MA: Harvard University Press, 2023).

45 Matthew Melvin-Koushki, "Being with a Capital *B*: Ibn Turka on Ibn ʿArabī's Lettrist Cosmogony," in *Islamic Thought and the Art of Translation: Texts and Studies in Honor of William C. Chittick and Sachiko Murata*, ed. Mohammed Rustom (Leiden: Brill, 2022), 150–77.

46 Ansari, "Survey," 293; Ansari also gives a very instructive survey of the Islamicate scientific works found in manuscript form in Indian and Pakistani libraries.

47 Ansari, "Survey," 582: "A unique copy of this simplified Zīj is extant in the CPM (Jaipur), MS (Arabic and Persian) No. 6. The manuscript bears the seal of one ʿAbd al-Khāliq ("a slave of Shāh Jahān"), dated AH 1038/A.D. 1628–29." Mullā Čānd is also known to have prepared horoscopes for Akbar and Jahāngīr.

48 ʿAbd al-Raḥīm b. Ṣāliḥ Muḥammad, *Šarḥ-i Zīj-i Uluġ Bīgī*, MS Lucknow, Jamia Sultaniya Library, MS no. unknown, foll. 1v–22v; his three other extant works were dedicated to Ḫalīl Allāh Ibrāhīm ʿĀdil Šāh of Bijapur (D.N. Marshall, *Mughals in India: A Bibliographical Survey, Vol. 1—Manuscripts* (Bombay: Asia Publishing House 1967), 21).

49 https://www.christies.com/en/lot/lot-2034406; the present whereabouts of this manuscript are unknown.

50 Paris, Bibliothèque nationale de France, MS Supp. persan 366; see John Seyller, "The Inspection and Valuation of Manuscripts in the Imperial Mughal Library," *Artibus Asiae* 57, no. 3–4 (1997): 319; Francis Richard, *Catalogue des manuscrits persans, Bibliothèque nationale de France, Département des manuscrits. Tome II: Supplément persan. Première partie,*

their horoscopes. Among the horoscopes cast for Akbar that were transcribed by Abū l-Faẓl, Mullā Čānd's horoscope was, unsurprisingly, based on the *Zīj-i Uluġ Bīg*. Whereas other astrologers, such as Mawlānā Ilyās al-Ardabīlī, still drew their data from the much older *Zīj-i Īlḫānī*.[51]

All of Mullā Farīd's extant works deal with astronomy and astrology: the *Sirāj al-istiḫrāj*, the *Zīj-i Raḥīmī*, the *Zīj-i Šāh Jahānī* and two horoscopes. Mainly known for his scientific output, Mullā Farīd was also noted for his piety[52] and wrote a commentary (*šarḥ*) on the Quranic sura *al-tīn* (Quran 95).[53] The *Maʾāṯir-i Raḥīmī* also reproduces a short verse composition by him containing in chronograms the dates of birth, enthronement and death of Timurid kings from Tīmūr to Jahāngīr.[54] Besides his merits as a mathematician and astronomer, Mullā Farīd was an expert lettrist indeed and never lost an occasion to ingratiate himself with kings and princes with his witty chronograms, a practice highly appreciated in the Persianate courts of the time. His verse chronogram composed for the date of Jahangir's enthronement was deemed particularly brilliant by ʿAbd al-Raḥīm Ḫān-i Ḫānān, who reproduces it in the *Maʾāṯir-i Raḥīmī* with several other chronograms composed in Safavid Iran. The *Maʾāṯir-i Raḥīmī* also records chronograms that Mullā Farīd created for ʿAbd al-Raḥīm Ḫān-i Ḫānān and his sons.[55] This same chronicle transcribes the prologue of a lost composition on lettrism (*jafr*) entitled *Ẓill-i lawḥ-i maḥfūẓ*.[56]

Mullā Farīd's first known astronomical work, the *Sirāj al-istiḫrāj*, was composed in 1006/1597–8,[57] possibly in Lahore.[58] Despite profuse praise,

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1–524; Deuxième partie, 525–1000 (Rome: Istituto per l'Oriente C.A. Nallino, 2013), vol. 1, 501–3.

51 Orthmann, "Circular Motions," 104; According to A. Tunç Şen and Cornell H. Fleischer ("Books on Astrology, Astronomical Tables, and Almanacs in the Library Inventory of Bayezid II," in *Treasures of Knowledge: An Inventory of the Ottoman Palace Library (1502/3–1503/4). Volume 1: Essays*, ed. Gülru Necipoğlu, Cemal Kafadar and Cornell H. Fleischer. Leiden: Brill, 2019, 773) the *zīj* most used to cast horoscopes at the Ottoman court between 1570–1610 was Wābkanawī's *Zīj al-muḥaqqaq*; only second came the *Zīj-i Uluġ Bīg* and the *Zīj-i Īlḫānī*.

52 Nahāvandī, *Maʾāṯir-i Raḥīmī*, vol. 3, 15.

53 Hamadānī, *Ṭabaqāt-i Šāh Jahānī*, 47.

54 Nahāvandī, *Maʾāṯir-i Raḥīmī*, vol. 3, 11–14.

55 Nahāvandī, *Maʾāṯir-i Raḥīmī*, vol. 3, 16–7.

56 Nahāvandī, *Maʾāṯir-i Raḥīmī*, vol. 3, 12–3.

57 The year of composition can be obtained by adding the abjad values of the dotted letters in the title *Sirāj al-istiḫrāj* (ج ت خ ج).

58 Mullā Farīd gives in two instances precise planetary coordinates for Lahore: Mullā Farīd, *Sirāj al-istiḫrāj*. MS London, British Library, 10 Islamic 476, foll. 127r, 132r. Mullā Farīd could also be giving the information for Lahore because of its status as the imperial capital at the time.

the dedicatee is not named explicitly, but it might very well have been ʿAbd al-Raḥīm Ḫān-i Ḫānān who became Mullā Farīd's patron in exactly the same year. This short treatise became a popular introduction to astronomy as the number of manuscripts and later citations show.[59] Some of the material in the *Sirāj al-istiḫrāj* was reused in the introductions (*muqaddima*) of Mullā Farīd's two *zījes*, the *Zīj-i Raḥīmī* and the *Zīj-i Šāh Jahānī*. The *Sirāj al-istiḫrāj* contains detailed calculations and advice on how to construct an almanac. According to the prologue, the objective of the treatise is to help "the derivation of the true positions of planets and such" (*istiḫrāj-i taqāvīm-i kavākib u ġayruh*) in a detailed and clear fashion with "examples" (*miṯāl*) for every calculation. Indeed, the *Sirāj al-istiḫrāj* was clearly aimed at providing its readers with practical clues to rapidly compute mean and true positions of planets or to predict specific astronomical events (Moon phases, conjunctions, eclipses, etc.), information that were necessary to draw a horoscope or compose an almanac for a given year. Interestingly, besides the dates in the Hijri calendar, it also contains a few dates in the Ilāhī calendar instituted by Akbar, which shows that it was in use by astronomers.

In the first section (*qism*) of the introduction, Mullā Farīd gives general definitions of *zījes*, almanacs (*taqvīm*) and observation (*raṣad*) and explains their

59 At least eleven copies are described in manuscript catalogues: Cambridge, King's College Library, MS King's Pote 223 (Edward Granville Browne, *A Supplementary Handlist of the Muhammadan Manuscripts, Including All Those Written in the Arabic Character, Preserved in the Libraries of the University and Colleges of Cambridge* (Cambridge: Cambridge University Press, 1922), 306); Hyderabad, Telangana Government Oriental Manuscripts Library and Research Institute (ex-Āṣafīya), MS riyāżī 198 (Rosenfeld and İhsanoğlu, *Mathematicians*, 358); Hyderabad, Osmania University Library, MS 1172 (Rosenfeld and İhsanoğlu, *Mathematicians*, 358); Lahore, Punjab University Library, MS Ph III 83/2004 (ʿĀrif Nawšāhī, *Fihrist-i nusḫahā-yi ḫaṭṭī-yi fārsī-yi kitābḫāna-yi markazī-yi dānišgāh-i panjāb, lāhūr* (*pākistān*) (*majmūʿahā-yi āzād, pīrzāda, šīrānī, kayfī va ʿumūmī*) (Tehran: Markaz-i pižūhišī-yi mīrāṯ-i maktūb, 1390/2011–2), vol. 1, 669); London, British Library, MS IO Isl. 476, foll. 118r–149r (Hermann Ethé, *Catalogue of Persian Manuscripts in the Library of the India Office* (Oxford: Printed for the India Office by H. Hart), 1903–37, vol. 1, 1230); Mosul, private collection of Dr Dāwud al-Jalbī (Sālimʿ Abd al-Razzāq Aḥmad, *Fihris maḫṭūṭāt maktab al-awqāf al-ʿāmma fī l-mawṣil* (Mosul: Maṭābiʿ jāmiʿat al-mawṣil, 1983), vol. 6, p. 232); Oxford, Bodleian Library, MS Fraser 180 (Eduard Sachau and Hermann Ethé, *Catalogue of the Persian, Turkish, Hindûstânî, and Pushtû Manuscripts in the Bodleian Library* (Oxford: Clarendon Press, 1889–1930), vol. 1, 941); Saint Petersburg, National Library of Russia, MS PNS 512/3 (Rosenfeld and İhsanoğlu, *Mathematicians*, 358); Tashkent, Academy of Sciences of Uzbekistan, MS 6413 (A.A. Semenov, ed., *Sobranie vostochnykh rukopisei Akademii Nauk Uzbekskoi SSR* (Tashkent: Akademiia Nauk, 1952–87), vol. 9, 255); two Iranian manuscripts are also described in Farīd Qāsimlū and Farībā Pāyravand Ṯābit, eds., *Fihristvāra-yi muštarak-i nusḫahā-yi ḫaṭṭī-yi riyāżī dar kitābḫānahā-yi īrān* (Tehran: Dānišgāh-i āzād-i islāmī, 1387/2008–2009), 643.

utility. He includes an interesting etymology of the word *zīj*. In this section, Mullā Farīd specifies that he is quoting from the *Zīj-i muḥaqqaq-i Sulṭānī*, which is a well-known *zīj* by Šams al-Munaǰǰim Muḥammad Wābkanawī (fl. early fourteenth century) and is one of the only two extant *zījes* based on the observations carried out at the Maragha observatory.[60] A comparison between the two texts makes it plain that this entire section is taken verbatim from Wābkanawī's *zīj*.[61] These preliminary definitions from Wābkanawī were reused by Mullā Farīd in later astronomical works, the *Zīj-i Raḥīmī* and the *Zīj-i Šāh Jahānī*. It is worth noting Wābkanawī's definitions seem to have also inspired other Indian authors such as Maḥmūd Šāh Ḫaljī (878/1473–4) in his *Zīj-i jāmiʿ* and Abū l-Fażl in his *Āʾīn-i Akbarī*.[62] Other influences are noticeable in the *Sirāj al-istiḫrāj*. For example, the third and fourth *qisms* of the introduction, on the method of interpolation between two lines in a table and on time divisions, draw extensively from the *Zīj-i Uluġ Bīg* but add new information such as the division of time in Indic astronomy.[63]

The popularity of the *Sirāj al-istiḫrāj* must have stemmed from its clear language and abundance of examples. The *Kaššāf iṣṭilāḥāt al-funūn wa-l-ʿulūm* (1158/1745–6), an important Arabic dictionary of technical terms written by the Indian lexicographer Muḥammad Aʿlà Tahānawī, quotes six definitions of astronomical and mathematical terms from the *Sirāj al-istiḫrāj*.[64] The definition of *zīj* was also quoted by the Indian lexicographer Muḥammad Ġiyāṯ al-Dīn Rāmpūrī in his *Ġiyāṯ al-luġāt*.[65] More surprisingly, Mullā Farīd's description of

60 Benno van Dalen, "Wābkanawī: Shams al-Munaǰǰim [Shams al-Dīn] Muḥammad ibn ʿAlī Khwāja al-Wābkanawī [Wābkanawī]," in *The Biographical Encyclopedia of Astronomers*, ed. Thomas Hockey et al. (New York: Springer, 2007), 1187–8.

61 Mullā Farīd, *Sirāj al-istiḫrāj*, foll. 119v–120r = Šams al-Munaǰǰim Muḥammad Wābkanawī, *Zīj-i muḥaqqaq-i Sulṭānī*, MS Tehran, Majlis Library, no. 6435, pp. 13–14; MS Istanbul, Süleymaniye Kütüphanesi, Ayasofya 2689, foll. 9v–10r (*maqāla* 1, *bāb* 1, *dar bayān-i ānki raṣad u zīj u taqvīm či bāšad u dar dānistan-i īnhā či fāyida buvad*)

62 Maḥmūd Šāh Ḫaljī, *Zīj-i jāmiʿ*, MS Oxford, Bodleian Library, Greaves 6, foll. 3rv; it is quite evident for the definitions of *raṣad* (observation), *taqvīm* (almanac) and *zīj*; see also the Persian text and Latin translation in John Greaves, *Astronomica quaedam ex traditione Shah Cholgii persae: una cum hypothesibus planetarum* (London: J. Flesher, 1652), 1–4. The definitions of *raṣad* and *zīj* in the *Āʾīn-i Akbarī* are less recognizable and were probably enhanced in Abū l-Fażl's typical florid and complex style (*Āʾīn-i Akbarī*, vol. 1 part 2, pp. 265–6).

63 Mullā Farīd, *Sirāj al-istiḫrāj*, foll. 121v–122r.

64 These are the definitions of *raṣad*, *zīj*, *sāʿa*, *taʿdīl*, *taqvīm*, and *buht* (Muḥammad Aʿlà Tahānawī, *Kitāb Kaššāf iṣṭilāḥāt al-funūn wa-l-ʿulūm*, ed. Muḥammad Wajīh, ʿAbd al-Ḥaqq, and Ġulām Qādir (Calcutta: Asiatic Society of Bengal, 1862), pp. 551, 610, 676, 1023, 1226, 1553) (= Mullā Farīd, *Sirāj al-istiḫrāj*, fol. 121r).

65 Ġiyāṯ al-Dīn Rāmpūrī, *Ġiyāṯ al-luġāt*, ed. Muḥammad Dabīr Siyāqī (Tehran: Kānūn-i maʿrifat, 1337/1958–9), vol. 1, 516.

the division of the nychthemeron into sixty parts by Indian astronomers[66] was used in the first modern Arabic encyclopedia published by Buṭrus al-Bustānī in 1875 in Beirut.[67]

Mullā Farīd's first *zīj*, the *Zīj-i Raḥīmī* is a Persian computational *zīj* based on the *Zīj-i jadīd-i Sulṭānī* by Uluġ Bīg.[68] Only one copy is extant in the Marʿašī Najafī library in Mashhad (Iran).[69] The material of the *Zīj-i Raḥīmī* is predominantly inspired by the *Zīj-i Uluġ Bīg*, the text and structure of which it most often reproduces verbatim. However, the introductory section (*muqaddima*) and a few other chapters are additions.[70] Most of this additional material also features in the *Zīj-i Šāh Jahānī* but sometimes in a revised form. Ansari has remarked that the *Zīj-i Raḥīmī* contains new tables in comparison to the *Zīj-i Uluġ Bīg*: "A large number of tables have been added in order to simplify (*tashīl*) the calculation of ephemerides (*taqwīm*) of Sun, Moon, and Saturn. In fact, the author has clearly explained two methods for the calculation, by not using or using Tashīl; in the latter case the interpolation between the entries of a table are not required (ff. 113b, 114a)."[71]

The authorship and chronology of the *Zīj-i Raḥīmī* are difficult to disentangle. If Mullā Farīd is clearly the main author of this *zīj*, his brother Mullā Ṭayyib seems to have had a hand in giving it its final form. Furthermore, there were probably several states of redaction spanning more than a decade, and the Mashhad manuscript contains the final version of the text, which is the only one available to us. According to the prologue of the text, this *zīj* was started by "Mawlānā Farīd al-Dīn Masʿūd" on the commission of the Mughal amīr ʿAbd al-Raḥīm Ḫān-i Ḫānān. Indeed, the *Maʾāṯir-i Raḥīmī* (1025/1616–7) lists a *zīj* named after ʿAbd al-Raḥīm Ḫān-i Ḫānān among Mullā Farīd's works.[72] Based on internal evidence, Ansari dates the composition of the *Zīj-i Raḥīmī* to around 1617–8: "As Mullā Farīd tabulated the equation of time (*taʿdīl al-ayyām*)

66 Mullā Farīd, *Sirāj al-istiḫrāj*, fol. 122v.

67 Buṭrus al-Bustānī, *Dāʾirat al-maʿārif* (Beirut: Maṭbaʿa al-adabiyya, 1887), 380: article on "hour" (*sāʿa*). This division of the nychthemeron into 60 units is also found in Fayżī's translation of the *Līlāvatī* (Sreeramula Rajeswara Sarma and Maryam Zamani, "On the Persian Translation of Bhāskara's *Līlāvatī* by Abu'l Faiẓ Faiẓī at the Court of Akbar," *The Indian Journal of History of Science* 43, no. 3 (2019): 275).

68 This text is briefly described by Ansari 2015.

69 Mullā Farīd, *Zīj-i Raḥīmī*, MS Mashhad, Marʿašī Najafī library, 5554; According to Ansari ("Survey," 583), this manuscript "ends abruptly on fol. 227 with the table for the first equation of Saturn, reckoned from the zodiacal sign Gemini (jawzāʾ)."

70 Arzoumanov and Misra, "Calendars, compliments, and computations."

71 Ansari, "Survey," 583.

72 *Maʾāṯir-i Raḥīmī*, vol. 3, p. 14: *zījī nīz ba ism-i īn darvīš-nihād ṣāfī-żamīr ki ġaraż-i aṣlī az taḥrīr-i īn risāla ḥālāt-i īšān ast nivišta and.*

for the Sun and Moon for the year AH1026 / AD1617 (ff. 152b, 153a), it appears that he might have been compiling the ZR around that year."[73] Still according to the prologue of the *Zīj-i Raḥīmī*, after the death of the amīr (October 1st, 1627), his daughter Jānān Bīgam ordered "Ṭayyib Ibrāhīm Dihlavī" to complete the work of his brother Mullā Farīd. Initially daunted by the enormous task, Mullā Ṭayyib explains somewhat mysteriously that his doubts were overcome by the abjad number corresponding to the title (288). He also explains that he added "introductory parts" (*muqaddimāt*) which his "dear brother" had not included in his draft (*tasvīd*).

The *Zīj-i Šāh Jahānī* is Mullā Farīd's most important composition. It ensured its author's fame as Šāh Jahān's main astronomer. Very similar to the *Zīj-i Raḥīmī*, it is also based on the *Zīj-i Uluġ Bīg*, and Ghori finds it "very much improved in comparison with Uluġ Bīg's *zīj*."[74] It has recently been surveyed alongside Nityānanda's Sanskrit translation.[75]

Three Mughal chronicles give a precious account of the composition of the *Zīj-i Šāh Jahānī*: ʿAbd al-Ḥamīd Lāhōrī's *Bādšāh-nāma*, ʿInāyat Ḫān's *Mulaḫḫaṣ-i Šāh Jahān-nāma*[76] and Kanbōh's *ʿAmal-i Ṣāliḥ*.[77] This project was initiated by the prime minister Āṣaf Ḫān and involved the participation of Mullā Ṭayyib and several unnamed astronomers. Despite these chronicles converging to date the *Zīj-i Šāh Jahānī* to the year 1039/1629–30,[78] it has been remarked that the epoch year of the tables is 1041/1631–2, which would imply a later date of completion.[79]

According to ʿAbd al-Ḥamīd Lāhōrī, the *Zīj-i Šāh Jahānī* is a "a computational *zīj* comprising the mending of the questions arising from the inspectors of observational calculations, the removal of the differences born of the passage of days since past *zījes*, the rectification of tables and of copyists' errors, the simplification of calculations and the correction of calculators' errors" (*zīj-i ḥisābī muštamil bar tadāruk-i masāyilhā-yi vāqiʿa az mubāširān-i aʿmāl-i raṣadī u rafʿ-i tafāvuthā-yi nāšiya az tamādī-yi ayyām dar zījāt-i māżiya u taṣḥīḥ-i jadāvil u ḫaṭāhā-yi nāsiḫān u tashīl-i aʿmāl u iṣlāḥ-i aġlāṭ-i muḥāsibān*).[80] In

73 Ansari, "Survey," 582.

74 Ghori, "Development of Zīj Literature," 35; see Arzoumanov, and Misra, "Calendars, Compliments, and Computations" for an overview of the similarities and differences between the *Zīj-i Šāh Jahānī*, the *Zīj-i Raḥīmī*, and the *Zīj-i Uluġ Bīg*.

75 Arzoumanov, and Misra, "Calendars, Compliments, and Computations."

76 *Bādšāh-nāma*, vol. 1, pp. 287–8; *Mulaḫḫaṣ-i Šāh Jahān-nāma*, p. 82.

77 *ʿAmal-i Ṣāliḥ*, vol. 1, pp. 361–2.

78 Lāhōrī dated it to the second regnal year of Šāh Jahān (1629) and ʿInāyat Ḫān included the description of the *zīj* in his account of the events of the month of Rabīʿ 1039 (1629).

79 Ansari, "Survey," 585, quoting the unpublished survey of Benno van Dalen (H6 (ZS X204)).

80 *Bādšāh-nāma*, pp. 286–7.

Kanbōh's simpler terms, the *Zīj-i Šāh Jahānī* aimed "at simplifying derivation and calculation" (*bā'iṯ-i suhūlat-i istiḫrāj u āsānī-yi ʿamal*).[81]

Chroniclers also mention that this *zīj* was approved by Šāh Jahān and that orders were given to translate it into Sanskrit. ʿInāyat Ḫān reports that "orders were given for Indian astronomers to translate it into the language of Hindustan with the approval of Persian astronomers" (*ḥukm šud ki nujūmīyān-i hindūstān ba istiṣvāb-i munajjimān-i furs ba zabān-i hindūstān tarjuma namāyand*).[82]

Besides the extant manuscripts, information on the reception of the *Zīj-i Šāh Jahānī* is scarce. A short passage is quoted by Muḥammad Aʿlà Tahānawī in the Arabic technical lexicon *Kaššāf iṣṭilāḥāt al-funūn wa-l-ʿulūm* in his definition of *muqawwim ʿadad* ("preceding number in a sequence").[83] In Mirzā Ḫayr Allāh's *Zīj-i Muḥammad Šāhī* composed for Sawāī Jai Singh (*c.*1735), it is mentioned as a "simplified *zīj*" (*tashīl*) next to Mullā Čānd's *tashīl*.[84] A precious late reference shows that the *Zīj-i Šāh Jahānī* was still popular with astronomers well into the nineteenth century. In a mixed astronomical manuscript dating from *c.*1862, Pandit Gawrī Šankar "Kawl" quotes from the "*Zīj-i tashīl-i Šāh Jahānī*"[85] to calculate the difference of culmination of the Sun between the Indian and the Hijrī calendars.[86] This passage gives a rare example of a precise use of an astronomical text for practical purposes, since after this short citation from the *Zīj-i Šāh Jahānī*, Gawrī Šankar "Kawl" applies Mullā Farīd's method of calculation to the current Hijrī year 1279/1862–3.

Besides his mathematical production, two extant horoscopes show Mullā Farīd's activity as a court astrologer and his reach across South Asian Islamicate courts. His first horoscope was cast on the occasion of the birth of the son of Abū l-Fatḥ Ibrāhīm ʿĀdil Šāh of Bijapur in the year 1022/1613–4.[87] Thus, like his mentor Fatḥ Allāh Šīrāzī, Mullā Farīd was also providing his services to the rulers of Bijapur. The second horoscope, transcribed in Lāhōrī's *Bādšāh-nāma*, gives the horoscope (*zā'ičа*) of the ascendant (*ṭāliʿ*) of Šāh Jahān on the date

81 *ʿAmal-i Ṣāliḥ*, vol. 1, pp. 361–2.

82 *Mulaḥḥaṣ-i Šāh Jahān-nāma*, p. 82.

83 *Kaššāf iṣṭilāḥāt al-funūn wa-l-ʿulūm*, p. 1226.

84 *Zīj-i Muḥammad Šāhī*, fol. 2r.

85 *Yāddāšthāī dar ʿilm-i hay'at*, Lahore, Punjab University Library, MS Aph III 8, pp. 103–104; Nawšāhī, vol. 1, p. 680.

86 = *Zīj-i Šāh Jahānī*, part 1, chapter 7; see transcription and translation of this passage in Jean Arzoumanov and Anuj Misra, "Calendars, Compliments, and Computations."

87 MS Berlin, Berliner Staatsbibliothek, no. Petermann II, 264, foll. 23v–sqq; Wilhelm Pertsch, *Verzeichniss der persischen Handschriften der königlichen Bibliothek zu Berlin* (Berlin: A. Asher and Co., 1888), 153.

of his enthronement.[88] It explains in much detail the auspicious omens determined by the planetary positions within the twelve zodiacal houses (*buyūt*) "in the fashion of Greek astronomers" (*ba ṭawr-i aḫtar-šināsān-i yūnānī*).

Beyond their practice of Islamicate astrology, Mullā Farīd and Mullā Ṭayyib had also first-hand experience of Indic astrological procedures, those in particular belonging to Indic catarchic astrology (*muhūrtaśāstra*). *Muhūrtaśāstra* is the science of determining propitious and unpropitious moments (*muhūrta*) for performing certain acts.[89] Śrīpati's *Jyotiṣaratnamālā* (*c.*1050), which, as noted above, was translated by Mullā Ṭayyib, was the first great Sanskrit treatise dedicated to *muhūrtas* and its layout became the model for subsequent works. Islamicate astrology also features its own tradition of catarchic astrology called *iḫtiyārāt* ("elections, choices"), which determines good (*saʿd*) and bad (*naḥs*) moments for performing a specific action. Remarkably, some elements of the science of *iḫtiyārāt* were consciously borrowed from the Indian *muhūrtaśāstra*.[90] As shown below, *karaṇas* were indeed appropriated by Muslim astrologers. *Karaṇas* belong to the *pañcāṅga* (San "five limbs"), according to which *muhūrtas* can be calculated, and which count lunar days (*tithis*), lunar mansions (*nakṣatra*), *karaṇas*, weekdays, and the angle between Sun and Moon (*yoga*). *Karaṇas* measure half a lunar day (*tithi*) each; seven are said to be "movable" and are repeated in cycles eight times across the lunar month followed by five said "fixed" *karaṇas*, which only occur at the end of the lunar month.

An intriguing dossier runs across Mullā Farīd and Mullā Ṭayyib's works, concerning the *bust* hours, an ancient system of Islamicate prognostication, which they identified with the inauspicious hours called *bhadra* belonging to Indic catarchic astrology. Despite the overwhelmingly Islamicate character of Mullā Farīd's works, the presence of a chapter on "*bust* and *bhadra*" in his *Zīj-i Šāh Jahānī* confirms his attraction to Sanskrit astrology, something which he obviously shared with his brother Mullā Ṭayyib. This interest in Sanskrit sciences was not uncommon among Indian Muslim scholars.[91] Varāhamihira's *Bṛhatsaṁhitā*, a Sanskrit encyclopedia on prognostication, had been translated

88 ʿAbd al-Ḥamīd Lāhōrī, *Bādšāh-nāma*, ed. Kabīr al-Dīn Aḥmad and ʿAbd al-Raḥīm (Calcutta: Asiatic Society of Bengal, 1867–8), vol. 1, 97–110; it is summarily described in Popp, "Mughal horoscopes," 56. Notably, Mullā Farīd's teacher Fatḥ Allāh Šīrāzī had also cast a horoscope for Akbar (Orthmann, "Circular Motions," 104).

89 David Pingree, *Jyotiḥśāstra: Astronomical and Mathematical Literature* (Wiesbaden: Otto Harrassowitz, 1981), 101–9.

90 David Pingree, "Eḵtīārāt," in *Encyclopaedia Iranica* 8:3, ed. by Ehsan Yarshater (London: Routledge and Kegan Paul, 1998), 445–48.

91 On Persian *zījes* describing Indic astronomy, see Ansari 2009, "Survey." Among them, the so-called *Zīj-i Muẓaffar Šāhī* (1525) was edited by Āftāb Aṣġar (Aṣġar 1980).

in the fourteenth century by ʿAbd al-ʿAzīz Šams-i Tahānisarī.[92] In 1587, Fayżī, Akbar's poet-laureate and Abū l-Fażl's brother supervised the translation of Bhāskāra's *Līlāvatī*.[93] ʿAṭāʾ Allāh Rašīdī, member of a prominent family of scholars, architects and engineers, translated Bhāskara's mathematical treatise *Bījagaṇita* from Sanskrit to Persian and dedicated it to Šāh Jahān.[94]

The so-called *bust* hours are described in al-Bīrūnī's famous Arabic book on India (*Kitāb mā li-l-hind*), where he writes a full account of the "*bust* hours" in his chapter on *karaṇas*, the auspicious and inauspicious times in India astrology associated with the lunar month:

> The Hindus attribute to some of the *karaṇas* dominants, as is their custom. Further they give rules showing what during each *karaṇa* must be done or not, rules which are similar to collection of astrological prognostics.[95]

Continuing on the subject of *karaṇas*, al-Bīrūnī remarks:

> Wishing to remind the reader of something relating to the *karaṇas* which he perhaps has forgotten, we must tell him that Alkindî and others like him have hit upon the system of the *karaṇas*, but one which was

92 Orthmann 2017.

93 Sarma and Zamani, "On the Persian Translation of Bhāskara's *Līlāvatī*."

94 Charles Ambrose Storey, *Persian Literature: A Bio-Bibliographical Survey. Vol. II. Part 1. A. Mathematics, B. Weights and measures, C. Astronomy and Astrology, D. Geography* (London: Luzac, 1958), 15; Marshall, *Mughals in India*, 345–7; see S.M. Razaullah Ansari ("Persian Translations of Bhāskara's Sanskrit Texts and Their Impact in the Following Centuries," in *Bhāskara-prabhā: Sources and Studies in the History of Mathematics and Physical Sciences*, ed K. Ramasubramanian, T. Hayashi, and C. Montelle. Singapore: Springer, 2019, 377–91) for a cursory survey of the Persian translations of Bhāskara's works; on this family, see the account by Sulaymān Nadvī ("Lāhōr kā ēk muhandis ḫāndān jis ne tāj ōr lāl qilʿa banāyā," *Rūʾīdād-i idāra-yi maʿārif-i islāmīya: ajlās-i avval munʿaqida-yi lāhōr 15–16 aprīl 1933*, (Lahore: Majlis-i ʿāmila-yi idāra-yi maʿārif-i islāmīya, 1933), 1–50); ʿAṭāʾ Allāh Rašīdī was also associated with Dārā Šikōh to whom he dedicated a treatise on mensuration and arithmetic (D.N. Marshall, *Mughals in India: A Bibliographical Survey, Vol. 1—Manuscripts, Supplementary Part*, (New Delhi: Munshiram Manoharlal, Indian Council of Historical Research, 1996), 10–11). His father Aḥmad Miʿmār Lāhōrī had designed the Taj Mahal, and his brother Ḥayr Allāh Ḥān Muhandis had penned in 1747 a commentary on Ptolemy's *Almagest* (Storey, *Persian Literature*, 37). His other brother Luṭf Allāh Muhandis translated Ṣūfī's *Ṣuwar al-kawākib* into Persian (Storey, *Persian Literature*, 16).

95 Abū Rayḥān Muḥammad b. Aḥmad al-Bīrūnī, *Alberuni's India: An Account of the Religion, Philosophy, Literature, Geography, Chronology, Astronomy, Customs, Laws and Astrology of India about A.D. 1030*, ed and transl. Edward Sachau (London: K. Paul, Trench, Trübner & Co., 1910), 198.

> not sufficiently explained. They did not comprehend the method of those who use the *karaṇas*. At one time they trace them back to Indian, another time to Babylonian origin, declaring all the time that they are altered on purpose and corrupted by the inadvertence of the copyists. They have invented a calculation for them which proceeds in a better order than even the original method itself. But thereby the thing has become something totally different from what it originally was. Their method is this: they count half days, beginning with new Moon. The first twelve hours they regard as belonging to the Sun, as *burning*, *i.e.* unlucky, the next twelve hours as belonging to Venus, the following twelve hours as belonging to Mercury, and so on according to the order of the planets. Whenever the order returns to the Sun, they call his twelve hours *the hours of Albist*, i.e. *viṣṭi*.[96]

Sachau interprets the Arabic *bust* as coming from the Sanskrit *viṣṭi*, which is known in Indian astrology. So does Pingree, who finds these periods of 12 hours similar to the Indian *karaṇas* described by Varāhamihira but notes that "the Indian method of determining their lords is completely different" and that "the origin method of assigning lords according to the descending order of the planets (that is, in accordance with their lordships of the hours) is not apparent."[97] It is indeed probable that the *bust* hours of the Arabic astrologers reflect the seventh movable *karaṇa*, called *viṣṭi* or *bhadrā*, which is particularly inauspicious and is presided by Yama, the god of death. The fifth chapter (*adhyāya*) of the *Jyotiṣaratnamālā* describes the *karaṇas* and mentions a method for determining the position of the beginning and end of the *viṣṭi karaṇa*.[98] In his influential *Muhūrtacintāmaṇi* composed in Benares in 1600, Rāma, a contemporary of Mullā Farīd and Mullā Ṭayyib, gives more details on determining the position of the *viṣṭi/bhadrā karaṇa*.[99]

Despite Bīrūnī's attribution to al-Kindī, I have not been able to locate any direct reference to *bust* hours in al-Kindī's works. However, a similar system

96 al-Bīrūnī, *Alberuni's India*, 200–1.

97 David Pingree, "The Indian and Pseudo-Indian Passages in Greek and Latin Astronomical and Astrological Texts," *Viator* 7 (1976): 176.

98 Śrīpatibhaṭṭa, *Jyotiṣaratnamālā*, ed. Vihārilālaśarma (Jammu: Śrīraṇavīrakendrīyasaṃskṛta-vidyāpīṭham, 1978), 22, verse 5:8; see also Pavel Poucha, "La Jyotiṣaratnamālā ou Guirlande des joyaux d'astrologie de Śrīpatibhaṭṭa," *Archiv orientální* 16 (1946): 301, verse 5:9; the translation of this verse is given in Rama, *Daivagye Acharya Shriram's Muhurta Chinta Mani*, tr., commentary and annotation Girish Chand Sharma (New Delhi: Sagar Publications, 1996), 35.

99 Rama, *Daivagye Acharya Shriram's Muhurta Chinta Mani*, 31–6 (I thank Martin Gansten for this reference); see Pingree, *Jyotiḥśāstra*, 105–6.

is described by al-Kindī in his book on astrology *Al-Arbaʿūn bāban*, which contains a long description of elections (*iḫtiyārāt*). In the chapter on war, al-Kindī describes the alternation between "combust" (*muḥtaraqa*) hours lasting 12 hours starting from the new Moon and non-combust hours in a 84-hour cycle.[100] These inauspicious combust hours are similar to the inauspicious *bust* hours, which are located under the rulership of the Sun. Al-Kindī does not however associate planetary rulers with this system of hours, nor does he mention any Indian origin.[101] Other authors such al-Qabīṣī and Bīrjandī consider the *bust* hours and the combust hours as equivalent. Besides al-Bīrūnī, the only Arabic astrological treatise known to describe these *bust* hours is Abū l-Ṣaqr ʿAbd al-ʿAzīz b. ʿUṯmān b. ʿAlī al-Qabīṣī al-Mawṣilī's (Alcabitius in Latin; fl. second half of the tenth century) *Kitāb al-Mudḫal ilà ṣināʿat aḥkām al-nujūm* ("Book of the Introduction to the Craft of Astrology"). Al-Qabīṣī's description is very similar to later Persian descriptions. He describes this *al-bust* system as being practiced in India (*hind*).[102] Pseudo-Majrīṭī's *Ġāyat al-ḥakīm*, an important Arabic book on magic known in Europe by its Latin name *Picatrix*, briefly mentions the existence of "combust" hours (*muḥtaraq*) at the end of its description of lunar mansions and their astrological effects but does not give any detail.[103]

Later on, this system of *bust* hours became part and parcel of Islamicate astronomy. It appears for example in a classic Persian work on astrology,

100 al-Kindī, *Mudḫal ilà ʿilm al-nujūm wa huwa al-kitāb al-musammà al-Arbaʿūn bāban*, MS Jerusalem, Khalidi Library, no. 996, fol. 43v; al-Kindī, *The Forty Chapters of al-Kindī: Traditional Horary and Electional Astrology*, transl. and ed. Benjamin N. Dykes (Minneapolis: The Cazimi Press, 2011), 178–9.

101 In other astrological texts, Al-Kindī is keen to acknowledge the Indian origin for a technique, e.g., the use of Indian lunar mansions in a text on weather forecasting, that has reached us in Hebrew and Latin (Gerrit Bos and Charles Burnett, *Scientific Weather Forecasting in the Middle Ages: The Writings of al-Kindī* (Abingdon: Routledge, 2000), 20–1).

102 Al-Qabīṣī (Alcabitius), *The Introduction to Astrology*, ed. of the Arabic and Latin text and English translation by Charles Burnett, Keiji Yamamoto, and Michio Yano (London-Turin: The Warburg Institute-Nino Aragno Editore, 2004); for the Arabic text and the English translation, see 136–9, for the Latin translation, see pp. 347–349 (where *al-bust* is transcribed in strikingly different manners in the various manuscripts); this passage by al-Qabīṣī in discussed in Pingree, "The Indian and Pseudo-Indian Passages," 176, 191; a description of the *bust* hours system is also found in a Greek manuscript (edited in Pingree, "The Indian and Pseudo-Indian Passages," 191, appendix 10).

103 Edition of the Arabic text: Pseudo-Majrīṭī, *Ġāyat al-ḥakīm*, ed. Hellmut Ritter (Glückstadt: Druck J.J. Augustin, 1927), 26; German translation: Pseudo-Majrīṭī, *"Picatrix": das Ziel des Weisen von Pseudo-Maǧrīṭī*, tr. Hellmut Ritter and Martin Plessner (London: The Warburg Institute, University of London, 1962), 24.

Niẓām al-Dīn ʿAbd al-ʿAlī Bīrjandī's (d. 934/1527–8) *Bīst bāb dar maʿrifat-i taqvīm*. Bīrjandī's treatise was extremely popular in the Persianate world and its commentary by Muẓaffar b. Muḥammad Qāsim Junābādī was dedicated to emperor Šāh ʿAbbās I (r. 1588–1629).

> The *bust* hours: Indian sages (*ḥukamā-yi hind*) have set a circle which is divided into seven parts. They have attributed each part to one planet and named it the *bust* of this planet. The duration of each part is twelve seasonal hours (*sāʿat-i zamānī*). Thus the duration of the whole circle is eighty-four seasonal hours. The circle starts from the time of the true new Moon (*ijtimāʿ-i ḥaqīqī*) and the first twelve seasonal hours are connected to the Sun. After that, the next twelve hours are related to Venus, and so on according to the order of the spheres [i.e., Mercury, Moon, Saturn, Jupiter, Mars] […] Every time the period returns to the Sun, it is called absolute (*muṭlaq*) *bust* by Indian sages. *Bust* is to be taken in the sense of passage (*sayr*) as given in [the dictionaries] *Al-Qāmūs* and [*Lisān al-*]*aʿrāb*. They consider these [*bust* hours] as combust hours (*sāʿāt-i muḥtaraqa*). These [hours] are abhorred in elections (*iḫtiyārāt*).[104]

Bīrjandī goes on to quote an excerpt from Faḫr al-Dīn Rāzī's *Iḫtiyārāt-i ʿalāʾīya* and gives instructions on how to construct tables containing the *bust* hours. The *Iḫtiyārāt-i ʿalāʾīya* indeed contains a chapter on *bust* hours, where Razi lists the actions recommended for every planet, the hours of the Sun being the most inauspicious. However, Faḫr al-Dīn Rāzī does not mention the Indian origin of the *bust* hours.[105] By the sixteenth century, *bust* hours had become a classic feature in Persian astrology and a part of the supplementary materials that could be added to an almanac. An example is given by an Indian almanac dating from 968/1560–1 kept at the Rampur Reza Library, which contains the *bust* hours amongst several other prognostication systems attributed to India and China.[106] Mullā Ṭayyib's *Risāla dar ḥall-i taqvīm* summarizes this chapter from Bīrjandī's *Bīst bāb dar maʿrifat-i taqvīm* but gives it a peculiar twist.[107] According to him, the *bust* hours "are called *bhadra* by Brahmanas" (*sāʿāt-i*

104 Niẓām al-Dīn ʿAbd al-ʿAlī Bīrjandī, *Bīst bāb dar maʿrifat-i taqvīm*, MS Tehran, Majlis Library, 112, foll. 67v–68v: *bāb* 12: *dar maʿrifat-i manāzil-i qamar u sāʿāt-i bust*.

105 Faḫr al-Dīn Rāzī, *Iḫtiyārāt-i ʿalāʾīya*, MS Istanbul, Süleymaniye Kütüphanesi, Ayasofya 2689, foll. 33v–34v; on the context of this work, see Frank Griffel, *The Formation of Post-Classical Philosophy in Islam* (New York: Oxford University Press, 2021), 297.

106 Anonymous, *Almanac* (*968/1527–8*), MS Rampur, Rampur Reza Library, 1216, fol. 7v.

107 Mullā Ṭayyib, *Risāla dar ḥall-i taqvīm*, MS Rampur, Rampur Reza Library, 1217: *aṣl* 15: *dar bayān-i sāʿāt-i bust*.

bust ki ān rā brahmanān bhadra gūyand). He also adds that this practice comes from India and Iran (*vilāyat*), whereas Bīrjandī was only referring to it as an Indian practice.

ʿAbd al-ʿAzīz Šams Tahānisarī's fourteenth-century Persian translation of Varāhamihira's *Bṛhatsaṃhitā* contains a few lines on *bhadrā*/*viṣṭi*. Chapter 92 on "*Karan gun*, that is on the prognostications associated with the *karans*" (Persian *dar bayān-i karan gun yaʿnī bayān-i aḥkām-i karan*) translates chapter 100 on the "Qualities of the *karaṇas*" (Sanskrit *karaṇaguṇādhyāya*) dealing with auspicious and inauspicious *karaṇas* in the lunar month. The Persian translation is more detailed than the Sanskrit root text (*mūla*) and lists "*bhadrā*" (written بهدرا) amongst the seven movable *karan* (Sanskrit *karaṇa*) (fol. 293v) before giving the detailed list of *karaṇas* in their order of succession in the lunar month. Tahānisarī goes on to describe the property of each *karaṇa* and writes: "In *bhadrā*, that is *viṣṭi karaṇa* (Persian *bišt karan*),[108] good actions should not be undertaken; actions such as killing enemies, giving poison, burning someone's house, and waging war are suitable."[109] Sastri's translation of the original Sanskrit writes: "Nothing done in Vishti leads to beneficial results, but attacking enemies, administering poison and other such things do succeed."[110]

Mullā Ṭayyib's *Muntaḫab-i ratan mālā*, also contains a discussion on the auspicious and inauspicious times of the lunar month. It describes the fundamentals of the *muhūrtaśāstra* system based on a "commentary" (*šarḥ*) on the *Ratnamālā*. His chapter on "the actions that are elected on days associated with one of the seven planets" explains on which *horās* (Persian *hūrā*) associated with a planet one should perform certain actions.[111] Mullā Ṭayyib lists the different *muhūrtas* ("moments") according to the *pañcāṅga*. The following chapter lists a range of actions and the conditions (*mašrūṭāt*) recommended for their performance according to the "five limbs."[112] In these chapters, *bhadra karaṇas* are duly mentioned by Mullā Ṭayyib among the *muhūrtas*.

The *Sirāj al-istiḫrāj*, Mullā Farīd's popular introduction to astronomy, contains yet another definition of *bust*. This time, Mullā Farīd clearly compares the *bust* hours with *bhadra*, an Indian astrological concept designating certain

108 The manuscript reads بششت but it is most certainly a scribal mistake for بشت.

109 ʿAbd al-ʿAzīz Šams Tahānisarī, *Tarjuma-yi Kitāb-i Bārāhī*, MS London, British Library, IO Islamic 1262, fol. 295v: *dar bhadrā yaʿnī bišt karan kārhā-yi nīkū našāyad kardan u kuštan-i dušmanān u zahr dādan u ātiš zadan az ḫāna-yi kasī u ḥarb kardan u mānand-i ān šāyad*.

110 Varāhamihira, *Brihat Samhita*, ed. and transl. V. Subrahmanya Sastri and M. Ramakrishna Bhat (Bangalore: Soobbiah and sons, 1946), 749: *na hi viṣṭikṛtaṃ vidadhāti śubhaṃ parighātiviṣādiṣu siddhikaram*.

111 Mullā Ṭayyib, *Muntaḫab-i ratan mālā*, MS Rampur, Rampur Reza Library, no. 1649, pp. 6–8.

112 Mullā Ṭayyib, *Muntaḫab-i ratan mālā*, pp. 8–36.

inauspicious hours during the month. Mullā Farīd was clearly familiar with Indian astrology and could either read almanacs himself or obtain information from *jyotiṣas*.

> On *bust hours*: The *bust* hours are called in their language *bhadra* [Sanskrit *bhadra* "auspicious"]. They are counted in *tithis*, so that *bhadra* happens after three and a half *tithis*, starting from the new Moon (*ijtimāʿ*), which is the beginning of their month. However, they don't write down the *bust* at the beginning and the end of the month, since they hold these two times to be inauspicious (*naḥs*) and there is no need to write them down. During these times, they consider necessary abstaining from electing (*iḫtiyār*) [the time] for a good action (*ḥasana*). In the moments which they write down as *bhadra* in their almanacs (*taqvīm*) [...]. They extend their inauspiciousness to the thirty *gharīs* [Sanskrit *ghaṭī* "one sixtieth of a sidereal day"] which are counted after.[113]

Strangely enough, the chapter on *bust* in the *Zīj-i Raḥīmī* is much shorter and does not contain this comparison with *bhadra* hours.[114] On the other hand, the *Zīj-i Šāh Jahānī* contains a summarized version of the description in the *Sirāj al-istiḫrāj*, but adds a few details. The inclusion of this chapter on *bust* and *bhadra* in the *Zīj-i Šāh Jahānī* is particularly striking since it occurs in a section discussing mathematical astronomy. Otherwise, the *Zīj-i Šāh Jahānī* does not contain any exposé on Indian astronomical and astrological theory. Mullā Farīd probably obtained his information on *bhadra* and Indian almanacs from Indian astrologers, which shows the intimacy that Mullā Farīd had with Indian astrological practice. Since the *Zīj-i Šāh Jahānī* was an official commission, it also indicates that Indian astrology was deemed by Mullā Farīd worthy of the interest of his patron Āṣaf Ḫān and his addressee Šāh Jahān. Even if Šāh Jahān's interest in Indian astrology does not seem recorded in sources, Mullā Farīd's chapter on *bhadra* is another indication that Indian astrology was still being practiced at court, as in his predecessors' time.

> *Bhadra* is similar to *bust*, except that they count its circle in *tithis*, so that three and a half *tithis* after the new Moon, it will be again *bhadra*. They

113 Mullā Farīd, *Sirāj al-istiḫrāj*, Mullā Farīd. *Sirāj al-istiḫrāj*. MS London, British Library, IO Islamic 476, foll. 126rv; Mullā Farīd. *Sirāj al-istiḫrāj*, MS Tashkent, Academy of Sciences of Uzbekistan, 6413, fol. 22v. The original text seems better preserved in the Tashkent manuscript, but remains difficult to read.

114 Mullā Farīd, *Zīj-i Raḥīmī*, MS Mashhad, Marʿašī Najafī library, 5554, fol. 116r: *dar bayān-i sāʿāt-i bust*.

> do not write *bhadra* for the beginning and end of the month. Since these two times are inauspicious (*naḥs*) because of their being directly under the beams (*taḥt al-šuʿāʿ*), the mention "*bhadra*" won't be needed.[115]

In Nityānanda's Sanskrit translation, this chapter is entitled "On the calculation of the *horā* of *busta* and *bhadrā*" (*bustabhadrayor horānayanaṃ*). Mullā Farīd's insight into the proximity between *bust* and *bhadrā* is thus confirmed by Nityānanda, who in his translation frustratingly omits this short paragraph and instead writes "the knowledge of *bhadrā* is quite well-known" (*atha bhadrājñānaṃ tu prasiddham eva*). The practically minded Nityānanda was evidently not satisfied with Mullā Farīd's account and added calculation on the correspondence between this 84-hour cycle and the Islamic lunar month: since a complete month contains a bit more than eight full cycles, Nityānanda specifies that "it is not pure and has a remainder of one and a half day."[116]

A survey of the works of Mullā Farīd and Mullā Ṭayyib allows a nuanced if sketchy reconstruction of their long and fruitful intellectual career. Among the two brothers, Mullā Farīd was most able to combine brilliant scholarly credentials with the talents of a seasoned courtier, crafting witty chronograms and supplying horoscopes to princes and kings from Deccan to Delhi. Besides these renowned figures, many now forgotten astronomers were plying their trade across princely courts. Up-to-date practical astronomical tools would have been in high demand across the land, as they allowed administrators and religious scholars to handle the necessary calendrical computations, and astrologers to quickly cast accurate horoscopes. But astronomy was not only about converting dates or making predictions, it was also about contributing to the symbolic apparatus bolstering Šāh Jahān's claims to imperial dominion. The central place of astral sciences in North Indian courtly environments encouraged a culture shared by Hindu and Muslim astrologers across Indic and Islamicate traditions. This intellectual exchange is documented by Mullā Farīd's and Mullā Ṭayyib's engagement with Indic astrological texts and practices. Scientific translations and multilingualism were also a larger phenomenon in North Indian courts. When commissioned to translate the *Zīj-i Šāh Jahānī* in his *Siddhāntasindhu*, Nityānanda, from the 1630s onwards,

115 Mullā Farīd, *Zīj-i Šāh Jahānī*, MS Oxford, Bodleian Library, Ind. Inst. Pers. 12, foll. 82rv: *dar bayān-i sāʿāt-i bust u bhadra*.

116 Nityānanda, *Siddhāntasindhu*, MS Jaipur, Maharaja Sawai Man Singh II Museum Library, Khasmohor Collection, 4962, fol. 103v: *evam aṣṭacakraparivartaiḥ saṃpūrṇo māso naśuddhyati kiṃtu māsānte sārdhadinam avaśiṣyate*.

started to introduce Islamicate astronomy to a Sanskrit audience.[117] He later reworked the material from his translation in his *Sarvasiddhāntarāja* to present it in a more classical form that would be acceptable to Sanskrit pandits.[118] Despite being grounded in two different astronomical traditions, both Mullā Farīd's and Nityānanda's works would be reunited a century later during the last efflorescence of mathematical astronomy in Sanskrit and Persian at the court of the Maharaja of Jaipur Savāī Jaisingh (1688–1743).

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117 On the earlier adaptation of Persian astronomy in the Sanskrit *tājika* tradition, see David Pingree, "Tājika: Persian Astrology in Sanskrit," in *From Astral Omens to Astrology: From Babylon to Bīkāner* (Rome: Istituto Italiano per l'Africa e l'Oriente, 1997), 79–90.

118 Nityānanda's production has been studied extensively by Anuj Misra. See for example *Learning with Spheres: The* Golādhyāya *in Nityānanda's* Sarvasiddhāntarāja (Abingdon: Routledge, 2023).

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