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Anuj Misra, Jean Arzoumanov

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# Calendars, Compliments, and Computations: A Comparative Survey of the Canon in the Persian *Zīj-i Šāh Jahānī* and in its Sanskrit translation, the *Siddhāntasindhu*

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## 1 INTRODUCTION

## 1.1 CULTURES OF ASTRONOMY AT THE MUGHAL COURT

IN RECENT YEARS, many studies have brought to light the complex nature of scientific discourses at the Mughal courts where political and philosophical preferences have variously influenced the admission and admonition of cross-cultural ideas.<sup>1</sup> Modern biographical studies of Mughal royals and elites have also discussed their proclivity for sponsoring scholarship across different disciplines.<sup>2</sup> In the astral sciences, the Islamicate tradition of composing *zīj*es (in Arabic and Persian) continued to enjoy patronage under the Mughal rule (see, e.g., Ghorī 1985; Ansari 2015),<sup>3</sup> and contemporaneously, important Sanskrit mathematical works were also translated into Persian under Mughal sponsorship (see, e.g., Ansari 2019: pp. 384–86, that describes the Mughal architect ‘Aṭā’ Allāh Ruṣdī’s Persian translation *Tarjuma-yi Bījganit* (c. 1634/35) of Bhāskara II’s *Bījagaṇita*, an acclaimed twelfth-century Sanskrit treatise on Algebra). By and large, the support of the mathematical sciences—astronomy being one among the quadrivium of the mathematical sciences along with number theory, geometry and musical theory—came to be institutionalised in the Mughal world as scientific patronage became a means to legitimise the intellectual authority of the Mughal state.<sup>4</sup>

<sup>1</sup> For example, see the studies of Gansten (2020), Misra (2021; 2022a), and Plofker (2022) in the astral sciences; of Moin (2012), Amanat (2014), Melvin-Koushki (2019), and Orthmann (2019) in the occult sciences; of Speziale (2018), Parpia (2019), Schlein (2019), and Tiefenauer (2019) in the life sciences; and more generally, of Alam and Subrahmanyam (2011), Haider (2011), Busch (2019), and Nair (2020) on the socio-philosophy of science in early modern Mughal India. For recent studies on the development of the secular sciences in pre-Mughal times, e.g., during the Delhi Sultanate (1206–1526), see Siddiqui (2012), Ray (2019), and Habib (2022).

<sup>2</sup> See, inter alia, Anooshahr (2017) (on Humāyūn), Wink (2012) (on Akbar), Balabanlilar (2020) (on Jahāngīr), Calabria (2018) (on Šāh Jahān), Gandhi (2020) (on Dārā Šikūh), Lefèvre (2014) (on ‘Abd al-Raḥīm Ḥān-i Ḥānān), and more expansively, see Ojha (1961), Sahay (1968), Soucek (1987), Kozłowski (1995), and Truschke

(2016) for larger discussions on Mughal patronage. Also see Sharma (2009), Busch (2010; 2011), Kinra (2015), and Sharma (2017) for studies on the literary arts in early modern India, especially, on the Mughal patronage of vernacular and Persianate poetry, and Orsini and Schofield (2015), Koch and Anooshahr (2019), and Truschke (2021) for essays on the Mughal milieu rendered through imperial iconography and subaltern narratives.

<sup>3</sup> In Islamicate astronomy, a *zīj* (ARA pl. *zījāt*) is a handbook of astronomical, mathematical, calendrical, and geographical tables with accompanying text (called canon) on its technical use and theoretical underpinning. See Mercier (2008) and Van Brummelen (2014) for encyclopedic descriptions of a *zīj*.

<sup>4</sup> See Brentjes (2009) for a more capacious study of patronage of the mathematical sciences in the Islamicate world (including in the Mughal sultanate), and the social and material consequences of various forms of

It is, perhaps, not surprising then to find two early-seventeenth century astronomers, a Muslim scholar named Mullā Farīd and his Hindu counterpart Pandit Nityānanda Miśra, working under the injunctions of Emperor Šāh Jahān's court to translate the former's Persian *Zīj-i Šāh Jahānī* into the latter's Sanskrit *Siddhāntasindhu*. Here, the act of commissioning the translation of a typical Persian *zīj* into an atypical Sanskrit *siddhānta* (a traditional scientific treatise) is as much an activity of consolidating power as it may be of acculturating knowledge.<sup>5</sup> In this study, we present, for the very first time, a comparative survey of the entire canon (text) in Mullā Farīd's *Zīj-i Šāh Jahānī* and Nityānanda Miśra's *Siddhāntasindhu* in an effort to illustrate the intimacy between the translated Sanskrit and its Persian original.

We note here at the outset that this study only surveys the canons in these two texts, which, in keeping with the genre of astronomical table-texts, include a vast number of tables of various kinds (like, e.g., calendrical, mathematical, astronomical, geographical, etc.). A detailed survey of the tables from these texts, along with apposite mathematical discussions, is to follow in an ensuing publication that would form the second and final part of our comprehensive survey of the *Zīj-i Šāh Jahānī* and the *Siddhāntasindhu*.

Presently, we begin this study (in § 1.2) with a brief biography of Mullā Farīd and his *Zīj-i Šāh Jahānī*, followed by a similar biographical sketch of Nityānanda Miśra and his *Siddhāntasindhu* (in § 1.3), before summarising some of the more salient features of the canons of these two texts (in § 1.4). This is followed by a description of the manuscripts utilised in our study (in § 2), and of our transcription and transliteration schemes (in § 3). Lastly, we present (in § 4) a detailed comparative survey of the individual chapters from the canon in the Persian *Zīj-i Šāh Jahānī* and the Sanskrit *Siddhāntasindhu*, typeset in parallel columns to allow for easy comparison. At the very end of this article, we describe certain aspects from select chapters in fuller detail in individual appendices.

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institutional support. More broadly, see Steele (2015) and Šprajc (2016) for studies on the intimacy between astronomy and politics in various scientific civilisations, and Rezavi (2007) and Tabrez (2019) for the social history of education under the Mughal rule.

<sup>5</sup> As a comparable example of the phenomenon of acculturation, see Wade (1998) that offers an ethnomusicological and art historical study on how music from the

Persian cultural sphere was Indianised at the Mughal courts. Conversely, many Persianate scholars at the Mughal courts were also familiar with Sanskrit knowledge systems: for example, as Singhanian (2009) shows, the *Āʾm-i Akbarī* of Abū l-Faʾl-i ʿAllāmī, the grand vizier and biographer of Emperor Akbar (r. 1556–1605), contains many technical discussions that reveal how its author was intimately acquainted with Sanskrit astronomical ideas.

## 1.2 MULLĀ FARĪD AND HIS ZĪJ-I ŠĀH JAHĀNĪ

MULLĀ FARĪD AL-DĪN MAS<sup>c</sup>ŪD ḤĀFIẒ IBRĀHĪM DIHLAVĪ (commonly known as Mullā Farīd) is described in several court chronicles as a prominent astronomer active during the reigns of the Mughal emperors Jahāngir (r. 1605–27) and Šāh Jahān (r. 1628–58). According to the chronicle *Maʿāẓir-i Raḥīmī* of ʿAbd al-Bāqī Nahāvandī, Mullā Farīd was given pride of place among the scholars at the court of the Mughal minister and general ʿAbd al-Raḥīm Ḥān-i Ḥānān (d. 1627), having been hired by Ḥān-i Ḥānān in 1597/8 (AH 1006) and still on his payroll as late as 1616/17 (AH 1025) (MR, pp. 14–15 in Vol. 3).

Later in his career, Mullā Farīd attached himself to the service of the Mughal minister Āṣaf Ḥān, who instructed him to compose the *Zīj-i Šāh Jahānī*, a computational *zīj* modelled on Uluḡ Bīg’s celebrated *Zīj-i jadīd-i Sulṭānī* but set to an epoch corresponding to the vernal equinox of the regnal year of Emperor Šāh Jahān enthronement (i.e., the epoch of 21 March 1628 that marked the beginning of the *tārīḫ ilāhī-yi Šāh Jahānī* ‘the divine era of Šāh Jahān’). Several Persian chronicles mention that Mullā Farīd was assisted in this task by his brother Mullā Ṭayyib, a noted astronomer and astrologer in his own right (see, e.g., AS, p. 361 in Vol. 1, and also MŠJn, p. 82, where Mullā Farīd is said to have been assisted by an unnamed brother).

According to the *Ṭabaqāt-i Šāh Jahānī* (also quoted in the *Nuzhat al-ḥawāẓir*), Mullā Farīd died in 1629/30 (AH 1039) (TŠJ, p. 48, and NH, p. 601). In fact, the *Tārīḫ-i Muḥammadī* gives an even more precise Hijri date of 2 Rabīʿ al-Avval in the year 1039 (corresponding to October 19, 1629) (TM, f. 162v), but, according to Ghori (1985: 34), this date is incorrect since the positions of the stars in the *Zīj-i Šāh Jahānī* are calculated for the year 1631/2 (AH 1041).<sup>6</sup>

1.2.1 *The Zīj-i Šāh Jahānī, its origins and structure*

While the *Zīj-i Šāh Jahānī* is overwhelmingly based on the fifteenth-century *zīj* of Uluḡ Bīg (i.e., the *Zīj-i jadīd-i Sulṭānī* or more commonly, the *Zīj-i Uluḡ Bīg*), it does, however, contain notable differences compared to its medieval precursor. To a large extent, these differences are a product of the changing times (along with a change of meridian) as the tradition of composing *zīj*es advanced in early modern Mughal India. In fact, some of the novelty in Mullā Farīd’s *Zīj-i Šāh Jahānī* can be traced back to his earlier works, in particular, his *Zīj-i Raḥīmī* (1617/8 or AH 1026) that also bears resemblance to the *Zīj-i Uluḡ Bīg* and, in many ways, may be thought of as an earlier version of the *Zīj-i Šāh Jahānī*.<sup>7</sup> Much of what is found

6 A more comprehensive biography of Mullā Farīd and his milieu can be found in Arzoumanov (2023).

7 Mullā Farīd’s *Zīj-i Raḥīmī* is briefly described in Ansari (2015). At the present

time, the only known extant copy of this work is held at the Marʿaṣī Najafī library in Mashhad (Iran). As Ansari describes, this manuscript “ends abruptly on fol. 227 with the table for the first equation of Saturn,



in Mullā Farīd's *Zīj-i Šāh Jahānī* appears first in his *Zīj-i Raḥīmī*, although there are notable differences between the two texts.<sup>8</sup> For example, the introduction (*muqaddama*) of the *Zīj-i Šāh Jahānī* is significantly longer in comparison to the one found in the *Zīj-i Raḥīmī*, and includes heterogeneous content collated from earlier works along with newer additions.<sup>9</sup>

The introduction of the *Zīj-i Raḥīmī* contains, inter alia, a description of the difference between observational and computational *zījes*; definitions of what constitutes *raṣad* 'observation', a *zīj-i ḥisābī* 'computational *zīj*', and a *taqwīm* 'almanac or ephemerides'; a praise of Uluḡ Bīg's astronomical tables; and an extolment of 'Abd al-Raḥīm's Ḥān-i Ḥānān's name and titles in chronograms (*tārīḥ*, pl. *tavārīḥ*) along with a comparison of these chronograms to other numbers (like, e.g., astronomical parameters) found elsewhere in the text. Going beyond, the introduction of the *Zīj-i Šāh Jahānī* contains additionally a list of older computational *zījes*, discussions on the etymology of the word *zīj*, the meaning of *tashīl* 'facilitation or simplification', and the purposes of *taqwīm*, *zījes*, and *raṣad*.

Interestingly, some of these preliminary definitions—like those of *taqwīm*, *zīj*, and *raṣad*—appear to be taken from Mullā Farīd's earliest known work, the *Sirāj al-istīhrāj* (1597/8 or AH 1006) even as their discussions are somewhat amplified in the *Zīj-i Raḥīmī* (and then again, in the *Zīj-i Šāh Jahānī*).<sup>10</sup>

reckoned from the zodiacal sign Gemini (*Jawzāʾ*)" Ansari 2015: p. 583. Over all, the *Zīj-i Raḥīmī* appears to contain newer tables compared to the *Zīj-i Uluḡ Bīg* on which it is largely based upon; this is supported by Ansari's observation that "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)" Ansari 2015: p. 583. Ansari also suggests that the *Zīj-i Raḥīmī* was composed around 1617/8, noting that as "Mullā Farīd tabulated the equation of time (*Taʿdīl al-Ayyām*) for the Sun and Moon for the year AH1026 / AD1617 (ff. 152b, 153a), it appears that he might have been compiling ZR [the *Zīj-i Raḥīmī*] around that year" Ansari 2015: p. 582.

8 Beyond minor differences in numbering, the structure and order of certain chapters in the *Zīj-i Uluḡ Bīg* and Mullā Farīd's two *zījes* are noticeably different: the twenty-second chapter from the second discourse

(i.e., *maqāla* 2: *bāb* 22) in the *Zīj-i Raḥīmī* is a conflation of the twenty-second chapter from the second discourse (i.e., *maqāla* 2: *bāb* 22) and the twelfth chapter from the third discourse (i.e., *maqāla* 3: *bāb* 12) of the *Zīj-i Uluḡ Bīg*, and this chapter then appears as the thirteenth chapter in the third discourse (i.e., *maqāla* 3: *bāb* 13) of the *Zīj-i Šāh Jahānī*.

9 Of particular note is the adaption of the section on *zījes* from Abū l-Faẓl's *Āʿīn-i Akbarī* (c. sixteenth century) in the first part (*qism*) of the introduction of the *Zīj-i Šāh Jahānī*. For example, Mullā Farīd provides here an account of earlier astronomers (starting from Antiquity) who made observations, and this account corresponds to an identical description given by Abū l-Faẓl in his *Āʿīn-i Akbarī* (cf. *ĀA*, p. 266 in Vol. 1, Part 2 and remark 2 in [§ ID.1] on page 116).

10 The *Sirāj al-istīhrāj* is a short treatise that enjoyed popularity as an introductory text to astronomy as the relatively large number of extant manuscripts and ancillary citations seem to suggest; see Arzoumanov (2023) for a fuller discussion on Mullā Farīd's *Sirāj al-istīhrāj* relative to his complete oeuvre.

As further examples, the praise of Uluğ Bîg in (the first part of) the introduction of the *Zîj-i Šāh Jahānī* is significantly longer than what is similarly found in (the second part of) the *Zîj-i Raḥīmī*; and in (the second part of) the introduction of the *Zîj-i Šāh Jahānī*, Mullā Farīd argues for the superiority of the *Zîj-i Šāh Jahānī* over previous *zîjes*—a novel addition compared to the *Zîj-i Raḥīmī*.

Also, in (the third part of) the introduction of the *Zîj-i Šāh Jahānī*, Mullā Farīd offers a numerological excursus on the name of his new patron Emperor Šāh Jahān instead of his earlier sponsor ‘Abd al-Raḥīm Ḥān-i Ḥānān whose name he has already analysed in (the third part of) the introduction of his *Zîj-i Raḥīmī*. And finally, towards the very end of the introduction of the *Zîj-i Šāh Jahānī* (in the fourth part), Mullā Farīd discusses the calculative corrections, inventions, and additions to the *Zîj-i Uluğ Bîg* that he now introduces in his *Zîj-i Šāh Jahānī* for the very first time.

Overall, comparing the other discourses (*maqāla*) of the *Zîj-i Raḥīmī* and the *Zîj-i Šāh Jahānī*, we find that, in the first discourse, the *Zîj-i Raḥīmī* follows the *Zîj-i Uluğ Bîg* near verbatim, while the *Zîj-i Šāh Jahānī* contains many new chapters (*bāb*) like, e.g., the one introducing the divine era of Šāh Jahān (*tārīḫ ilāhī-yi Šāh Jahānī*) (see Appendix § G), and another describing the methods to convert various calendrical eras to this new era of Šāh Jahān. Notably, the first discourse of the *Zîj-i Šāh Jahānī* contains two new chapters on the Indian (Vikram Saṃvat and Śālivāhana) calendrical era (*tārīḫ-i hindī*) (see Appendix § H) and its conversion to and from the Islamic (Hijri) era.

At the end of its first discourse, the *Zîj-i Raḥīmī* contains a table listing the festivals (according to the different calendrical eras) that is more expansive compared to the festivals listed in the *Zîj-i Uluğ Bîg*. However, in his *Zîj-i Šāh Jahānī*, Mullā Farīd augments this table of festivals by including Hindu festivals based on the Indian eras (see Appendix § I). Also, while the second chapter in the third discourse (i.e., *maqāla* 3: *bāb* 2) of the *Zîj-i Raḥīmī* includes a chapter on the horoscope and numerology of ‘Abd al-Raḥīm’s Ḥān-i Ḥānān, the same chapter in the third discourse of the *Zîj-i Šāh Jahānī* now includes the horoscope and numerology of Emperor Šāh Jahān.

The ninth and fourteenth chapters from the third discourses (i.e., *maqāla* 3: *bābs* 9 and 14) of the *Zîj-i Raḥīmī* and the *Zîj-i Šāh Jahānī* both contain identical discussions on the Indian astrological concepts of *bust* and *bhadra*, and on the ominous planet *al-Kayd* of Islamic astrology respectively. Here, the contents of both these chapters are reproduced near-verbatim in the *Zîj-i Šāh Jahānī* from the *Zîj-i Raḥīmī*.

And finally, the second chapter in the fourth discourse (i.e., *maqāla* 4: *bāb* 2) of the *Zîj-i Šāh Jahānī* on the Islamicate idea of the ‘ascendant of the world’ (i.e., the ascendant at the Aries ingress) is completely new and not found in the *Zîj-i Raḥīmī*.

1.3 NITYĀNANDA AND HIS *SIDDHĀNTASINDHU*

VERY SOON AFTER MULLĀ FARĪD COMPLETED HIS *ZĪJ-I ŠĀH JAHĀNĪ*, or perhaps near-contemporaneously towards the end, a Hindu Pandit named Nityānanda Miśra (fl. 1630/50) was commissioned by Āṣaf Ḥān, the prime minister (*vazīr-i aʿẓam*) of Šāh Jahān, to translate into Sanskrit Mullā Farīd's Persian *zīj*. The circumstances surrounding this commission are described by the seventeenth-century Mughal historian Mīrzā Muḥammad Ṭāhir Ḥān Āšnā (alias ʿInāyat Ḥān) in his abridged chronicle of Emperor Šāh Jahān, the *Mulāḥḥaṣ-i Šāhjahān-nāma* (MŠJn, p. 82):

چون متضمن فواید بسیار و ضوابط و قواعد بی شمار بود تا فایده آن عموم  
بهم رسانند حکم شد که نجومیان هندوستان باستصواب منجمان فرس بزبان  
هندوستان ترجمه نمایند.

*čūn mutaẓammin-i favāyid-i bisyār u ẓavābiṭ-i bī-šumār būd tā fāyida-yi ān  
ʿumūm ba ham rasānand ḥukm šud ki nujūmīyān-i hindūstān ba istiṣvāb-i  
munajjimān-i furs ba zabān-i hindūstān tarjuma namāyand.*

Since [this Persian *zīj*, i.e., the *Zīj-i Šāh Jahānī*] contained many advantages and countless rules, an order was given that Indian astronomers translate it into the language of Hindustan with the approval of Persian astronomers so that the public may profit from it.<sup>11</sup>

In fact, Nityānanda describes the story of his patronage in the preface (*granthārambha*) of this commissioned Sanskrit translation, the *Siddhāntasindhu*:

तस्य प्रेरणया नृपालमुकुटालङ्कारचूडामणि-  
मामाज्ञापितवान्सुतत्रकरणे लोकोपकाराय यत् ॥  
श्रीमच्छाहजहाँप्रकाशममलं सिद्धान्तसिन्धुं स्फुटम्  
नित्यानन्द इति प्रसिद्धगणकः कर्तुं समीहे ततः ॥ २४ ॥

*tasya preraṇayā nṛpālamukutaṅkāraṇācūḍāmaṇi  
mām ājñāpitavān sutantrakaraṇe lokopakārāya yat ॥  
śrīmacchāhajāhāṅprakāśam amalam siddhāntasindhuṃ sphuṭam  
nityānanda iti prasiddhagaṇakaḥ kartuṃ samīhe tataḥ ॥ 24 ॥*

Since he who is the crown jewel in the head ornament of kings [i.e., Āṣaf Ḥān] ordered me by his command to compose a beautiful treatise for the benefit of men, for that reason this Nityānanda, a celebrated mathematician, endeavoured to compose the *Siddhāntasindhu* that is pure and precise resembling [the tables of] the venerable Šāh Jahān. 24

<sup>11</sup> Henceforth, unless otherwise indicated, all English translations of the Persian and

Sanskrit text quoted in this paper are the authors' own.

There is little known about Nityānanda's life by way of historical testimony beyond the names of his patrilineal ancestors and the place of his origin (in Indrapurī or Old Delhi). A brief biographical account of Nityānanda's life and works (reconstructed from the scant colophonic information available on him) is described in Misra (2022a: 11–12).

However, the patronage of Hindu astronomers/astrologers (*jyotiṣas*) at the Mughal courts is certainly well documented (see, e.g., Minkowski 2014), and to a large extent, their presence was legitimised by the endorsement of the astral sciences by successive Mughal emperors. Misra (2021: 32–43) provides a concise sociohistorical account of the culture of translating astronomy in early-modern Persianate India, and in particular, Nityānanda's advent as a Hindu mathematician-astronomer (*gaṇaka-jyotiṣa*) in service of the Mughal court of Šāh Jahān.

### 1.3.1 *The Siddhāntasindhu, its novelty and enterprise*

Nityānanda called his Sanskrit translation the *Siddhāntasindhu* 'An ocean of doctrinal truths', and in many ways, his text was as much a recipient of the intellectual endowments of the Mughal milieu as he himself was of the material benefaction of Mughal sponsorship.

The *Siddhāntasindhu* is a complex scholastic, scientific, and sociocultural experiment of bringing Islamicate ideas into the discourse of Sanskrit astronomy of seventeenth-century Mughal India. The structure of its canon mimics that of a Persian *zīj* with a preface (*granthārambha*, lit. the beginning of a book), an introduction (*granthamukha*, lit. the mouth of a book), and four distinct parts (*kāṇḍas*, lit. joints of the stalk or stem of a plant); see Table 1.

At the very outset, this arrangement is novel compared to anything seen in any of the Sanskrit astronomical texts prevalent at the time. In traditional Sanskrit *siddhāntas*, technical (calculative) topics were often discussed under topical headings (*adhikāra*)—like those on calculating the mean positions of planets (*madhyama*), their true positions (*spaṣṭa*), the 'three questions' of determining the direction, place, and time (*tripraśna*), etc.—subsumed under a chapter on computations (*gaṇitādhyāya*). However, in his *Siddhāntasindhu*, Nityānanda imitates the arrangement of the chapters of the Persian original with perhaps an ambition of transmitting the organisation of Islamicate astronomy as well as the prestige of Mughal patronage. In fact, this latter intention is evident in an original Sanskrit composition Nityānanda includes at the beginning of the preface of his *Siddhāntasindhu* (see § P.1 on page 106). In it, he exalts Šāh Jahān's imperial lineage and regnal calendar in metrical Sanskrit poetry in an effort to impress upon the reader the magnanimity of his patron's being.<sup>12</sup>

<sup>12</sup> A critical edition with an annotated English translation of this original San-

Throughout the *Siddhāntasindhu*, Nityānanda translates Mullā Farīd’s Persian passages in an ad hoc mixture of Sanskrit prose and metrical verses, and in several instances, augments his translations with additional explanatory statements not found in the Persian original (see, e.g., Misra 2021: 57–60 that compares the structure of the chapter on computing the true declination of a celestial object in Mullā Farīd’s *Zīj-i Šāh Jahānī*, Discourse II.6 and Nityānanda’s *Siddhāntasindhu*, Part II.6). In many ways, these pedagogical additions reveal Nityānanda’s own conception of the intended utility of his text as a propaedeutic for Sanskrit astronomers attempting to learn Islamicate astronomy.<sup>13</sup> Also, the fluency of his translations attests to his intimacy with the Persian language in much the same way as its thoroughness testifies to his knowledge of astronomy. Over all, the *Siddhāntasindhu* is Nityānanda’s bold enterprise in using language, logic, and mathematics to transcreate a new treatise in Sanskrit astronomy with ideas originating in several older works of Islamicate astronomy.

#### 1.4 HIGHLIGHTS FROM THE CANONS OF THE ZĪJ-I ŠĀH JAHĀNĪ AND THE SIDDHĀNTASINDHU

TABLE 1 DESCRIBES THE DIVISIONS OF THE CANON IN Mullā Farīd’s *Zīj-i Šāh Jahānī* and Nityānanda’s *Siddhāntasindhu* in parallel. The distribution of the chapters in the introduction and the four discourses/parts of these two texts is described in Table A1 (in Appendix A).<sup>14</sup>

Among the many features of the canons of both these texts, the following are some of the more salient observations that come to the fore.

1. Nityānanda begins his *Siddhāntasindhu* with a preface (*granthārambha*) that includes a Sanskrit prolegomenon (*prathamāvāsara*) not found in Mullā Farīd’s *Zīj-i Šāh Jahānī*; see [§ P.1]. In it, he summarises the different calendrical eras described in this text and proposes a system of converting between them (Misra forthcoming).
2. In translating Mullā Farīd’s Persian passages into Sanskrit, Nityānanda’s language often appears to be grounded in the linguistic and cultural ambit of his source. For instance, instead of *Indianising* the foreign content, he

sanskrit prolegomenon from the preface of Nityānanda’s *Siddhāntasindhu* is to appear in Misra (forthcoming).

<sup>13</sup> In fact, in his second text the *Sarvasiddhāntarāja* (1639), he transforms his exposition of Islamicate astronomy to suit the more traditional paradigms of a Sanskrit *siddhānta*—in essence, anonymising the origins of ‘foreign’ ideas by ascribing them to divine revelations in lieu of human

authorship—and by doing so, attempts to cater to his learner’s autochthonous sensibilities better; see Misra (2022b: 71–83).

<sup>14</sup> To allow for comparative cross-referencing, we have enumerated the individual chapters (like, e.g., “[§ ID.5]”), enclosing them in square brackets to indicate that they are modern editorial additions and not those made by any of the scribes of the Sanskrit or Persian manuscripts.

composes his Sanskrit passages in a manner that reflects its adventitious origins: prime examples of this can be seen in his Sanskrit translations of the praises to Allah (in [§ P.2] ) and to prophet Muḥammad (in [§ P.3]), and in his Sanskrit eulogy to Šāh Jahān (in [§ P.4]) wherein he emulates the original Persian meter and terminal rhyme in his metrical encomium (Arzoumanov and Misra *forthcoming*).

That said, on certain occasions, particularly when translating technical computations, Nityānanda has chosen to culturally appropriate the context of the calculation to suit his local readership: for example, in translating Mullā Farīd's computation of Qibla (i.e., the direction of Mecca), he changes the locus from Mecca to Kāśī and then proceeds to explain the procedure identically: see [§ II.20].

3. For the most part, Nityānanda provides precise translations to reflect the linguistic fidelity of his work in relation to its source. For example, in his exhaustive translations of technical and non-technical material in the first part of the introduction (in [§ ID.1]), he renders into Sanskrit Mullā Farīd's discussion on the etymology of the Persian word *zīj* (see Appendix § D), or in translating the praise of Uluḡ Bīg, he translates the string of effusive Persian epithets applied to the Samarqand astronomer using corresponding Sanskrit appositives.

More astutely, he transcribes into Devanāgarī Persian proper names, titles of works, and certain technical terms (e.g., PER: *zīj* 'tables' to SAN: *jīca* or PER: *raṣād* 'observation' to SAN: *rasada*) in a manner that perhaps reflects some of the ways in which Persian was spoken at the Mughal courts of his time; see, e.g., the list of earlier Greek and Muslim astronomers (in [§ ID.1]); the lists of earlier Islamicate *zījes* (in Appendix § B) and simplification tables (in Appendix § C); or statements on the utility of *zījes*, almanacs, and observations (in Appendix § E).

4. For technical topics like, e.g., the definitions of various calendrical terms in different calendar systems (see Appendix § F), Nityānanda translates formal Persian expressions using apposite Sanskrit equivalents. In the fourth part of the introduction (in [§ ID.4]), he translates into Sanskrit the 101 technical additions/improvements Mullā Farīd has self-admittedly made to the *Zīj-i Uluḡ Bīg*, drawing upon his extensive knowledge of Sanskrit astronomy to identify equivalent terms for Islamicate astronomical concepts. In fact, his mastery of the vocabulary of Sanskrit astronomy is evident by looking at his translations of the technical topics in the twenty-two chapters of the second part (see [§ II.1]–[§ II.22]) and the fifteen chapters of the third part (see [§ III.1]–[§ III.15]) of his *Siddhāntasindhu*.
5. However, Nityānanda's translations are not always exhaustive: in some instances, entire passages (or sections) are completely omitted. For example,

Nityānanda does not translate Mullā Farīd’s statements on the numerology of the name ‘Šāh Jahān’ on account of its irrelevancy; see [§ ID.3].

Similarly, in the first part of the *Siddhāntasindhu* (in [§ I]) describing the different calendrical eras—including the newly instituted era of Šāh Jahān (see Appendix § G)—Nityānanda does not translate into Sanskrit Mullā Farīd’s Persian descriptions of the Chinese-Uyghur calendrical era (see [§ I.9] of the *Zīj-i Šāh Jahānī*). More significantly, he also omits translating Mullā Farīd’s descriptions of the Hindu calendrical eras (see Appendix § H), presumably believing Sanskrit reader were already familiar with these topics.

In contrast, in the tenth chapter of the first discourse of the *Zīj-i Šāh Jahānī*, Mullā Farīd includes a unique calendar of festivities following the prevalent Muslim and Hindu traditions (see Appendix § I), which Nityānanda notably excludes from his translation.

6. In Nityānanda’s *Siddhāntasindhu*, each of the three parts of the text terminates with a colophon; see [§ I.col], [§ II.col], and [§ III.col]). No corresponding colophons are found at the ends of the three discourses of Mullā Farīd’s *Zīj-i Šāh Jahānī*.
7. Lastly, the canon in Mullā Farīd’s *Zīj-i Šāh Jahānī* is a remarkably composite text that weaves together passages from the *Zīj-i Uluġ Bīġ*—copied (near-)verbatim in several instances—and material from other Persian texts, as well as the author’s earlier works. The Indian context of this *zīj* is made very apparent by Mullā Farīd’s discussions of, inter alia, the Hindu calendrical eras (in [§ I.7]), Indian religious festivals (in [§ I.10]), and inauspicious hours (i.e., *bust* and *bhadra*) according to Indian astrology (in [§ III.9]); see (Arzoumanov 2023). The author’s augural and ample descriptions of the ‘divine era of Šāh Jahān’ (in [§ P.3], [§ ID.3], and more elaborately in [§ I.1]) also serve as an excellent historical example of promotional and sponsored scientific content.

Table 1: Structure of the canon in Mullā Farīd’s *Zīj-i Šāh Jahānī* vis-à-vis the canon in Nityānanda’s *Siddhāntasindhu*.

<i>Zīj-i Šāh Jahānī</i>	<i>Siddhāntasindhu</i>
[§ P] Preface	[§ P] ग्रन्थारम्भ ( <i>granthārambha</i> ) ‘Preface’

(continued)

*(continued)*

## Containing

1. a حمد (*ḥamd*) 'Praise of God' (in [§ P.1]);
2. a نعت (*na<sup>ct</sup>*) 'Praise of the Prophet' (in [§ P.2]);
3. a praise of Šāh Jahān and his regnal era (in [§ P.3]); along with
4. a praise of Āṣaf Ḥān and the commissioning of a new *zīj* named after Šāh Jahān (in [§ P.4]).

[§ ID] مقدمه (*muqaddama*)  
'Introduction'

In پنچ قسم (*pañc qism*) 'five parts' ([§ ID.1–§ ID.5]).

## Containing

1. the प्रथमावसर (*prathamāvasara*; lit. the first occasion), i.e., the Prolegomenon (in [§ P.1]);
2. the यवनोक्तमङ्गलाचरण (*yavanokta-maṅgalācarāṇa*, lit. a benediction according to the Muslims, in [§ P.2])—a Sanskrit translation of the Islamic *ḥamd*;
3. the भगवद्भक्तवचन (*bhagavadbhaktavacana*, lit. the sayings of the Devotee of God, i.e., of the Prophet, in [§ P.3])—a Sanskrit translation of an Islamic *na<sup>ct</sup>*, citing hadiths;
4. a praise of Šāh Jahān and his regnal era (in [§ P.4]); along with
5. a praise of Āṣaf Ḥān and the commissioning of a new *siddhānta* named after Šāh Jahān (in [§ P.5]).

[§ ID] ग्रन्थमुख (*granthamukha*)  
'Introduction'

In पञ्चप्रकार (*pañcaprakāra*, lit. five kinds), i.e., in five parts ([§ ID.1–§ ID.5]).

*(continued)*



*(continued)*

[§ I] مقاله اولین (*maqāla-yi avvalīn*)  
‘First discourse’

In ده باب (*dah bāb*) ‘ten chapters’  
([§ I.1–§ I.10]).

[§ I] प्रथमकाण्ड (*prathamakāṇḍa*)  
‘First part’

In सप्ताध्याय (*saptādhyāya*) ‘seven chapters’ ([§ I.1–§ I.7]), with section-terminal colophon ([§ I.col]).

[§ II] مقاله دوم (*maqāla-yi duvum*)  
‘Second discourse’

In بیست و دو باب (*bīst u dū bāb*) ‘twenty-two chapters’ ([§ II.1–§ II.22]).

[§ II] द्वितीयकाण्ड (*dvitīyakāṇḍa*)  
‘Second part’

In द्वाविंशत्याध्याय (*dvāviṃśatyādhyāya*) ‘twenty-two chapters’ ([§ II.1–§ II.22]), with section-terminal colophon ([§ II.col]).

[§ III] مقاله سیوم (*maqāla-yi sīvum*)  
‘Third discourse’

In پانزده باب (*pānzdah bāb*) ‘fifteen chapters’ ([§ III.1–§ III.15]).

[§ III] तृतीयकाण्ड (*trtīyakāṇḍa*)  
‘Third part’

In पञ्चदशाध्याय (*pañcadaśādhyāya*) ‘fifteen chapters’ ([§ III.1–§ III.15]), with section-terminal colophon ([§ III.col]).

[§ IV] مقاله چهارم (*maqāla-yi čahārum*)  
‘Fourth discourse’

Contains the باب اول (*bāb-i avval*) ‘first chapter’ ([§ IV.1]) with هفت فصل (*haft faṣl*) ‘seven sections’ ([§ IV.1.i–§ IV.1.vii]), and a final باب دوم (*bāb-i duvum*) ‘second chapter’ ([§ IV.2]).

A corresponding fourth part is absent (according to the only near-complete MS Kh; see page 101).

## 2 MANUSCRIPT SOURCES

## 2.1 THE ZĪJ-I ŠĀH JAHĀNĪ OF MULLĀ FARĪD

BY CONSERVATIVE ESTIMATES, there are about twelve manuscripts of the *Zīj-i Šāh Jahānī* that are variously complete in their extent. These manuscripts are held at different libraries across India, Iran, Russia, Tajikistan, the United Kingdom, and Uzbekistan.<sup>15</sup>

2.1.1 *Manuscripts consulted*

In preparing this comparative survey, we consulted seven manuscripts of the *Zīj-i Šāh Jahānī* that were fully or partially complete. These are briefly described in Table 2

Table 2: Description of the manuscripts of the *Zīj-i Šāh Jahānī*.

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*Signum Manuscript Description*


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- D MS 2007 from the Rudaki Institute of Language, Literature, Oriental and Writing Heritage, Dushanbe, 403 folia, Persian Nastaliq, decorated headpiece (*sarlawḥ*) above the text on first folio, c. seventeenth century. See ROSEN-ĪHSAN (p. 358).
- H MS *riyāzī fārsī* 302 from the Telangana Government Oriental Manuscripts Library and Research Institute, Hyderabad, 412 folia, Persian Nastaliq, c. eighteenth century. (From the ex-Āṣafīya collection.)
- Acknowledgement:* We are very grateful to Dr Kaveh F. Niazi for providing us a complete digital copy of this manuscript gratis.
- L MS Or. 372 from the British Library, London, 419 folia, 31 lines per folio, 13  $\frac{3}{4}$  × 8  $\frac{1}{2}$  inches, Persian Nastaliq in red and black ink, c. seventeenth century. See RIEU (pp. 459b–60b).
- O MS Ind. Inst. Pers. 12 from the Bodleian Library, Oxford, 380 folia, 25 lines per folia, 13  $\frac{1}{4}$  × 9  $\frac{3}{8}$  inches, Persian Nastaliq in red and black ink, c. seventeenth century. See BEESTON (p. 61b, no. 2735).
- Acknowledgement:* We are very grateful to Alasdair Watson, the Bahari Curator of Persian Collections at the Bodleian Library, for providing us a complete digital copy of this manuscript gratis.

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<sup>15</sup> A fuller catalogue description of the extant manuscripts of Mullā Farīd's *Zīj-i Šāh Jahānī* can be found

at [https://ceemsa.hypotheses.org/manuscripts\\_zij\\_i\\_shah\\_jahani](https://ceemsa.hypotheses.org/manuscripts_zij_i_shah_jahani).

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- Q MS 14012 from the Mar<sup>c</sup>ašī Najafī Library, Qom, 409 folia, 29 × 20 cm, Persian Nastaliq written within red and golden ruled margins, decorated headpiece (*sarlawḥ*) above the text on first folio, copied on 10 Dū l-qa<sup>c</sup>da 1082 (March 8, 1672) by Muḥammad Sa<sup>c</sup>īd b. ʿAbd al-ʿAzīz b. Muḥammad Šādiq Zāhid. See **MARASHI** (pp. 457–7; [mis]catalogued as *Zīj-i Raḥīmī*).
- R MS 1218 from the Rampur Raza Library, Rampur, 344 folia, Persian Nastaliq, c. eighteenth century. See **RAMPUR** (p. 344; [mis]catalogued with the accession number ‘1222’).
- S MS Leningrad Univ. no. 97 from the Maxim Gorky Scientific Library of St Petersburg University, St Petersburg, 428 folia, Persian Nastaliq, c. eighteenth century. See **SMANN-ROSEN** (p. 16).

*Acknowledgement:* We very gratefully acknowledge Dr Milana A. Azarkina, the Head of the Asia and Africa Department of the Scientific Library of St. Petersburg State University, for her invaluable assistance in providing us a complete digital copy of this manuscript gratis.

## 2.2 THE *SIDDHĀNTASINDHU* OF NITYĀNANDA MIŚRA

ACCORDING TO MOST RELIABLE CATALOGUES, there are just a handful of near-complete manuscripts of the *Siddhāntasindhu* currently extant.<sup>16</sup>

**MMSM** (pp. 138–143) describes four manuscripts held at the Maharaja Sawai Man Singh II Museum Library at the City Palace in Jaipur that are perhaps the best preserved copies of this text; namely, MSS 4960, 4961, and 4962 from the Khasmohor (HIN: *khās muhar*, lit. special seal) collection and MS 23 from the Museum collection. These three Khasmohor manuscripts are also referenced in **CESS** (A3, p. 173b) as (presumably identical to) three Jaipur (II) manuscripts of 441 ff, 536 ff, and 442 ff,<sup>17</sup> and in **CESS** (A5, p. 184a) as ‘Jaipur (Khasmohor)

<sup>16</sup> A post-colophonic note (in vernacular Hindi) at the end of two manuscripts (MSS Khasmohor 4960 and Museum 23) of the *Siddhāntasindhu* lists nine historical recipients (seventeenth-century Mughal elites) among whom copies of this text were distributed; see Misra (2021: 50–51). However, at the present time, there are only five near-complete manuscripts of the text extant. A fuller catalogue description of the extant manuscripts of Nityānanda’s *Siddhāntasindhu* can be found

at [https://ceemsa.hypotheses.org/manuscripts\\_siddhantasindhu](https://ceemsa.hypotheses.org/manuscripts_siddhantasindhu).

<sup>17</sup> **CESS** (A3, p. 173b) describes three Jaipur (II) manuscripts of 441 ff, 536 ff, and 442 ff. David Pingree, in **CESS** (A2, p. 29b), identified the Jaipur (II) collection as the ‘List of MSS. by Dr. Kunhan Raja of the Jaipur Pothikhana in poss. of V. Raghavan. Handwritten’. In the introduction to his *A Descriptive Catalogue of the Sanskrit Astronomical Manuscripts Preserved at the Maharaja Man Singh II Museum in Jaipur, In-*

4960; 4961; and 4962'. The MS 23 from the Museum collection is also listed in *MJM* (p. 58, Serial No. 249E).

Beyond these four manuscripts, there is a few other manuscripts of the *Siddhāntasindhu* catalogued in *CESS* (A3, p. 173b and A5, p. 184a). Almost all of them are fragmentary copies, with the exception of RORI (Alwar) 2627 (= MS Alwar 2014) held at the Rajasthan Oriental Research Institute in Jodhpur that is attested as being complete; see *RORI* (pp. 602–603, Serial No. 5401E).

### 2.2.1 Manuscripts consulted

In preparing this comparative survey, we consulted three manuscripts of the *Siddhāntasindhu*, of which one is a near-complete copy and two are fragmentary copies.<sup>18</sup> These are briefly described in Table 3.

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*dia*, Pingree describes some of the manuscripts in the Pothikhana collection, instituted by Sawai Jai Singh II, as copies of those from the Khasmohor collection; see *MMSM* (pp. xiii). Therefore, it is quite likely that these three Jaipur (II) manuscripts from the Pothikhana (HIN: *pothī khānā*, lit. library) collection are copies of the three manuscripts from the Khasmohor collection described above, even though the individual manuscripts in these two collections attest to slightly different total number of folia.

<sup>18</sup> The majority of the near-complete manuscripts of the *Siddhāntasindhu* are held at

the Maharaja Sawai Man Singh II Museum Library at the City Palace in Jaipur as a part of the Khasmohor/Museum collection. Despite repeated entreaties over the last several years, we have been unsuccessful in obtaining complete copies of any of these manuscripts, except one (Khasmohor 4960). Regrettably, the board of trustees of the City Palace Museum refuse to provide complete copies of any of the manuscripts in their holdings, and even substantial partial copies (in any digital format) are rarely given to visiting scholars.

Table 3: Description of the manuscripts of the *Siddhāntasindhu*.*Siglum Manuscript Description*

Al MS 2627 (catalogued under Serial No. 5401 E, identical to MS 2014) from the Alwar collection held at the Rajasthan Oriental Research Institute in Jodhpur, 441 folia, 25/26 lines per folia, 28 × 37.5 cm, Sanskrit Nāgarī, writing parallel to the shorter edge and enclosed within framed margins on each folio, bound to the left, copied in 1855 (1912 Vikram Saṃvat), identified as a collection of tables (*sāraṇī-saṃgraha*). See RORI (Alwar) (pp. 604–05) and CESS (A3, p. 173b, and A5, p. 184a).

*Acknowledgement:* We are very grateful to Prof. Kim Plofker for providing me digitised photocopies of 145 folia of this manuscript (containing the text of the preface, the introduction, and the first two parts) to include in this study. These photocopies were originally made for Prof. David Pingree, and the physical copy is stored at the John Hay Library at Brown University (stored in box C-24X, barcode 3-1236-07181-3961, call number 2826).

Kh MS 4962 from the Khasmohor collection held at the Maharaja Sawai Man Singh II Museum Library at the City Palace in Jaipur, 436 folia (incomplete, with missing ff. 1 and 3 and damaged f. 2), 21–30 lines per folio, 37 × 25 cm, Sanskrit Nāgarī script with red and black ink, writing parallel to the shorter edge and enclosed by double-ruled four-sided margins on each folio, bound to the left with side-sewing stitches and held between red-and-blue striped cloth-covered boards and book flap, property of Jagannātha Joṣī acquired for 100 rupees. See MMSM (p. 143)

*Acknowledgement:* We are very grateful to Dr Chandramani Singh, (retired) Director of the Archives of the Maharaja Sawai Man Singh II Museum Library, for her assistance in acquiring a complete digital copy of this manuscript back in 2014.

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Pg A collation of photocopies of parts of two different (unidentified) manuscripts of the *Siddhāntasindhu* held at the John Hay Library at Brown University (stored in box C-50X, barcode 3-1236-07181-4324, old box number 43). According to the 2016 consolidated handlist of manuscripts prepared by Prof. Kim Plofker for the David Pingree collection held at the John Hay Library at Brown University, this copy is tagged as

‘Important work on Islamic math; mentions Nityananda + Shah Jahan, based on Siddhantasindhu.’

The same identification appears on the first page of this collated photocopy in the handwriting of Prof. David Pingree.

The first manuscript in this photocopy—with writing parallel to the long edge as is conventional for Sanskrit *pothī*-like manuscripts—includes the second part (*dvitīyakāṇḍa* or [§ II]) of the canon over ff. 1v–6r, until the end of the fourth chapter (*caturthādhyāya* or [§ II.4]). On the top of f. 1v, Prof. Pingree suspects this manuscript to be ‘BORI 579 of 1895/1902’; however, this identification is inaccurate according to the manuscript catalogue of the Bhandarkar Oriental Research Institute (BORI) in Pune.<sup>19</sup>

*Note:* We describe this information on the first manuscript for reference; we do not, however, include this incomplete manuscript in our comparative survey.

The second manuscript in this photocopy—with writing parallel to the short edge resembling a Persian bound book—includes, inter alia, the entire preface (*grathārambha* or [§ P]), introduction (*granthamukha* or [§ ID]), and the first part (*prathamakāṇḍa* or [§ I]) of the canon, as well as the second part (*dvitīyakāṇḍa* or [§ II]) until the middle of the fourth chapter (*caturthādhyāya* or [§ II.4]) over ff. 1v–18r, 27v, and 28r.<sup>20</sup>

*Note:* Our reference to MS Pg in our comparative survey refers to this second manuscript from this collation of photocopies.

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*Remark:* The (second) manuscript Pg includes marginal text by the scribe that describe some unconventional palaeographic conventions. For example, at the end of the Fourth part of the Introduction (i.e., [§ ID.4]), we find an enumerated list of additions/improvements included in the *Siddhāntasindhu* (translated via a similar list seen in the *Zīj-i Šāh Jahānī*) where the scribe of MS Pg inscribes a ring above the numbers: for instance, ६२ '62' or ७३ '73' on f. 9v. At the end of the list, this convention is explained (in the right margin on f. 10r) as

*atra bindūpalakṣaṇāni mayā likhitāni nānyāni*

Here, no other cypher marks (*bindu-upalakṣana*) [besides these] are written by me.

<sup>19</sup> The manuscript 'BORI 579 of 1895/1902' is a work entitled *Śaṅkuchāyāyābhujasādhanam*, 24 folia, of anonymous authorship.

<sup>20</sup> Judging by the photocopy, and based on what is described in the catalogue *MMSM* (pp. 138–143), we suspect this second man-

uscript to be either Khasmohor 4960 or Museum 23 held at the Maharaja Sawai Man Singh II Museum Library at the City Palace in Jaipur. However, at the time of writing, we have not been able to identify this manuscript definitively.

### 3 TRANSCRIPTION AND TRANSLITERATION SCHEMES

WE ADOPT THE FOLLOWING TRANSCRIPTION/TRANSLITERATION SCHEMES in rendering the Arabic (ARA), Chinese (CHIN), Hindi (HIN), Persian (PER), Sanskrit (SAN), and Turkic (TUR) text in the Roman (Latin) script.

1. The text in Arabic, Persian, and Turkic is transcribed into Latin characters following the transcription scheme adopted as a part of the *Perso-Indica* research and publishing project.<sup>21</sup> Table 4 lists this transcription scheme. As special notes:
  - (a) for Arabic transcription, the article is always transcribed as ‘al-’ and the *alif maqṣūra* is transcribed as ‘-à’ (e.g., مصطفیٰ Muṣṭafà); and
  - (b) for Persian transcription, the *izāfa* is rendered as *-i* or *-yi*; the silent و is transcribed (e.g., خواستن *ḥwāstan*); the final ◦ is not transcribed (e.g., نامه *nāma*); and compound words are separated with a dash (e.g., شاهنامه *Šāh-nāma*).
2. The text in Sanskrit and Hindi is transliterated following the International Alphabet of Sanskrit Transliteration (IAST) scheme. In vernacular Hindi words (typically, in the Devanāgarī renderings of Persian words), certain characters are transliterated into the Latin script using the International Organisation for Standardisation (ISO) 15919 scheme, e.g., ङी is transliterated as *ṅī*, खँ as *khāṁ*, etc. Commonly attested words of Indian origin (e.g., Hindu, Brahmin, Mughal, Varanasi, etc.) are presented without diacritics.

*Remarks:*

- (a) In transliterating Devanāgarī renderings of certain Persian words, especially names, consecutive un-sandhied vowels are indicated with a diaeresis on the terminal (second) vowel to show a separation of words (*padaccheda*); for example, जीचउलगबेगी (parsed as *jīca-ulaga-begī*) is transliterated as *jīcaülagabegī*.
  - (b) Nityānanda has (or, at the very least, the scribes of the three manuscripts consulted have) near-consistently made use of certain Devanāgarī diacritic (from vernacular Hindi) to render particular Persian letters. These include गँ (*gaṁ*) for غ (*ġ*) and य (ya) for ء (*ʿ*). We preserve these choices in this paper; see, e.g., the Sanskrit transliterations *Jīca-bāliḡaṁ* (PER: *Zīj-i bāliġ*) and *Jīca-yilakhānī* (PER: *Zīj-i ilḡhānī*) in Appendix § B.
3. Chinese words are transliterated into Latin following Pinyin (*hànyǔ pīnyīn*).

<sup>21</sup> See <http://www.perso-indica.net>.



Table 4: Chart of Latin transcription of Arabic/Persian characters following the transcription scheme of the project *Perso-Indica*. Courtesy: Fabrizio Speziale.

<i>Letter</i>	<i>Latin transcription</i>	<i>Letter</i>	<i>Latin transcription</i>	<i>Letter</i>	<i>Latin transcription</i>
آ	ā	ر	r	ف	f
ب	b	ز	z	ق	q
پ	p	ژ	ž	ک	k
ت	t	س	s	گ	g
ث	ṭ	ش	š	ل	l
ج	j	ص	ṣ	م	m
چ	č	ض	ẓ	ن	n
ح	ḥ	ط	ṭ	و	v/w <sup>†</sup> or ū/aw (as long vowel/diphthong)
خ	ḫ	ظ	ẓ	ه	h
د	d	ع	ʿ	ی	y or ī/ay (as long vowel/diphthong)
ذ	ḏ	غ	ġ	أ	ʾ

<sup>†</sup> و is transcribed as 'w' in Arabic syntagms.

## 4 A COMPARATIVE SURVEY OF THE CANONS

ZŠJ	[§ P]	[§ P]	SS
ff. 1v–2v D	[Preface] <sup>1</sup>	ग्रन्थारम्भ ( <i>granthārambha</i> , lit. the beginning of the book): Preface	ff. 1r–5v Al
ff. 1v–3r H			ff. 2r–7r Kh
ff. 2v–3v L			ff. 1v–6v Pg
ff. 4v–6r O	[-]	[§ P.1]	SS
f. 1v Q <sup>†</sup>	A corresponding prolegomenon is absent	प्रथमावसर ( <i>prathamāvasara</i> , lit. the first occasion): Prolegomenon	ff. 1r–3r Al
pp. 2–5 R <sup>‡</sup>		Begins with:	ff. 2rv Kh
ff. 1v–2v S			(incomp.)
<sup>†</sup> The Qum manuscript contains only the first page of the prologue.		श्री गणेशाय नमः । <i>śrī gaṇeśāya namaḥ</i>	ff. 1v–3v Pg
<sup>‡</sup> The two folia are badly damaged and the end is missing.		Obeisance to Ganeśa.	
		Ends with:	
		इति ग्रन्थारम्भतः प्रथमावसरः । <i>iti granthārambhataḥ prathamāvasaraḥ</i>	
		Thus ends the prolegomenon from the preface.	

**Remarks** Contains, inter alia,

1. a benediction (*maṅgalācaraṇa*);
2. the genealogy of Šāh Jahān beginning from Timūr;
3. a (shorter) eulogy of Šāh Jahān and Āṣaf Ḥān;
4. the reasons for translating the Persian *Zīj-i Šāh Jahānī* into the Sanskrit *Siddhāntasindhu*;
5. the conversion between the calendrical eras of Vikramārka (Vikram Saṃvat), Śālivāhana (Śāka), Saljūq King Jalāl al-Dīn Malik Šāh I (*jalālī* or *malakī*),

<sup>1</sup> Henceforth, any text enclosed in square brackets indicates an editorial addition not found in the original text. As the Persian text sometimes lacks chapter headings, these have been supplied here inside square

brackets for comparison with the Sanskrit. Additionally, a dash ‘-’ preceding a manuscript siglum (in the margin) is used to indicate the absence of the corresponding chapter in the respective manuscript.

Rūmī (*rūmī* or *sikandarī*), Hijri (*hijarī*, *arabī*, or *cāndrābdagaṇa*), Yazdgirdī (*yajdajiradī*, *kadīmī*, or *pārasī*), and of Šāh Jahān (*śāhajahānī* or *ilāhī*); and

6. a colophon identifying Nityā-nanda's ancestry.

A critical edition with an annotated English translation of the Sanskrit text of the prolegomenon is to appear in Misra (*forthcoming*).

ZŠJ

[§ P.1]

f. 1v D

[حمد (*ḥamd*): Praise of God]

f. 1v H

f. 2v L

f. 4v O

f. 1v Q

p. 2 R

f. 1v S

Begins with:

حمد بی حد خالقى را سزد که مهندس  
قدرت شامله اش در تقویم درجات مخلوقات  
دقیقه از دقایق فرو نگذاشت

*ḥamd-i bī-ḥadd ḥāliqī rā sazaḍ ki  
muhandis-i qudrat-i šāmīla-š dar taqṵm-i  
darajāt-i mahluqāt daqīqa az daqāyīq furū  
naḡudāšht*

Boundless praise is suitable to the Creator whose comprehensive engineering power did not neglect any small detail (*daqīqa az daqāyīq*, lit. minute by minute) in the adjustment (*taqṵm*, also an 'almanac') of the degrees of the creatures.

[§ P.2]

SS

यवनोक्तमङ्गलाचरण (yavanoktamāṅgalā-  
*carāṇa*, lit. a benediction according to  
the Muslims): a Sanskrit translation of  
the Islamic *ḥamd*

Begins with:

अथ यवनोक्तमङ्गलाचरणादिलिखनं । तस्य विश्व-  
कर्तुरपारमहिमा तद्योग्यो ऽस्ति । यस्य शक्तिरेव  
शिल्पादिकलाकलापकोविदा सर्वत्र व्यापिका  
भूतांशपरिस्फुटत्वे कलामेकामपि न तत्याज ।

*atha yavanoktamāṅgalācarāṇādilikhanam |  
tasya viśvakartur apāramahimātadyogyo  
'sti | yasya śaktir eva śilpādikalā-  
kalāpakovidā sarvatra vyāpikā bhūtāṁśa-  
parisphuṭatve kalām ekām api na tatyāja |*

Now, the writing beginning with a benediction spoken by the Muslims. The boundless greatness of that Creator of the world is befitting Him whose very power, an all-pervading [power] adroit in the totality of the arts like [the science of] form etc., did not dismiss even one small part (*ekā-kalā*, lit. one arcminute) in the distinct manifestness (*parisphuṭatva*, contextually, an 'almanac') of the degrees of living beings.

Ends with:

تعالی شانہ و عم احسانہ

*ta‘ālā šānuhu u ‘amma ihsānuhu*

May the eminence of the Almighty be elevated and His benevolence universal.

End with:

अहो परमेश्वरो महानुभावः सर्वफलप्रदः । इत्येवं  
रीत्या यवनैः परमेश्वरस्य स्तुतिः कृता ।*aho parameśvaro mahānubhāvaḥ sarva-  
phalapradaḥ | ityevaṃ rītyā yavanaiḥ  
parameśvarasya stutiḥ kṛtā |*

“O God, the Almighty One, the Giver of all benefactions”, thus in this way the praise of God is accomplished by the Muslims according to custom.

ZŠJ

[§ P.2]

[*na<sup>ct</sup>*]: Praise of the Prophet]

f. 1v D

f. 1v H

f. 2v L

f. 4v O

f. 1v Q

p. 2 R

f. 1v S

Begins with:

و صلوات بی غایت بر مرکز دایره نبوت و  
قطب سپهر رسالت  
*u ṣalāt-i bī-ḡāyat bar markaz-i dāyira-yi  
nubuṣṣat u quṭb-i sipihr-i risālat*

Endless blessings be upon the centre of the circle of prophethood (*nubuṣṣat*) and pole of the celestial sphere of apostleship (*risālat*).

Ends with:

و علی اصحابه الراشدين المهديين که  
از حدیث اصحابی کالنجوم باہم اقتدیتم  
اقتدیتم وصف ہدایت شان پیدا

*u ‘alā aṣḥābihi l-rāšidīn al-mahdiyyin ki  
az ḥadīṭ aṣḥābī ka-l-nujūm bi-ayyahum*

[§ P.3]

भगवद्भक्तवचन (bhagavadbhaktavacana, ff. 3rv Al  
lit. the sayings of the Devotee of God, ff. 4rv Kh  
i.e., of the Prophet): a Sanskrit translation of an Islamic *na<sup>ct</sup>*, citing hadiths. ff. 3v-4r Pg

Begins with:

अथ भगवद्भक्तमण्डलकेन्द्ररूपस्य दौत्यकृद्भ्रपञ्जर-  
ध्रुवसदृशस्य मुनेरुपरिभगवतः कृपानन्तास्ति यत् ।  
*atha bhagavadbhaktamaṇḍalakendra-  
rūpasya dautyakṛḍbhapañjaradhruva-  
sadṛśasya muner upari bhagavataḥ  
kṛpānantāsti yat |*

Now, endless compassion of God is what is [shown] over the Seer who is the centre of the circle of the prophets of God (*bhagavadbhakta*) [and] resembles the pole of the sphere of asterisms of messengers (*dautyakṛt*).

Ends with:

पुनर्दृष्टमार्गाणामन्यमार्गदर्शकानां भगवद्भक्त-  
मित्राणामुपरिभगवतः कृपा भवन्ति । मम  
मित्राणि नक्षत्रतुल्यानि भवन्ति भो लोका  
यमनुसरिष्यथतमवश्यं प्राप्स्यथेति भगवद्भक्त-  
वचनादेतेषां मार्गदर्शित्वकीर्तिः प्रकटास्ति ।

*punar dṛṣṭamārgāṇām anyamārga-  
darśakānāṃ bhagavadbhaktamitrāṇām*

*iqtadaytum ihtadaytum vaṣf-i hidāyat-aṣān paydā*

And [may God's praise be] on his rightly guided companions whose guidance is described with this hadith: "My companions are like the stars; whomever among them you follow, you will be rightly guided."

*upari bhagavataḥ kṛpā bhavanti | mama mitrāṇi nakṣatratulyāni bhavanti bho lokā yam anusariṣyatha tam avaśyam prāpsyatheti bhagavadbhaktavacanād eteṣāṃ mārgadarśitvakīrtiḥ prakāṣṭi |*

Moreover, the compassions of God are over the companions of the Prophet who are the others guides of valid paths. "My companions are like asterisms: O people, whom[ever] you will follow, you will certainly obtain [right guidance in] him," from such a statement of the Prophet [from the hadith,] the glory of guidance of these [companions of the Prophet] is manifest.

ZŠJ

[§ P.3]

ff. 1v-2r D

[In praise of Šāh Jahān and his regnal era]

f. 2r H

ff. 2v-3r L

Begins with:

ff. 4v-5r O

f. 1v Q

اما بعد چون بعنایت بی نهایت حضرت بادشاه علی الاطلاق خدیو کیوان رفعت...  
*ammā baʿd čūn ba ʿināyat-i bī-nihāyat-i ḥazrat-i bādšāh-i ʿalā l-iṭlāq ḥadīv-i kayvān-rafcāt...*

p. 3 R

Thus it starts: since by the endless grace of the Absolute Emperor, the King who is Saturn-like in elevation,...

ff. 1v-2r S

Ends with:

روز دوشنبه<sup>2</sup> هشتم جمید الثانی سنه ۱۰۳۷ هزار و سی و هفت هجری بر سریر سلطنت و خلافت جلوس فرمودند و مبدء تاریخ جدید سعید الهی شاهجهانی در تقاویم و تواریخ ازین سال خجسته مآل نمودند و آغاز نفاذ امور مملکت بران ساعت سعادت انجام نهادند و همین تاریخ دستور العمل کارگزاران

[§ P.4]

[In praise of Šāh Jahān and his regnal era]

SS

ff. 3v-4v Al

ff. 4v-5v Kh

ff. 4r-5r Pg

Begins with:

अथ यदि सकलब्रह्माण्डनायकस्यानन्तकृपया शनिकक्षोच्छ्रायवन्महान्...

*atha yadi sakalabrahmāṇḍanāyakyasyā-nantakṛpayā śanikakṣocchrāyavan mahān...*

Now, if by the infinite grace of the Lord of the entire universe, the Noble One, possessing an elevation like the orbit of Saturn,...

End with:

सप्तत्रिंशदुत्तरसहस्रप्रमिते १०३७ हिजरीशके वर्तमाने जमीदलसानीमासे मध्यमाख्याष्टमदिवसे सोमवासरे सराज्याभिषेकं प्राप्तवान्सिंहासने तस्थौ ततः प्रभृति शाहजहानी नवीनः समीचीनः शाकः पञ्चाङ्गपत्रेषु लोकव्यवहारेषु च प्रवृत्तस्तदा प्रभृति राज्यकार्यपरिचालनारंभो जातः । पुनरयं शाको राज्यभारग्रहणसमर्थानामभ्यासेन दिक्षु विदिक्षु च प्रसिद्धो ऽभूत् ।

بارگاه سلطنت شد چنانچه در اطراف و اکناف  
عالم شیوع یافت

*rūz-i dū-šanba<sup>2</sup> haštum-i jumayd al-tānī*  
*sana 1037 hazār u sī u haft hijrī bar*  
*sarār-i salṭanat u ḥilāfat julūs farmūdand*  
*u mabda<sup>2</sup>-i tāriḥ-i jadīd-i sa‘īd-i ilāhī-yi*  
*šāh-jahānī dar taqāwīm u tavārīḥ az īn sāl-i*  
*ḥujasta-ma‘āl namūdand u āgāz-i nafāḍ-i*  
*umūr-i mamlakat bar ān sā‘at-i sa‘ādat-*  
*anjām nihādand u hamīn tāriḥ dastūr*  
*al-‘amal-i kār-guzārān-i bārgāh-i salṭanat*  
*šud čunānčī dar aṭrāf u aknāf-i ‘ālam šuyū<sup>c</sup>*  
*yāft*

On Monday,<sup>2</sup> the eighth of the month of Jumayd al-tānī, the year 1037 of Hegira, [Šāh Jahān] sat on the imperial and caliphal throne. He set the beginning of a new fortunate era [called] the Divine [era] of Šāh Jahān (*ilāhī-yi šāh-jahānī*) in the almanacs (*taqāwīm*) and chronicles (*tārīḥ*) [counting] from this auspicious year. He started to implement sovereign affairs on this blessed hour. This same date became administrative practice for the officers of the imperial court since it gained publicity in every part of the world.

**Remark** Contains, inter alia, ten verses praising Emperor Šāh Jahān and his full regnal name:

<sup>2</sup> Manuscripts S and L insert here the following:

مطابق اول ۵۵۰ ناقص جلالی

*saptatrimśaduttarasahasrapramite 1037*  
*hijariśake vartamāne jamīdalasānīmāse*  
*madhyamākhyāṣṭamadivase somavāsare*  
*sarāyābhiṣekaṃ prāptavān siṃhāsane*  
*tasthau tataḥ prabhṛti śāhajahānī navīnaḥ*  
*samīcīnaḥ śākaḥ pañcāṅgapattreṣu*  
*lokavyavahāreṣu ca pravṛttas tadā*  
*prabhṛti rājyakāryaparicālanāraṃbho*  
*jātaḥ | punar ayaṃ śāko rājyabhāra-*  
*grahaṇasamarthānām abhyāseṇa dikṣu*  
*vidikṣu ca prasiddho ‘bhūt |*

In the year 1037 of the Hijri era (*hijariśaka*) in the present time, in the month of Jumayd al-tānī (*jamīdalasānī*), on the eighth day called the middle [of the lunar fortnight], on Monday, obtaining that royal unction, [Emperor Šāh Jahān] was established on the throne, [and] from that moment, the new true era [called] Šāh Jahānī circulated in the almanacs (*pañcāṅgapattra*) and common customs (*lokavyavahāra*), [and] from that point its circulation in state affairs commenced. Moreover, this era became famous in all directions [of the world] on account of [its] use in undertaking and sustaining the weight of the [duties of the] state.

**Remark** Contains, inter alia, ten verses praising Emperor Šāh Jahān and his full Persian regnal name (in Devanāgarī):

*muṭābiq-i avval 550 nāqīṣa jalālī*

equal to the first incomplete [year] 550 [of the] Jalālī era

ابو المظفر شهاب الدين صاحب قران ثانی  
شاهجهان بادشاه غازی  
*abū l-muzaffar šihāb al-dīn ṣāhib qirān-i*  
*ṭānī śāh-jahān bādšāh-i ḡāzī*

Father of the victorious, Star of faith,  
Lord of the second conjunction, King of  
the world (*śāh-jahān*), Emperor, Con-  
queror.

अबल-मुजफर-शाहिब्बदीन-महम्मद-साहिब-  
किरान-सानी-शाहजहा-बादिशाह-गाजी  
*abala-mujaphara-śāhibbadīna-mahammada-*  
*sāhiba-kirāna-sānī-śāhajahā-bādīśāha-gājī*

ZŠJ  
ff. 2rv D  
ff. 2r-3r H  
ff. 5r-6r O  
ff. 3rv L  
f. - Q  
pp. 3-5 R  
ff. 2rv S

[§ P.4]  
[In praise of Āṣaf Ḥān and the commis-  
sioning of a new *zīj* named after Śāh  
Jahān]

Begins with:

درین اثنا بخاطر خطیر و ضمیر فیض پذیر...  
*dar īn atnā ba ḥaṭīr-i ḥaṭīr u zamīr-i fayz-*  
*padīr...*

In this moment, [it came] to the es-  
teemed and gracious mind [of Āṣaf  
Ḥān]...

Ends with:

ملتمس از محققان و مدققان این فن آن است  
که چون بر سهوی و نسیانی که لازم انسان  
است اطلاع یابند آنچه از تقویم و تعدیل  
خارج باشد بقلم کریم تصحیح فرموده بذیل  
عفو در پوشند فمن عفی واصلح فاجرہ علی  
الله

*multamas az muḥaqqiqān u mudaqqiqān-i*  
*īn fann ān ast ki cūn bar sahvī u nisyānī*  
*ki lāzim-i insān ast iṭṭilā<sup>c</sup> yāband āncī az*  
*taqṣīm u ta<sup>c</sup>dīl ḥārij bāśad ba qalam-i karīm*  
*taṣḥīḥ farmūda ba ḍayl-i ‘afw dar pūśand*  
*fa-man ‘afū wa-aślahā fa-ajruhu ‘alā llāh*

[§ P.5]  
[In praise of Āṣaf Ḥān and the commis-  
sioning of a new *siddhānta* named after  
Śāh Jahān]

Begins with:

एतस्मिन्तरे प्रसन्नहृदयस्य जगत्प्रयोजितदयस्य  
महामात्यप्रधानस्य...  
*etasmin antare prasannahrdayasya jagatprajoyitadayasya*  
*mahāmātyapradhānasya...*

After this event, [Āṣaf Ḥān] of a de-  
lightful heart, the one who is compas-  
sionately attached to the world, the ex-  
alted Prime minister...

Ends with:

अथैतच्छास्त्रसारकोविदान्प्रति विज्ञप्तिश्चैयं  
केयमुच्यते यदि कुत्रापि मनुष्यधर्मत्वान्मम  
भ्रान्तिमशुद्धत्वं वा भवन्तः पश्यन्ति तदा  
कृपालेखन्या शोधनं च कृत्वापराधक्षमण-  
रूपपटान्तरेण च पिधाय रक्षन्तु । यः कश्चिद-  
पराधक्षमणं करोति शोधयति चेति तस्मै प्रत्यु-  
पकारवेतनफलमीश्वरो दास्यतीश्वरो ब्रूते ।

*athaitacchāstrasāraḥkovidān prati vijñaptiś*  
*ceyaṃ keyam ucyate yadi kutrāpi*  
*manuṣyadharmatvān mama bhrāntim*  
*aśuddhatvaṃ vā bhavantaḥ paśy-*  
*anti tadā kṛpālekhanīyā śodhanam ca*  
*kṛtvāparādhakṣamanarūpapaṭāntareṇa ca*  
*pidhāya rakṣantu | yaḥ kaścid aparādha-*

*kṣamaṇaṃ karoti śodhayati ceti tasmai  
praty upakāravetanaphalam īśvaro dāsyā-  
tīśvaro brūte |*

[My] request to scholars who verify and scrutinise this discipline is the following: when they come across the errors and lapses which are inherent in humanity, may they correct with a gentle pen everything that deviates from the almanac (*taqvīm*) and adjustment (*ta<sup>c</sup>dīl*) [i.e., the corrective equations to mean positions] and hide it under the hem of their pardon. Whoever forgives and corrects, his recompense lies with Allah.

And now what is [my] request towards those learned in the essence of this science [of *vyotiṣa*], this is said: when, anywhere [in this text], they find my error or inaccuracy on account of the inherent nature of man, may they then examine it with a compassionate pen, and having made the correction and having covered it within the hem of [their] patience for transgressions, may they hide it. And thus, whoever patiently endures transgressions and corrects, God (*īśvara*) will give the fruit of favourable returns to him—thus proclaims God.

**Remarks** Contains, inter alia,

1. epithetic praise of Āṣaf Ḥān; ending with his titular name:

مقرب حضرت سلطانی یمن الدوله  
آصفجاهی آصفخان  
*muqarrab-i ḥazrat-i sulṭānī yamīn  
al-dawla āṣaf-jāhī āṣaf-ḥān*

Intimate of His Imperial Majesty,  
Right hand of the State Āṣaf Jāhī,  
Āṣaf Ḥān;

2. statements on the commissioning of a new *zīj* named after Šāh Jahān;
3. the name of its author Mullā Farīd:

فرید ابراہیم دہلوی  
*farīd ibrahīm dihlovī*

**Remarks** Contains, inter alia,

1. epithetic praise of Āṣaf Ḥān (*āsaphakhāna*), ending with his titular name:

प्रभुनिकटवर्तिनो दक्षिणसम्पत्तिरासफ-जाही-  
आसफ-खान  
*prabhunikaṭavartino dakṣiṇa-  
sampattir-āsapha-jāhī-āsapha-khāna*

Remaining close to the Lord [i.e., near Šāh Jahān], the Right hand of prosperity Āṣaf Jāhī, Āṣaf Ḥān;

2. statements on the commissioning of a new *siddhānta* named after Šāh Jahān;
3. the Sanskrit translation of the name of its author Mullā Farīd:

मुल्ला-फरीद-इबराहीम-पुत्र-दिल्ली-निवासिन  
*mullā-pharīda-ibarāhīma-putra-  
dhillī-nivāsin*



- Farīd, [son of] Ibrāhīm, of Delhi;
4. thirty distichs on the composition of this *zīj*;
5. the complete title of the *Zīj-i Šāh Jahānī*:
- کارنامه صاحب قران ثانی زیج  
شاهجهانی  
*kārnāma-yi ṣāḥib qirān-i t̄ānī zīj-i šāh-jahānī*
- The Great Work of the Second Lord of Auspicious Conjunction, the *Zīj* of Šāh Jahān; and
6. an entreaty to the readers to correct any shortcoming in the text.
- Mullā Farīd, son of Ibrāhīm, inhabitant of Delhi;
4. thirty verses in praise of the distinction of this text;
5. the Devanāgarī transcription of the full Persian title of the *Zīj-i Šāh Jahānī*:
- कारनामै-साहिव-किरान-सानी-जीच-शाह-जहानी  
*kāranāmai-sāhiba-kirāna-sānī-jīca-šāhajahānī*; and
6. an appeal to the readers to correct any errors in the text.

ZŠJ

ff. 2v–5v D

ff. 3r–6v H

ff. 3v–6v L

ff. 6r–9v O

f. – Q

pp. 5–8 R

ff. 2v–6r S

[§ ID]

مقدمه (*muqaddama*):**Introduction**

Begins with:

در بیان آنچه پیش از شروع این کتاب دانستن  
آن ضروری است و آن مشتمل است بر پنج

قسم

*dar bayān-i ānči piš az šurū<sup>c</sup>-i īn kitāb  
dānistan-i ān žarūrī ast u ān muštamil ast  
bar panj qism*

On what needs to be known before starting this book. It contains five parts (*qism*).

[§ ID]

**ग्रन्थमुख (granthamukha, lit. the mouth of the book): Introduction**

Begins with:

अथेदं पुस्तकं ग्रन्थमुखेन चतुर्भिः काण्डैश्च  
निबध्यते । ग्रन्थमुखं किमिति कथ्यते । यद्ग्रन्था-  
रम्भतः प्रागेवोपेक्षितं भवति तत्पञ्चप्रकारं वर्तते ।

*athedaṃ pustakaṃ granthamukhena  
caturbhiḥ kāṇḍaiś ca nibadhyate |  
granthamukhaṃ kim iti kathyate | yad-  
granthārambhataḥ prāgevopekṣitaṃ  
bhavati tatpañcaprakāraṃ vartate |*

Now, this book is bound with the Introduction (*granthamukha*, lit. the mouth of the book) and with four parts (*kāṇḍa*). What is the Introduction, that is [now] said: what is indeed regarded as succeeding the preface (*granthārambha*), that [Introduction] exits in five parts (*pañcaprakāra*, lit. five kinds).

SS

ff. 5v–10r Al

ff. 7r–12r Kh

ff. 6v–10v Pg

ZŠJ

ff. 2v–3v D

ff. 3rv H

ff. 3v–4r L

ff. 6r–7r O

f. – Q

f. – R

ff. 3rv S

[§ ID.1]

قسم اول (*qism-i avval*):**First part**

Begins with:

در بیان آنکه رصد و زیج و تسهیل و تقویم  
چیست و در دانستن آنها چه فایده

*dar bayān-i ānki raṣad u zīj u tashīl u  
taqvīm čīst u dar dānistan-i īnhā čī fāyida*

On the question of observation (*raṣad*), tables (*zīj*), simplification (*tashīl*) and almanac (*taqvīm*) and on the advantage of knowing them.

[§ ID.1]

**प्रथमप्रकार (prathamaparakāra, lit. the first kind): First part**

Begins with:

प्रथमप्रकारे रसद इति वेधः । जीच इति  
सिद्धान्तः । तसहील इति सारणी । तकवीम इति  
ग्रहस्फुटत्वमेतेषां लक्षणं प्रयोजनं च ।

*prathamaparakāre rasada iti vedhaḥ | jīca iti  
siddhāntaḥ | tashīla iti sārāṇī | takavīma  
iti grahasphuṭatvam eteṣāṃ lakṣaṇaṃ pra-  
yojanaṃ ca |*

In the first part, the definition and purpose of these [topics such as] *rasada* meaning insight (*vedha*, lit. piercing), *jīca* meaning a canon (*siddhānta*), *tashīla* meaning a [simplification] table (*sārāṇī*), and *takavīma* meaning

SS

ff. 5v–7r Al

ff. 7r–8v Kh

ff. 6v–8r Pg

the true position of a celestial object (*grahasphuṭatva*) [i.e., an almanac].

**Remarks** Contains, inter alia,

1. a definition of the technical term *raṣad*:

مخفی نماند که رصد عبارت است از نظر کردن در احوال اجرام علوی بآلات مخصوصه چون لبینه و سدس فخری و ذات الشعبتین و ذات الثقبیتین و ذات الحلقه و ذات الحلق و غیر آنکه حکما بجهت این غرض وضع کرده اند تا بدان آلات دانسته شود مواضع ستارگان در فلک و مقدار حرکات ایشان در طول و عرض و ابعاد آنها از یکدیگر و از زمین و بزرگی و کوچکی اجرام آنها و آنچه بدان ماند

*mahfī namānad ki raṣad ʿibārat ast az nazar kardan dar ahvāl-i ajrām-i ʿulvī ba ālāt-i mahṣūṣa čun libna u suds-i fahrī u dāt al-šūbatayn u dāt al-tuqbatayn u dāt al-ḥalqa u dāt al-ḥilaq u ġayr-i ān ki ḥukamā ba jihat-i īn ġaraḥ vaḥ<sup>c</sup> karda and tā badān ālāt dānista šavad mavāzi<sup>c</sup>-i sitāragān dar falak u miqdār-i ḥarakāt-i īšān dar ḥūl u ʿarḥ u abʿād-i ānhā az yak-dīġar u az zamīn u buzurgī u kūčakī-yi ajrām-i ānhā u ānči badān mānad*

It is well known that observation (*raṣad*) designates the action of observing the states of celestial objects with specific instruments, such as the quadrant (*libna*), Fahr

**Remarks** Contains, inter alia,

1. a description of the technical term *rasada* (PER: *raṣad*):

यत्पूर्वाचार्यै रचितं लिबनै । सुदसफखरी । जातलशावतैन । जातलशुकवतैन । जातलहिलक । जातलहलका । चेत्यादि यन्त्रवेधयोग्यं तेन यन्नक्षत्रग्रहबिम्बसंस्था विलोकनं तद्रसद इत्यभिधीयते । तेनाकाशे दैर्घ्यविस्तारयोः को ऽर्थो मेषाद्यस्फुटत्व-शरयोर्ग्रहसंस्थितभुक्तिपरिमाणं पुनर्ग्रहाणां परस्परान्तरं पुनर्भूगर्भग्रहबिम्बयोरन्तरा-भिधः कर्ण इति पुनर्नक्षत्रग्रहबिम्बन्यूना-धिकत्वमन्यदपि ज्ञातुं शक्यते ।

*yatpūrvačāryai racitaṃ libanai | sudasaphakharī | jātalaśāvataina | jātalaśukavataina | jātalahilaka | jātalahalakā | cetyādi yantra-vedhayogyam tena yannakṣatragrahabimbasaṃsthā vilokanam tadrasada ity abhidhīyate | tenā-kāṣe dairghyavistārayoḥ ko ʿrtho meśādyasphuṭatvaśarayor grahasaṃsthitabhuktīparimānaṃ punar grahāṇāṃ parasparāntaraṃ punar bhūgarbhagrahabimbayor antarā-bhidhaḥ karṇa iti punar nakṣatragrahabimbanyūnādhiakatvam anyad api jñātum śakyate |*

What things like quadrants (*libana*), Fahr al-Dawla's sextant (*sudasa-phakharī*), the triquetrum (*jātala-śavataina*), the dioptra (*jātala-śukavataina*), the armillary

al-Dawla's sextant [created by al-Ḥujandī] (*suds-i faḥrī*), the triquetrum (*dāt al-šūbatayn*), the dioptra (*dāt al-ṭuqbatayn*), the armillary ring (*dāt al-ḥalqa*), the armillary sphere (*dāt al-ḥilaq*) etc., which scientists have invented for this purpose, so that by them they may know the positions of the stars on the sphere, the measure of their movements in longitude and latitude, their distance from one another and from the Earth, their size, big or small, and such things;<sup>3</sup>

sphere (*jātala-hilaka*), the armillary ring (*jātala-halakā*) etc. were conceived by earlier teachers, [they are] useful observational instruments (*yantra-vedha-yogyā*, lit. useful in fixing the position of celestial objects by mechanical contrivances). [And] with them, observing the arrangement of the planetary discs and constellations is what is known as *rasada*.<sup>4</sup> What is the use of it in [understanding] the length and breadth in the sky? The measure of the daily motion of the planets in [terms of their ecliptic] latitude and longitude; and the mutual distance between planets; and again the hypotenuse called the distance between the disc of a planet and the Earth's centre, and the largeness or smallness of the discs of the planets and stars; and even other [such things] can be known [by *rasada*];

2. an account of earlier astronomers who made observations: namely,
  - (a) Hipparchus (*abarḥus*) who made his observations around 1400 years before the beginning of Ilkhanid observations;

2. an account of earlier astronomers who made observations: namely,
  - (a) Hipparchus (*abarakhusa*) [of Nicaea];

<sup>3</sup> See, e.g., S. R. Sarma (2019:1486) for an account of some of the Indo-Persian astronomical equipment, including the ones listed here.

<sup>4</sup> See, e.g., K. V. Sarma (1985: 22) for a list of (near-)identically named astronomical instruments created by Maharaja Sawai Jai Singh (1686–1743) of Jaipur.

- (b) Ptolemy (*baṭlamīyūs*), the author of the *Almagest*, who made his observations in Alexandria 280 years after Hipparchus;
- (c) Caliph al-Maʿmūn (*māmūn ḥalīfa*) who made his observations around 430 years before the beginning of Ilkhanid observations;
- (d) Unnamed astronomers who made the Ilkhanid observations (*raṣad-i īlhānī*) in Maragha;
- (e) al-Battānī in Syria;
- (f) [Ibn Yūnus] the author of the *Zīj-i ḥākīmī* composed in Egypt;
- (b) Ptolemy (*batlamayūsa*), the author of the *Almagest* (*mu-jasti*), who made his observations in the city of Alexandria (*sikandarīya-nagara*) 280 years after Hipparchus;
- (c) The Abbasid Caliph al-Maʿmūn (*māmūn-khalīphai*) who made observations in the region of Baghdad (*baḡadāda-deśa*) 690 years after Ptolemy;
- (d) Unnamed astronomers who made the Ilkhanid observations (*īlakhānī-rasada*) in the city of Maragha (*marāḡam-nagara*) 430 years after al-Maʿmūn;
- (e) al-Battānī (*battānī*) in Syria (*śāma-deśa*) who worked near-contemporaneously to the time of the Il-ḥanid observations;
- (f) [Ibn Yūnus] the author of the *ḥākīmī zīj* composed in Egypt (*misara-deśa*) contemporaneous to Il-ḥanid observations;

(g) Ibn al-A<sup>c</sup>lam in Baghdad;<sup>5</sup>  
and

(h) Uluġ Bīg the king-  
astronomer leading the  
Mīrzā<sup>ʔ</sup>i observations in  
Samarqand;

3. a praise of Mīrzā Uluġ Bīg, the  
author of the *Zīj-i Uluġ Bīg* (alias  
*Zīj-i Sulṭānī*):

سلطان اعظم خاقان اكرم قطب سپهر  
سلطنت شمس جهان معدلت الجامع  
بين الدين والدولة العارف بلعلوم  
والمعقولة والمعقولة مكمل علوم  
الحساب والعدد كاشف مفصلات  
التحرير والرصد الغ بيگ ميرزا طاب  
شاه كه از ابای كرام اين شهنشاه  
عالميان است باتفاق اكثر علمای  
متبحر كه هر يك بى نظير زمانه  
بودند بدقايق و لطايف و تحقيقات  
تمام باتمام رسانيده اند

*sulṭān-i a<sup>c</sup>zam hāqān-i akram  
qutb-i sipihr-i salṭanat šams-i  
jahān-i ma<sup>c</sup>dalat al-jāmi<sup>c</sup> bayna  
l-dīn wa-l-dawla al-<sup>c</sup>ārif bi-l-<sup>c</sup>ulūm  
al-manqūla wa-l-ma<sup>c</sup>qūla mukam-  
mil <sup>c</sup>ulūm al-ḥisāb wa-l-<sup>c</sup>adad*

<sup>5</sup> Mullā Farīd states that none of the above mentioned observations were complete; the only complete set of observations is the Mīrzā<sup>ʔ</sup>i observations of Uluġ Bīg.

(g) Ibn al-A<sup>c</sup>lam (*ibanala-ālama*)  
who made observations  
in the region of Baghdad  
बगदाद-देश (*bagadāda-deśa*)  
contemporaneous to Il-ḥa-  
nid observations;<sup>6</sup> and

(h) Mīrzā Uluġ Bīg in the city  
of Samarqand (*mirajā-  
ulaga-bega*) who made  
observations in Samarqand  
(*samarakanda-deśa*);

3. a praise of Mīrzā Uluġ Bīg, the  
author of the *Zīj-i Uluġ Bīg* (alias  
*Zīj-i Sulṭānī*):

...किंतु समर्कन्दनगरे महाराजाधिराजस्य  
महोदास्य राज्याकाशध्रुवस्य न्याय-  
लोकभास्करस्य राज्यलक्ष्मीधर्मग्राहकस्य  
शब्दयुक्तिशास्त्रप्रवीणस्य गणितकलासर्वज्ञ-  
कल्पस्य शिल्पशास्त्ररसदशास्त्रसूक्ष्मप्रमेय-  
प्रकाशकस्य मिरजाउलुगवेगस्य रसदइति  
को ऽर्थो यन्त्रविशेषैर्ग्रहसमस्तनक्षत्रवेध  
आसीत् । परमेश्वरस्तस्य स्वर्गवासं  
करोतु । एतस्यैवास्माकं प्रभोर्महाराजा-  
धिराजस्य कुले पितामहादिषु पूर्वज  
आसीत् । तस्मिन्नेव समये महातन्त्र-  
विद्भिरनन्योपमैर्विषया समुद्रसदृशैरन्यैरपि  
मिलित्वा सग्रहादिवेधोविधाय संपूर्णीकृतः ।

*...kiṃtu samarkandanagare mahā-  
rājādhirājasya mahodāsya rājyākāśa-  
dhruvasya nyāyalokabhāskarasya  
rājyalakṣmīdharmagrāhakasya śabda-  
yuktiśāstrapravīṇasya gaṇitakalā-  
sarvajñakalpasya śilpaśāstrarasada-*

<sup>6</sup> Like Mullā Farīd, Nityānanda also states that none of the above mentioned observations were complete in all respects; the only complete observations are those made by Mīrzā Uluġ Bīg.

*kāšif mufaṣṣalāt al-tahrīr wa-l-raṣad uluġ bīg mīrẓā ṭāba ṭarāhu ki az abā-yi kirām-i īn šahanšāh-i ʿālamīyān ast ba ittifāq-i akṭar-i ʿulamā-yi mutabaḥḥir ki har yak bī-nazīr-i zamāna būdand ba daqāyiq u laṭāyif u taḥqīqāt tamām ba itmām rasānīda and*

The supreme ruler, the noblest king, the pole of the sphere of kingship, the Sun of the world of justice, the uniter of faith and power, the knower of traditional and rational sciences, the perfecter of the sciences of computation and numbers, the unveiler of the details of writing and observation, Uluġ Bīg Mīrẓā—May the soil [of his grave] be fragrant—who is amongst the noble fathers of this emperor of men, with the collaboration of the many of the most learned men, every one of whom were peerless in their time, has brought to perfection every subtle and delicate point of research;

*śāstrasūkṣmaprameyaprakāśakasya mirajāulugabegasya rasadaīti ko ʿrtho yantraviśeṣair grahasamastanakṣatravedha āsīt | parameśvaras tasya svargavāsam karotu | etasyai-vāsmākaṃ prabhor mahārājā-dhirājasya kule pitāmahādiṣu pūrvaḥ āsīt | tasminn eva samaye mahātantravidbhir ananyopamair vidyayā samudrasadrśair anyair api militvā sagrahādivedho vidhāya sampūrṇīkr̥taḥ |*

...but in the city of Samarqand, the observation (*rasada*) of Mīrẓā Uluġ Bīg, the one who is the king among kings; the mighty one; the pole of the sky of kingship; the Sun of the world of justice; the one who seizes the faith and good fortunes of the kingdom; the one versed in the sciences, reasoning, and speech; the one competent knowing all things in the mathematical arts; the illuminator of the subtle topics in the science of *rasada* and of form, was the one who was capable of providing insight [about the true positions of] constellations and all the planets with special [astronomical] instruments. May God give him residence in heaven. He was an ancestor among the grandfathers in the ancestral lineage of my lord [Šāh Jahān], this very King among kings. At that very time, having collaborated with many of those most knowledgeable in the sciences, the ones who are unique in resembling oceans with knowledge, [Uluġ

4. the definition of observational *zījes* (*zīj-i raṣādī*):

چون حرکات کواکب بحسب اصول  
رصدی معلوم کنند و بجداول در  
کتابی مضبوط گردانند آنرا زیج  
رصدی خوانند چنانچه زیج الغ بیگ  
و آنرا زیج سمرقندی و زیج  
گورگانی نیز گویند و آن  
مشمتمل است بر اعمال تحقیقی  
مثل جیب یک درجه که بنای  
عمل جدول جیب و ظل بران است  
و الی یومنا هذا هیچکس بطریق  
برهانی استخراج نکرده و همه  
حکما تصریح کرده اند با آنکه  
طریق عمل استخراج آن نیافته  
اند و حیلہ کرده بتقریب بدست  
آورده اند و غیر آن از اعمال  
کثیره

*čün ḥarakāt-i kavākib ba ḥasb-i  
uṣūl-i raṣādī maʿlūm kunand u ba  
jadāvil dar kitābī maẓbūṭ gardānand  
ān rā zīj-i raṣādī ḥwānand čunānči  
zīj-i uluḡ biḡ u ān rā zīj-i samar-  
qandī u zīj-i gūrgānī nīz gūyand u  
ān muštamil ast bar aʿmāl-i taḥqīqī  
mitl-i jayb-i yak-daraja ki binā-yi  
ʿamal-i jadval-i jayb u zill bar ān  
ast u ilā yawminā hādā hič-kas ba  
ṭarīq-i burhānī istiḥrāj nakarda u  
hamā ḥukamā taṣrīḥ karda and bā ān  
ki ṭarīq-i ʿamal-i istiḥrāj-i ān nayāfta  
and u ḥīla karda ba taqrīb ba dast  
āvarda and u ḡayr-i ān az aʿmāl-i  
kaṭīra*

Big] brought to completion the  
insight beginning with the plan-  
ets etc. for the sake of piercing  
[the truth];

4. a description of observational  
*zījes* or *rasadī-jica* (PER: *zīj-i  
raṣādī*):

यद्रसदविधानेन ग्रहभुक्तिमानीयकोष्ठकै-  
द्वेदीकृत्य तन्नं लिख्यते तस्य नाम  
जीचरसदीति व्याख्यायते । यथा जीच-  
उलगवेगी अस्यैव नाम जीचसमरकन्दी  
पुनः कोर्गानी चेति कथ्यते । तदिदं  
पुस्तकं सूक्ष्मसूक्ष्मगणितप्रमेयैर्युतमस्ति  
यथा प्रत्येकांशस्य जीवा सर्वगणितस्य  
छाया प्रभृतेर्मूलमस्ति पुनरध यावत्केनापि  
वासनया सा न कृता किंतु सर्व एवाचार्या  
एवमेव जगुर्ज्यायाः साधने वासनया प्रकारः  
केनापि न लब्धः योज्यानयने प्रकारः कृतः  
स सर्वो वास्तवेन न किंतु स्थूलः कृतः ।  
अस्मिन्ग्रन्थे सा ज्या प्रत्येक कलाया  
वासनामार्गेण कृतान्यदपि तथैव । इति  
रसदीजिचविवरणम् ।

*yad rasadavidhānena grahabhukti-  
mānīyakoṣṭhakair dṛḍhikṛtya  
tantraṃ likhyate tasya nāma  
jīcarasadīti vyākhyāyate | yathā  
jīcaūlagabegī asyaiva nāma jīca-  
samarakandī punaḥ korgānī ceti  
kathyate | tad idam pustakaṃ  
sūkṣmasūkṣmagāṇitaprameyair  
yutam asti yathā pratyekāṃśasya  
jīvā sarvagāṇitasya chāyāprabhṛter  
mūlam asti punar adha yāvat  
kenāpi vāsanayā sā na kṛtā kiṃtu  
sarva evācāryā evam eva jaḡur  
jyāyāḥ sādhanē vāsanayā prakāraḥ  
kenāpi na labdhaḥ yojyānayanē  
prakāraḥ kṛtaḥ sa sarvo vāstavena  
na kiṃtu sthulāḥ kṛtaḥ | asmin  
granthe sā jyā pratyeka kalāyā*



When the movements of celestial objects are exposed according to the fundamentals of observation (*uṣūl-i raṣadī*) and ordered in tables inside a book, it is called an observational *zīj*. Such an example is the *Zīj-i Uluḡ Bīḡ*, which is also called the *Zīj-i Samarqandī* and the *Zīj-i Gūrgānī*. It contains verified calculations (*a<sup>c</sup>māl-i taḥqīqī*), like the sine for every degree on which is constructed the calculation of the table of the sine and the tangent. Until now, no one has been able to derive this [table] by means of a demonstration (*ṭarīq-i burhānī*) and scholars have all made it clear. Despite having not found a way to calculate its derivation, they have procured [the table] by approximation using stratagems (*ḥīla*). Besides this there are many calculations [in the *Zīj-i Uluḡ Bīḡ*];

*vāsanāmārgeṇa kṛtānyad api  
tathaiva | iti rasadījicavivaraṇam |*

The treatise that is meant to be strengthened following the method of observations (*rasada-vidhāna*) [and] is written with tables meant to measure the daily motion of the planets: its name called *jicarasadī* is [now] described. Such an example is the *Zīj-i Uluḡ Bīḡ* (*jīca-ulaḡabegī*), which is also called *Zīj-i Samarqandī* (*jīca-samarakandī*) and also known as the *Gūrgānī* (*korgānī*) [*zīj*]. This book contains extremely subtle demonstrable computations (*sūkṣma-sūkṣma-gaṇita-prameya*) such as the sine of every degree which is the foundation of all computations beginning with [the computation of] shadow-lengths [i.e., tangents]. Moreover, until now, no one has composed [such a text] supported by demonstration (*vāsanā*); however, all teachers admit in this manner that the kind of computation of sine with demonstration has not been obtained by anyone, and the kind [which is] done in practical calculation (*yojyānāyana*), all that is not with exactness but roughly done. In this book [i.e., the *Zīj-i Uluḡ Bīḡ*], the sine for every minute is computed by the method of demonstration; even other [computations in this book] are done in like manner [supported by demonstrations].

5. on the reason of correcting observational *zīj*es (*zīj-i raṣādī*) and producing computational *zīj*es (*zīj-i ḥisābī*):

و آنکه در ارقام بعضی جداول تفاوت  
قلیل یافته میشود ظاهرا محاسبان این  
زیج بمسامحه عمل فرموده باشند و  
چون تفاوتهای که بمرور ایام در  
زیج رصدی حادث شده باشد مثل  
تعدیل الایام و غیره بمعونت حساب  
بقدر امکان رفع نمایند و آنچه بجهت  
تسهل دران کمی کرده باشند یا از  
محاسبان آن وقت سهوی شده باشد  
درست سازند و خطاهای جداول که  
بمرور ایام از قلم ناسخان بوقوع  
آمده باشد تصحیح نمایند و تصرفات  
بجهت حصول مدعا باسانی کنند و  
غیر ذلک آنرا زیج حسابی گویند

*u ānki dar arqām-i ba<sup>o</sup>zī-yi jadāvīl  
tafāvūt-i qalīl yāfta mišavad zāhīran  
muḥāsibān-i īn zīj ba musāmaha  
‘amal farmūda bāšand u čūn  
tafāvūthāi ki ba murūr-i ayyām  
dar zīj-i raṣādī ḥādīṭ šuda bāšad  
miṭl-i ta<sup>d</sup>īl al-ayyām u ḡayruhu  
ba ma<sup>c</sup>ūnat-i ḥisāb ba qadr-i imkān  
raf<sup>c</sup> namāyand u ānči ba jihat-i  
tasāhul dar ān kamī karda bāšand yā  
az muḥāsibān-i ān vaqt sahvī šuda  
bāšad durust sāzand u ḥaṭāhā-yi  
jadāvīl ki ba murūr-i ayyām az  
qalam-i nāsīhān ba vuqū<sup>c</sup> āmada  
bāšad taṣḥīḥ namāyand u taṣarrufāt  
ba jihat-i ḥuṣūl-i mudda<sup>c</sup>ā ba āsānī  
kunand u ḡayr dālīka ān rā zīj-i  
ḥisābī ḡūyand*

Thus ends the description of  
*rasādī-jīca*;

5. a description of the computational *zīj*es or *jīca-hisābī* (PER: *zīj-i ḥisābī*):

अथ यत्र केषुचिदङ्केषु कोष्ठगतेषु  
स्वल्पमन्तरं दृश्यते प्रायो ऽस्य जीचस्य  
ये गणकाः स्वल्पान्तरदोषमन्यमाना  
एतादृशं गणितं चक्रुः ततः कियता  
कालेन गतेन सान्तरमाविर्भूतं यथा  
द्युफलादिषु परत्रापि तदन्तरं गणितबलेन  
गणकैर्यथा शक्तिं दूरीक्रियते । पुनर्यत्किं-  
चिदङ्कनिःशेषग्रहणाभावेनाङ्कस्य न्यूनाधि-  
कत्वं कृतमस्ति किंवा गणका एवात्र  
प्रमादयुक्ता बभूवुः किंवा लेखकपरम्परया  
कोष्ठकेषु लिखितमशुद्धमस्ति तद्गणकैः  
शोध्यते । वास्तवफलं वा सुगमप्रकारान्त-  
रेणानीयते तस्य नाम जीचहिसाबीति  
कथ्यते ।

*atha yatra keṣucid aṅkeṣu koṣṭha-  
gāteṣu svalpam antaram dṛśyate  
prāyo ‘sya jīcasya ye gaṇakāḥ  
svalpāntaradoṣam amanyamānā  
etādṛśam gaṇitam cakruḥ tataḥ  
kiyatā kālena gatena sāntaram  
āvīrbhūtam yathā dyuphalādiṣu  
paratrāpi tadantaram gaṇita-  
balena gaṇakair yathā śaktim  
dūrīkriyate | punar yatkiṃcid aṅka-  
niḥṣeṣagrahaṇābhāvenāṅkasya nyū-  
nādhikatvaṃ kṛtam asti kiṃvā  
gaṇakā evātra pramādayuktā  
babhūvuḥ kiṃvā lekhaka-  
paramparayā koṣṭhakeṣu likhitam  
aśuddham asti tad gaṇakaiḥ  
śodhyate | vāstavaphalam vā  
sugamaprakārāntareṇānīyate tasya  
nāma jīcahisābīti kathyate |*

When, apparently, the calculators of a *zīj* [re]calculate with leniency the small discrepancies found in the numbers given in some tables; when they correct as much as possible with the help of calculation the discrepancies that arise in the observational *zīj*es because of the passing of time such as the equation of time etc.; when they correct things which are lacking in that [*zīj*] because of indulgence/negligence or are errors made by calculators at that time; when they rectify the mistakes which have crept in the tables through the pen of copyists with the passing of time; when they simplify the sums [needed] to grasp the intended [subject] etc., this is called a computational *zīj*;

6. a list of earlier Islamicate *zīj*es: see Appendix § B;
7. a discussion on the etymology of the word *zīj* going from Persian to Arabic: see Appendix § D;
8. a definition of simplification tables (*tashīl*), beginning with

Now, when, for the most part, a very small difference is seen in some digits [written] in the cells of this *zīj* [with] which mathematicians, on account of not regarding the error of these very small differences, made calculations like this, then with even a little elapsed time that difference becomes evident just as is in [the case of] the equation of time etc. and elsewhere; that difference is [then] removed by [other] mathematicians by the strength of calculations to the best of one's ability. Moreover, [if] on account of not completely accepting whatever little digits there is the state of deficiency or excess in [their] work, or [if] the mathematicians just became negligent here, or [if] by following the tradition of scribes, the writing is erroneous in the tables, [then] that is rectified by mathematicians. Or [if] the true result is calculated by another simplified manner, [then] the name of that [*zīj*] is said to be *jīca-hisābī*;

6. a Devanāgarī transcription of the Persian names of earlier Islamicate *zīj*es: see Appendix § B;
7. a Devanāgarī (Sanskrit) translation of the discussion on the etymology of the word *jīca* (*zīj*) going from Persian to Arabic: see Appendix § D;
8. a description of the [simplification] tables (*sāraṇīs*), beginning with

چون تصرفات در بعضی جداول مثلا  
تعدیلات کواکب و غیره بجهت آسانی  
عمل کنند و آن خالی از مساهله نباشد  
آنها تسهیل نامند

*čün tašarrufāt dar ba<sup>o</sup>zī-yi jadāvil  
maṭalan ta<sup>o</sup>dīlāt-i kavākib u ḡayruhu  
ba jihat-i āsānī ‘amal kunand u ān  
hālī az musāhala nabāšad ān rā tashīl  
nāmand*

When in some tables, the usages  
such as the equations of celes-  
tial objects etc., are simplified by  
calculation and are exempt from  
negligence, this is called simpli-  
fication (*tashīl*);

and ending in

کتابی که مشتمل بر اعمال تسهیلی  
و تحقیقی باشد و همه اعمال زیج  
در وی بود آنها زیج گویند نه تسهیل  
چنانچه زیج خاقانی که همه اعمال  
تحقیقی و تسهیلی در وی است و  
زیج عمده از علیشاه خوارزمی صاحب  
اشجار و اثمار که در احکام نجوم  
است و زیج مظهري از ملا مظهر و  
مقصود ازین تفصیل آنکه فرق کنند  
میان زیج رصدی و زیج حسابی و  
تسهیل تا یکی را بنام دیگری نخوانند

*kitābī ki muštamil bar a<sup>o</sup>māl-i tashīlī  
u taḥqīqī bāšad u hama a<sup>o</sup>māl-i zīj  
dar vay buvad ān rā zīj ḡūyand na  
tashīl čunānči zīj-i ḥāqānī ki hama  
a<sup>o</sup>māl-i taḥqīqī u tashīlī dar vay ast  
u zīj-i ‘umda az ‘alī-šāh ḥwārazmī  
šāḥib-i ašjār u aṭmār ki dar aḥkām-i*

यत्र कोष्ठकेषु केषुचित्किंचिद्गणितमुत्पाद्य  
यथा ग्रहशीघ्रमन्दफलमन्यदपि सुगमार्थं  
स्थूलमपि लिख्यते सा सारणी ।

*yatra koṣṭhakeṣu keṣucit kiṃcid-  
gaṇitam utpādya yathā graha-  
śīghramandaphalam anyad api  
sugamārtham sthūlam api likhyate  
sā sārāṇī |*

When in some tables, having  
made whatever computation  
such as the slow and fast cor-  
rective equations of the planets  
and also other [similar computa-  
tions], [the correction] is written  
for the sake of ease even though  
inexact, that is a [simplification]  
table (*sārāṇī*);

and ending in

यस्मिन्ग्रन्थे स्थूलसूक्ष्मगणितानि भवन्ति  
तस्य नाम जीच इति । एतन्नाम सारिणी  
नेति यथा जीचखाकानी पुनः सजरे  
समरकर्तुरली शाहख्वारजमी पुनः  
मुल्लामजहरीति नाम्नो जीचमजहरी ।  
प्रयोजनमिदमेवात्र जीचरसदीजीचहिसाबी-  
सारणीनां यथाभेदो भवति ।

*yasmingranthe sthūlasūkṣma-  
gaṇitāni bhavanti tasya nāma  
jīca iti | etatnāma sārīṇī neti  
yathā jīcakhākānī punaḥ sajare  
samarakarturalī śāhakhvārajamī  
punaḥ mullāmajharīti nāmno  
jīcamajharī | prayojanam idam*

*nujūm ast u zīj-i maẓharī az mullā maẓhar u maqṣūd az īn tafṣīl ānki farq kunand miyān-i zīj-i raṣādī u zīj-i ḥisābī u tashīl tā yakī rā ba nām-i dīgarī nahwānand*

A book which contains calculations both simplified and verified and contains all the calculations of a *zīj* is called *zīj* and not *tashīl* 'simplification'. Such is the case of the *Zīj-i Ḥāqānī*, which contains every simplified and verified calculations, also of the *Zīj-i ʿumda* by ʿAlī Šāh Ḥwārazmī, the author of [the book] *Trees and Fruits* (*ašjār u aṭmār*) which is on astrology, and of the *Zīj-i Maẓharī* by Mullā Maẓhar. The objective of this division is to separate between observational *zījes*, computational *zījes* and simplifications so that they are not called by each other's name;

*Note:* This section includes a list of earlier Islamicate simplification tables (*tashīl*): see Appendix § C;

9. a definition of an almanac (*taqvīm*):

چون از زیج مواضع ستارگان در روزیهای یکسال بیرون آرند در طول و عرض و اتصالات ایشان را با یکدیگر و طالعهای فصول و اجتماعات و استقبالات و قرانات و کسوف و رؤیه اهله و مانند آن در دفتر نویسند آنرا تقویم خوانند و تقویم در لغت راست داشتن و قیمت کردن است

*evātra jīcarasadījīcahisābīsāraṇīnām yathābhedo bhavati |*

The book in which there are [both] rough and exact computations is called *zīj* (*jīca*) by name. Its name is not [the simplification] table (*sāraṇī*): for example, the *Zīj-i Ḥāqānī* (*jīca-khākānī*), and [the one] by the author of *sajare-samara* (PER: *ašjār u aṭmār*) ʿAlī Šāh Ḥwārazmī (*alī-šāha-khṣārajamī*), and again the *Zīj-i Maẓharī* (*jīca-majaharī*) by the one named Mullā Maẓharī (*mullā-majaharī*). Here, the very purpose [of this division] is to make evident the distinction between the [simplification] tables (*sāraṇīs*), the observational *zījes* (*jīca-rasadī*), and the computational *zījes* (*jīca-hisābī*);

*Note:* This section includes the Devanāgarī transcriptions of the Persian names of earlier Islamicate simplification tables (*sāraṇī*): see Appendix § C;

9. a description of an almanac (*pañcāṅgapattra*):

अथ यत्र जीचतः सर्ववर्षस्य दिनेषु ग्रहाणां स्फुटत्वं शरश्च ग्रहाणां परस्परमित्तशालानि ऋतुप्रारम्भलग्नं पूर्णमासीलग्नममावस्यालग्नं ग्रहाणामेककलायां संयोगः किराननामा चन्द्रग्रहणं सूर्यग्रहणं चन्द्रदर्शनं लिख्यते तन्नाम तकवीमेति पञ्चाङ्गपत्रमित्यर्थः । क्रमपरिपाद्या यथास्थानरक्षणं तकवीमशब्दस्येत्यर्थम् ।

*čün az zīj mavāzi<sup>c</sup>-i sitāraḡān dar rūzihā-yi yak-sāl bīrūn ārand dar ʔūl u ʕarż u ittiṣālāt-i iṣān rā bā yak-dīgar u ʔālī<sup>c</sup>hā-yi fuṣūl u ijtimā<sup>c</sup>āt u istiḡbālāt u qirānāt u kusūf u ḡusūf u ru<sup>2</sup>ya-yi ahilla u mānand-i ān dar daftar navīsand ān rā taqṡīm ḡwān-and u taqṡīm dar luḡat rāst dāṣtan u qīmat kardan ast*

When one extracts the positions of celestial objects for every day in a year inside a volume with their longitudes, latitudes, their mutual conjunctions/applications (*ittiṣālāt*), the ascendants of the seasons (*ʔālī<sup>c</sup>hā-yi fuṣūl*), their conjunctions (*ijtimā<sup>c</sup>āt*), oppositions (*istiḡbālāt*), conjunctions (*qirānāt*), the solar and lunar eclipses, the sighting of the new Moons, and similar matters, it is called almanac (*taqṡīm*). And *taqṡīm* literally means to ‘straighten’, to ‘fix’; and

10. on the advantage (*fāyida*) of almanacs (*taqṡīm*) and *zījes*, and

*atha yatra jīcataḡ sarvavarṣasya dīneṣu grahāṇāṃ sphuṡatvam śaraśca grahāṇāṃ parasparam ittaśālāni ṛtuṡrārambhalagnaṃ ṡūrṇamāsīlagnam āmāvasyālagnam grahāṇāṃ ekakalāyāṃ saṃyogaḡ kirānanāmā candragrahaṇaṃ sūryagrahaṇaṃ candradarśanaṃ likhyate tannāma takavīmeti pañcāṅgapattram ityarthah | krama-paripādyā yathāsthānarakṣaṇaṃ takavīmaśabdasyetyartham |*

Now, [extracted] from the *zīj*, [the book] where, for the days of every year, the true position [i.e., longitude] and latitude of the planets; the mutual [Tājika configuration of] conjunctions/applications (SAN: *ittaśāla*, PER: *ittiṣāl*) of the planets; the ascendant of the beginning of the seasons (*ṛtu-ṡrārambhalagna*); the ascendant of the the night of full Moon; the ascendant of the night of new Moon; the conjunction (*saṃyoga*), called *kirāna* (PER: *qirān*) by name, of the planets at a moment of time; the lunar eclipse; the solar eclipse; [and] the visibility of [the disc of] the Moon is written, that is called *takavīma* (PER: *taqṡīm*) meaning the almanac (*pañcāṅgapattra*). For this purpose, the regular root of the word *takavīma* is [to be understood] as the preservation of the appropriate place; and

10. on the use (*prayojana*) of almanacs (*takavīma*) and *zījes*, and of

of observation (*raṣad*): see Appendix § E.

observations (*rasada*): see Appendix § E.

ZŠJ  
f. 3v D  
ff. 3v–4r H  
ff. 4rv L  
f. 7r O  
f. – Q  
p. – R  
ff. 3v–4r S

[§ ID.2]

قسم دوم (*qism-i duvum*):

Second part

Begins with:

در حالات و صفات این زیج که بر همه  
زیجهای سابقه ترجیح بآن یافته  
*dar ḥālāt u ṣifāt-i īn zīj ki bar hama zījā-yi*  
*sābiqa tarjih̄i ba ān yāfta*

On the characteristics of these tables which make them superior to earlier tables.

Ends with:

اکنون بر جمیع دولتخواهان و بندگان آن  
حضرت واجب و لازم است که این کتاب  
را رواج دهند و مکرر نویسانده در اطراف  
و اکناف عالم مشهور گردانند بنوعی که در  
اندک مدت در جمیع بلاد و امصار اعتبار و  
اشتهار یابد که آن موجب اشتهار و بقای نام  
سعادت فرجام این بادشاه عالیشان تا ابد الآباد  
شود و مستلزم آن است که تاریخ مبارک  
آن حضرت همیشه در تمام عالم معمول و  
مشهور باشد

*aknūn bar jamī<sup>c</sup>-i dawlat-ḥwāhān u band-*  
*agān-i ān ḥazrat vājib u lāzim ast ki īn kitāb*  
*rā ravāj dahand u mukarrar navīsānda dar*  
*aṭrāf u aknāf-i ʿālam mašhūr gardānand ba*  
*naw<sup>c</sup>i ki dar andak maddat dar jamī<sup>c</sup>-i bilād*  
*u amṣār i<sup>c</sup>tibār u ištihār yābad ki ān mūjib-i*  
*ištihār u baqā-yi nām-i saʿādat-farjām-i īn*  
*bādšāh-i ʿālī-šān tā abad al-ābād šavad u*  
*mustalzam ān ast ki tāriḥ-i mubārak-i ān*  
*ḥazrat hamīša dar ʿālam ma<sup>c</sup>mūl u mašhūr*  
*bāšad*

[§ ID.2]

द्वितीयप्रकार (*dvitīyaprakāra*, lit. the second kind): Second part

Begins with:

अथ द्वितीयप्रकारे ऽस्य जीचस्य प्रशंसा यत्सर्वेभ्यो  
जीचेभ्यो माहात्म्यं प्राप्नोति तथाहि ।  
*atha dvitīyaprakāre ʿsya jīcasya praśamsā*  
*yatsarvebhyo jīcebhyo māhātmyam*  
*prāpnoti tathāhi |*

Now, in the second part, the praise of this *zīj*, which, amongst all [other] *zīj*es, obtains magnanimity thusly.

Ends with:

अधुना सर्वे महाप्रभुशुभवाञ्छका अवश्यमेवास्य  
ग्रन्थस्य प्रसिद्धिं कारयन्तु बहुशो ऽस्य पुस्तकानि  
लिखापयित्वा दिक्षु विदिक्षु प्रेषयन्तु यथास्य ग्रन्थस्य  
प्रसिद्धिर्भवति यथा स्वल्पैर्दिनैः सकलदेशनगरेषु  
प्रसिद्धमिदं भवति पुनरस्य महाप्रभोर्नामशुभायति  
संसारे स्थिरं चिरं वसति प्रयोजनमिदं महाप्रभोः  
शाकः सदैवास्मिञ्जगति सर्वत्र प्रवृत्त्या प्रसिद्धो  
भवति ।

*adhunā sarve mahāprabhuśubhavāñchakā*  
*avaśyam evāsyā granthasya prasiddhim̄*  
*āvāsyantū bahūśo ʿsya pustakāni likhāpa-*  
*yitvā dikṣu vidikṣu preṣayantu yathāsyā*  
*granthasya prasiddhir bhavati yathā*  
*svalpair dinaiḥ sakaladeśanagareṣu*  
*prasiddham idaṃ bhavati punar asya*  
*mahāprabhor nāmaśubhāyati saṃsāre*  
*sthiraṃ ciraṃ vasati prayojanam idaṃ*  
*mahāprabhoḥ śakaḥ sadaivāsmiñ jagati*  
*sarvatra pravṛtṭyā prasiddho bhavati |*

SS  
ff. 7rv Al  
ff. 8v–9r Kh  
ff. 8rv Pg

Now, it behoves every well-wisher and servant of His Majesty to circulate this book and, by repeated copy, make it famous in every corner of the world, in a manner that, in a short time, it will gain credit and fame in all countries, by which the auspicious name of this High Emperor will be famed and endure for all eternity. From this, it will necessarily ensue that the blessed era of His Majesty will be forever established and famous in the world.

Now, certainly, may all the well-wishers of the King bring about the renown of this text. After having made [manuscript-]copies of this repeatedly, may they diffuse [these copies] in every part of the world so that the renown of this book grows in a manner that within the littlest of days in all the countries and cities this [text] becomes famous, [and] moreover, the name of this King becomes a blessing [and] maintains [its] steadfast and long-lasting purpose in the world. [Thus,] the era of the King will always be celebrated in this world everywhere by [its] use.

**Remarks** Contains, inter alia,

1. statements on the conditions for writing an observational *zīj* and the reason why the author chose to compose a computational *zīj*:

مخفی نماند که چون زیج رصدی  
بکمتر از سی سال که دور سبعة سیاره  
دران تمام میشود و غیر از معاونان  
بسیار و آلات صحیحه و نصب آن  
کما ینبغی و جاه و مال و فراغ بال  
نتوان ساخت و اگر بیشتر از سی سال  
باین کار پردازند بهتر و صحیحتر بود  
چنانچه علامه طوسی در زیج خود  
آورده بنا بران فرصت را غنیمت شمرده  
اختیار زیج حسابی نمود

*maḥfī namānad ki čūn zīj-i raṣadī  
ba kamtar az sī sāl ki dawr-i sab<sup>ca</sup>  
sayyāra dar ān tamām mišavad u  
ğayr az mu<sup>ca</sup>āvinān-i bisyār u ālāt-i  
ṣaḥīḥa u naṣb-i ān kamā yanbağī u  
jāh u māl u firāğ-i bāl natavān sāḥt u*

**Remarks** Contains, inter alia,

1. statements on the inability to update in time a three-hundred year old *zīj* (i.e., the *Zīj-i Uluğ Bīg*) observationally, bearing upon al-Ṭūsī's statement:

किंवा त्रिंशद्वर्षेभ्यो ऽप्यधिककालेन यदा  
रसदं सध्यते तदातीव शुद्धा ग्रहा भवन्तीति  
ऽलामततूसीनाम्राचार्येण स्वजीचे प्रोक्तं  
तस्मादिममेव बहुसमयं मत्वा हिसाबीजीच-  
स्याङ्गीकारो मया कृतः ।

*kiṃvā triṃśadvārṣebhyo 'py adhi-  
kakālena yadā rasadam sadhyate  
tadātīva śuddhā grahā bhavantīti  
'lāmatatūsīnāmñācāryeṇa svajice  
proktaṃ tasmād imam eva*



*agar bištar az sī sāl ba īn kār pardāz-  
and bihtar u šahihtar buvad čunānči  
‘allāma ṭūsī dar zīj-i ḥwud āvarda  
binā bar ān furšāt rā ḡanīmat šu-  
murda iḥtiyār-i zīj-i ḥisābī namūd*

It is known that it is impossible to make an observational *zīj* in less than thirty years, in which the revolution of the seven planets is completed, and also without many assistants, exact instruments and their installation as is required, a high rank, fortune and leisure. If more than thirty years are spent on this work it will be better and more perfect, just as the learned [Naṣīr al-Dīn] Ṭūsī related in his own *zīj*. On this ground, having seized the opportunity, [this author] chose to [write] a computational *zīj*;

2. statements proselytising the divine era of Šāh Jahān in relation to writing astronomical tables derived from the *Zīj-i Gūrgānī* (an alias of *Zīj-i Uluḡ Bīg*).

*bahusamayaṃ matvā ḥisābījica-  
syāṅgikāro mayā kṛtaḥ |*

Otherwise, if observation (*rasada*) is made over time in excess of three-hundred years, then extremely precise [positions of the] planets can be determined—this is said by the preceptor ‘Allāma al-Ṭūsī (*alamata-tūsī*) in his own *zīj*. Therefore, having thought about this [for a] long time, the promise of [composing] a computational *zīj* (*ḥisābī-jīca*) is made by me;

2. statements on the superiority of the numbers contained in the *Zīj-i Uluḡ Bīg*; and
3. list of certain modifications made in the tables, especially the correspondence between values found in some tables and the abjad values of names of Šāh Jahān; and the addition of dates given in the divine era of Šāh Jahān.

ZŠJ [§ ID.3]  
 ff. 3v–4v D قسم سوم (*qism-i sīvum*):  
 ff. 4rv H Third part  
 ff. 4v–5r L Begins with:  
 ff. 7r–8r O در بیان موافقت و مناسبت اعدادی که درین  
 f. – Q زیج سعید معمول و مذکور است  
 p. – R *dar bayān-i muvāfaqāt u munāsabāt-i*  
 ff. 4rv S *a<sup>c</sup>dādī ki dar īn zīj-i sa<sup>c</sup>īd ma<sup>c</sup>mūl u maḍkūr*  
*ast*

On the conformity and convenience of numerology (*a<sup>c</sup>dād*, lit. numbers) calculated and mentioned in these fortunate tables.

**Remark** Contains a detailed exposition on the correspondences between the abjad values of several names given to Šāh Jahān and various astronomical parameters; for example, the number of solar days in a year (365) and the abjad value of ‘Šāh Jahān’ (365). Includes tables.<sup>8</sup>

ZŠJ [§ ID.4]  
 ff. 4v–5r D قسم چهارم (*qism-i čahārum*):  
 ff. 4v–6v H Fourth part  
 ff. 5r–6r L Begins with:  
 ff. 8r–9r O در ذکر آنچه دران زیج بعمل آورده شد از  
 f. – Q تصحیحات و اختراعات و الحاقات زیاده از  
 p. 7 R زیج الغ بیگی نور الله مرقد راصده  
 ff. 4v–5v S

<sup>7</sup> An alternative understanding of the word *aprayojakatva* as the ‘state of being without the means to cause or effect’, i.e., being ineffective, lends a second translation of this opening statement: ‘Now, due to ineffectiveness, the third part is not considered.’

[§ ID.3] SS  
 तृतीयप्रकार (*tr̥tīyaparakāra*, lit. the third kind): Third part f. 7v Al  
 f. 9v Kh  
 f. 8v Pg  
 Begins with:  
 अथ तृतीयप्रकारो नविवर्णितो ऽप्रयोजकत्वात् ।  
*atha tr̥tīyaparakāro navivarṇito ‘prayojakatoāt |*

Now, on account of irrelevancy (*aprayojakatva*), the third part is not considered.<sup>7</sup>

[§ ID.4] SS  
 चतुर्थप्रकार (*caturthaparakāra*, lit. the fourth kind): Fourth part ff. 7v–9r Al  
 ff. 9v–11r Kh  
 ff. 8v–10r Pg  
 Begins with:  
 अथ चतुर्थप्रकारे परमेश्वरप्रसादात्प्राप्तस्वर्गस्य  
 मिरज्याउल्लगवेगस्य जीचतो नवनव-  
 वस्तूत्पादनैर्ग्रन्थशोधनैर्ग्रन्थान्तरादानीय  
 लिखनैर्यदधिकं तदनुक्रमणं द्विविधं प्रोक्तं ।

<sup>8</sup> A more extensive discussion on numerology in the *Zīj-i Šāh Jahānī* is to appear in Matthew Melvin-Koushki’s forthcoming publication (personal communication, July 2023).

*dar dīkr-i ānči dar īn zīj ba ʿamal āvarda šud az taṣḥīḥāt u iḥtirāʿāt u ilḥāqāt ziyāda az zīj-i uluḡ biḡī nawwara llāh marqad rāšidihi*

On what was introduced to the calculations in these tables in terms of corrections, inventions, additions [that are made to the] *Zīj-i Uluḡ Biḡ*—May Allah enlighten the tomb of His observer.

ZŠJ  
f. 4v D  
f. 5r H  
f. 5r L  
f. 8r O  
f. – Q  
p. – R  
f. 4v S

In two verbal recollections (*dīkrs*), the first beginning with:

درانچه قبل ازین علامه العالم مولانا الأعظم  
ناصریایات الفضل والحکم افتخار العلماء  
فی العالم المغفور بعناية الله الملك الصمد  
مولانا محمد و سالک مسالک التحقیق  
ناهج مناهج التدقیق زبدة المهندسين قدوة  
المدققين المرحوم برحمة الملك المنان مولانا  
روزبهان عليهم الرحمة والغفران بعمل آورده  
بودند

*dar ānči qabl az īn ʿallāma al-ʿālim al-aʿzam nāṣib rāyāt al-faẓl wa-l-ḥukm iftiḥār al-ʿulamā fi l-ʿālam al-maḡfūr bi-ʿināyat allāh al-malik al-ṣamad mawlānā muḥammad u sālīk masālīk al-taḥqīq nāhij manāhij al-tadqīq zubdat al-muhandīsīn qidwat al-mudaqqiqīn al-marḥūm bi-rahmat al-malik al-mannān mawlānā rūzbihān ʿalayhim al-rahma wa-l-ḡufrān ba ʿamal āvarda būdand*

On what was brought to calculations before these [tables] by the most learned, holder of the standard of ex-

*atha caturthaprakāre paramēśvaraprasādāt prāptasvargasya mirajyāūlagabegasya jīcato navanavavastūtpādanair granthāśodhanair granthāntarād ānīya likhanair yadadhikaṃ tadanukramaṇaṃ dvoividhaṃ proktaṃ |*

Now, in the fourth part, compared to the *zīj* of Mirzā Uluḡ Biḡ (*mirajyā- ulaga-bega*) who obtained heaven by the mercy of God, what is superior by writing, having brought [it] from the interior of the book [i.e., from inside the *Zīj-i Uluḡ Biḡ*] by correcting the book [and] by producing things that are completely new, proceeding methodically, that is described in two ways.

In two parts (*dvoividha*), the first part be-

तत्र पूर्वं विश्वैकपण्डितस्य युक्तिपाण्डित्यध्वज-  
स्थापकस्य संसारे बुधजनयशसः परमेश्वरमोचिता-  
पराधस्य मौलानामहम्मदस्य पुनः प्रामाणिक-  
सूक्ष्मज्ञानां पथिपथिकस्य कलाविदां सारस्य  
परमेश्वरमोचितापराधस्य मौलानारोजविहारस्य या  
या कृतिस्तस्यास्तस्या अनुक्रमः ।

*tatra pūroaṃ viśvaikapāṇḍitasya yukti- pāṇḍityadhvajasthāpakasya saṃsāre bud- hajanayaśasaḥ paramēśvaramocitāparā- dhasya maulānāmahammadasya punaḥ prāmāṇikasūkṣmajñānāṃ pathipathikasya kalāvidāṃ sārasya paramēśvaramocitā- parādhasya maulānārojavihākhyā yā yā kṛtis tasyās tasyā anukramaḥ |*

First then, whatever is in the composition of Mawlānā Muḥammad (*maulānā-mahammada*), the one whose

SS  
ff. 7v–8r Al  
f. 9v Kh  
ff. 8v–9r Pg

cellence and authority, glory of the learned in the world, forgiven by the grace of Allah, who is the King, the Sublime, Mawlānā Muḥammad and the traveller of the paths of certainty, the pointer of the roads of scrutiny, the best of the geometers, an exemplar of inspectors, the late and regretted by the mercy of the King, the Bounteous, Mawlānā Rūzbihān—May the mercy and pardon [of Allah] be upon them;

transgressions are forgiven by God, the one venerated among wise men in the world, the establisher of the standard of erudition by [his] rationales, a one [true] scholar in the world; and of the one named Mawlānā Rūzbihān (*maulāna rojavihā*), the one whose transgressions are forgiven by God, the one who is the essence of men learned in the arts, a guide to the path of men possessing subtle probative knowledge—an enumerated list of contents of all of that [is now described];

ZŠJ

ff. 4v–5r D

f. 5r–6r H

ff. 5r–6r L

ff. 8r–9r O

f. – Q

p. 7 R

ff. 4v–5v S

and the second beginning with:

درینچه این کمترین بنده‌های درگاه عمل  
نموده و از کتب معتبره آورده  
*dar īnči īn kamtarīn-i bandahā-yi dar-  
gāh ‘amal namūda u az kutub-i mu‘tabara  
āvarda*

On the calculations made by this lowest of the slaves of the [heavenly] palace [Mullā Farīd] and on what was chosen from reputable books.

End with:

در زیج گورگانی و شرح هر یک در محل  
خود گفته شود انشاء الله تعالی با چندین  
جزئیات دیگر که اینجا تذکار نیافته  
*dar zīj-i gūrgānī u šarḥ har yak dar  
maḥall-i ḥwud gufta šavad inšā<sup>3</sup> llāh ta‘ālā  
bā ‘andān juz<sup>2</sup>īyāt-i dīgar ki īnjā taḍkār  
nayāfta*

In the *Zīj-i Gūrgānī* and in its commentary, every [topic] is discussed in its own place, if God—May He be exalted—wills, with some more details which are not here mentioned.

and the second part beginning with:

अथ द्वितीयो ऽनुक्रमो मुल्लाफरीदेनोक्तः ।

*atha dvitīyo ‘nukramo mullāpharī-  
denoktaḥ |*

Now, the second enumerated list of contents stated by Mullā Farīd (*mullā-pharīda*).

End with:

स्वस्वविषये सर्वं विवर्ण्यते ।

*svasvaviṣaye sarvaṃ vivarṇyate |*

In their own respective topics, everything is described.

SS

ff. 8r–9r Al

ff. 9v–11r Kh

ff. 9r–10r Pg

**Remark** Contains, in two separate enumerated lists, the 11 additions/improvements to the *Zīj-i Uluḡ Bīg* made by Mawlānā Muḥammad and Mawlānā Rūzbihān and the 101 additions/improvements to the *Zīj-i Uluḡ Bīg* made by Mullā Farīd.

**Remark** Mirroring the Persian, the Sanskrit text also contains an enumerated list of Mavlānā Muḥammad's and Mavlānā Rūzbihān's 11 additions/improvements to the *Zīj-i Uluḡ Bīg*, as well as an enumerated list of Mullā Farīd's 101 additions/improvements to the *Zīj-i Uluḡ Bīg*.

ZŠJ

[§ ID.5]

ff. 5rv D

قسم پنجم (*qism-i panjum*):

ff. 6rv H

Fifth part

ff. 6rv L

Begins with:

ff. 9rv O

f. -Q

در معرفت تاریخ و سال و ماه و روز و  
اجزای آن

pp. 7-8 R

*dar maʿrifat-i tāriḫ u sāl u māh u rūz u  
ajzā-yi ān*

ff. 5v-6r S

On the knowledge of the eras, years, months, days and parts of the day.<sup>9</sup>

Ends in:

اول سالی که دران سال حادثه عظیم واقع شده باشد چون ظهور ملتی یا دولتی<sup>10</sup> آنرا مبدء سازند تا چون ضبط اوقات حوادث دیگر خواهند که کنند بآن مبدء نسبت کنند و آنرا تاریخ خوانند و آن بحسب اصطلاح هر قوم چیزی دیگر باشد و آنچه مشهور است تاریخ هجری است و تاریخ جدید سعید الهی شاهجهانی و تاریخ فرس و تاریخ روم و تاریخ ملکی و تاریخ هندی و تاریخ خطا و ایغور و هر یک در محل خود تذکار یابد انشاء الله تعالی

<sup>9</sup> This section corresponds to the introduction (*muqaddama*) in the first discourse (*maqāla-yi avvalīn*) of the *Zīj-i Uluḡ Bīg*.

<sup>10</sup> Sédillot's edition of the *Zīj-i Uluḡ Bīg* adds the following additional occurrences, which the Sanskrit translation appears to

[§ ID.5]

पञ्चमप्रकार (*pañcamaparakāra*, lit. the fifth kind): Fifth part

Begins with:

अथ पञ्चमप्रकारे परिभाषाज्ञानम् ।

*atha pañcamaparakāre paribhāṣājñānam |*

Now, in the fifth part, the knowledge of the definitions [of calendrical terms].

Ends in:

यस्मिन्वर्षे स्यान्महाभूमिकंपः  
किंवोत्पातो ऽन्यो ऽथवा राज्यलक्ष्मीः ॥  
उत्कृष्टा स्याद्भूपतेः कस्यचिद्वा  
शाकारंभो जायते तत्र वर्षे ॥ २२ ॥

नानाविधाः शका भवन्ति ।

अथ प्रसिद्धतरा आरबीयशाहजहानीयरौमीय-  
फरसीयमलकीयहिन्दुकीयखितायीयतुरकीयशाका  
ये वर्तन्ते तेषां विवरणं स्वस्वाधिकारे करिष्यामि  
प्रकरणे ।

SS

ff. 9r-10r Al

ff. 11r-12r Kh

ff. 10rv Pg

(शालिनी)

echo; see ZUB, p. 295:

یا طوفانی یا زلزله یا امثال اینها  
*yā ṭūfānī yā zalzala yā amtāl-i īnhā*

a flood or an earthquake, or such things

*avval-i sālī ki dar ān sāl hādīta-yi ‘azīm vāqi<sup>c</sup> šuda bāšad čūn zuhūr-i millatī yā dawlatī<sup>10</sup> ān rā mabda’ sāzand tā čūn zabṭ-i awqāt-i ḥavādīt-i dīgar ḥwāhand ki kunand ba ān mabda’ nisbat kunand u ān rā tārīḥ ḥwānand u ān ba ḥasb-i iṣṭilāḥ-i har qawm čīzī dīgar bāšad u ānči mašhūr ast tārīḥ-i hijrī ast u tārīḥ-i jadīd-i sa‘īd-i ilāhī-yi šāh-jahānī u tārīḥ-i furs u tārīḥ-i rūm u tārīḥ-i malikī u tārīḥ-i hindī u tārīḥ-i ḥaṭā u uyğūr u har yak dar maḥall-i ḥwūd tadkār yābad inšā’ llāh ta‘ālā*

The beginning of the year in which an important event has taken place, such as the birth of a religion or a state,<sup>10</sup> is made as a starting point, so that when one wants to keep the times of other events, they are connected to this starting point and it is called an era. According to the usage of each community, it will be a different thing. Those that are famous are the era of the Hegira, the new and fortunate divine era of Šāh Jahān, the Persian era, the Greek era, the Malikī era, the Indian era and the era of the Chinese and the Uyghur. Each of them will be discussed in its own place, God willing.

**Remark** See Appendix § F for a fuller description of the contents of this section.

*yasminvarṣe syān mahābhūmikampah kiṃvotpāto ‘nyo ‘thavā rājyalakṣmīḥ || utkrṣṭā syād bhūpateḥ kasyacid vā śākāraṃbho jāyate tatra varṣe || 22 ||*

(śālinī)

*nānāvīdhāḥ śakā bhavanti |*

*atha prasiddhatarā ārabīyaśāhajahānīya-raumīyapharasīyamalakīyahindukīyahitā-yīyaturakīyaśakā ye vartante teṣāṃ vivaraṇaṃ svasvādhikāre kariṣyāmi prakaraṇe |*

The year in which a great earthquake or any other calamity occurs, or rather [when] the glory of the kingdom of some sovereign gets exalted perhaps, the beginning of a calendrical era commences in that year. 22

The calendrical eras are of various forms.

Now, I shall describe in individual topics, in chapters, what exists in the more well-known eras of the Arabic [Hijri] (*ārabīya*), Šāh Jahān (*śāhajahānīya*), Rūmī (*raumīya*), Persian [Yazdgirdī] (*phārasīya*), Malakī (*malakīya*), Hindū (*hindukīya*), Chinese [and Uyghur] (*khitāyīya*), and Turcic (*turakīya*) calendars.

**Remark** See Appendix § F for a fuller description of the contents of this section.

ZŠJ ff. 5v–16r D ff. 6v–14r H ff. 6v–13r L ff. 9v–18v O f. – Q pp. 8–25 R ff. 6r–13r S	[§ I] مقاله اولین ( <i>maqāla-yi avvalīn</i> ): <b>First discourse</b> Begins with در معرفت تواریخ و آن مشتمل است بر نه باب <i>dar ma<sup>c</sup>rifat-i tavārīḥ u ān muštamil ast bar nuh bāb</i>	[§ I] <b>प्रथमकाण्ड</b> ( <i>prathamakāṇḍa</i> ): <b>First part</b> Begins with अथ प्रथमकाण्डे सप्तभिरध्यायैः समस्तशाक- विवरणम् । शकस्य नाम तारीखेति कथयन्ति । <i>atha prathamakāṇḍe saptabhir adhyāyairiḥ samastaśākavivarṇam   śakasya nāma tārikheti kathayanti  </i>	SS ff. 10r–15r Al ff. 12r–16v Kh ff. 10v–15v Pg
	On the knowledge of the eras. In nine chapters.	Now, in the first part, with seven chapters, the descriptions of all the calendrical eras. The name of an era is called <i>tārikha</i> (PER: <i>tārīḥ</i> ).	
ZŠJ f. 6r D ff. 6v–7r H f. 6v L ff. 9v–10r O f. – Q pp. 8–9 R ff. 6rv S	[§ I.1] باب اول ( <i>bāb-i avval</i> ): <b>First chapter</b> Begins with در معرفت تاریخ الهی شاهجهانی <i>dar ma<sup>c</sup>rifat-i tāriḥ-i ilāhī-yi šāh-jahānī</i>	[§ I.1] <b>प्रथमाध्याय</b> ( <i>prathamādhyāya</i> ): <b>First chapter</b> Begins with तत्र प्रथमाध्याये शाहजहानीयशकविवरणम् । <i>tatra prathamādhyāye śāhajahānīyaśakavivarṇam  </i>	SS ff. 10rv Al ff. 12rv Kh ff. 11r Pg
	On the knowledge of the divine era of Šāh Jahān ( <i>tārīḥ-i ilāhī-yi šāh-jahānī</i> ).	Then, in the first chapter, the description of the era of Šāh Jahān ( <i>śāhajahānīya-śaka</i> ).	
	<b>Remark</b> See Appendix § G for the text and translation of this chapter.	<b>Remark</b> See Appendix § G for the text and translation of this chapter.	
ZŠJ ff. 6rv D ff. 7rv H ff. 6v–7r L ff. 10rv O f. – Q pp. 9–10 R f. 6v S	[§ I.2] باب دوم ( <i>bāb-i duvum</i> ): <b>Second chapter</b> Begins with در معرفت تاریخ هجری ابتداء آن از اول محرم آن سال بوده است که پیغمبر ما محمد مصطفی صلی الله علیه از مکه بمدینه تشریف فرموده اند	[§ I.2] <b>द्वितीयाध्याय</b> ( <i>dvitīyādhyāya</i> ): <b>Second chapter</b> Begins with अथ द्वितीयाध्याये हिजरीशकज्ञानं । पर्यायेण तस्य नामारवीति । अस्य शकारम्भे पूर्व मुहरम- मासारम्भो बभूव ।	SS ff. 10v–11v Al ff. 12v–13r Kh ff. 11r–12r Pg

*dar ma<sup>c</sup>rifat-i tārīḥ-i hijrī ibtidā<sup>2</sup>-i ān az avval-i muḥarram-i ān sāl būda ast ki paygambar-i mā muḥammad muṣṭafā ṣallā llāh <sup>c</sup>alayhi az makka ba madīna tašrīf farmūda and*

On the knowledge of the Hijri era (*tārīḥ-i hijrī*). The beginning of this [era] was on the first day of Muḥarram of the year in which our messenger Muḥammad the Chosen—May God’s prayers be upon him—[left] Mecca and honoured Medina [with his visit].

*atha dvitīyādhyāye hijarīśakajñānaṃ | paryāyeṇa tasya nāmārabīti | asya śakārambhe pūrvaṃ muḥaramamāsārambho babhūva |*

Now, in the second chapter, the knowledge of the Hijri era (*hijarī-śaka*). Alternatively, [it is called the] Arabic (*ārabi*) [era] by name. Formerly, the beginning of the month of Muḥarram (*muḥarama*) was at the beginning of this era.

ZŠJ

ff. 6v–7r D

f. 7v H

f. 7r L

ff. 10v–11r O

f. – Q

pp. 10–11 R

ff. 6v–7r S

## [§ I.3]

باب سوم (*bāb-i sūm*):

Third chapter

Begins with

در معرفت تاریخ رومی مبدء این تاریخ روز دوشنبه بوده بعد از وفات اسکندر بن فلیقوس رومی بدوازده سال شمسی

*dar ma<sup>c</sup>rifat-i tārīḥ-i rūmī mabda<sup>2</sup>-i īn tārīḥ dū-šanba būda ast ba<sup>c</sup>d az vafāt-i iskandar bin falīqūs rūmī ba davāzdah sāl-i šamsī*

On the knowledge of the Rūmī era (*tārīḥ-i rūmī*), i.e., the Greek [Seleucid] era. This era starts on a Monday, twelve solar years after the death of Alexander (*iskandar*) [the Great], son of Philip [II] of Macedon (*falīqūs rūmī*).

## [§ I.3]

तृतीयाध्याय (*tr̥tīyādhyāya*):

Third chapter

Begins with

अथ तृतीयाध्याये रूमीशकज्ञानं । अस्य शक-स्यारम्भे सोमवारो बभूव । फैलकूसरूमीतिनाम्नो यः पुत्रः सिकन्दरस्तस्य निधनानन्तरं द्वादशसौरवर्षैरयं शकः प्रवृत्तो ऽभूत् ।

*atha tr̥tīyādhyāye rūmīśakajñānaṃ | asya śakasyārambhe somavāro babhūva | phailakūsarūmītināmno yaḥ putraḥ sikandarasya tasya nidhanānantaraṃ dvādaśasauravarṣair ayam śakaḥ pravṛtto 'bhūt |*

Now, in the third chapter, the knowledge of the Rūmī era (*rūmī-śaka*). Monday was at the beginning of this era. Twelve years following the demise of Alexander (*sikandara*) [the Great], the son of the one named Philip [II] of Macedon (*phailakūsa-rūmī*), this era came into circulation.

SS

ff. 11v–12r Al

ff. 13rv Kh

ff. 12rv Pg



ZŠJ

ff. 7rv D

f. 8r H

f. 7v L

f. 11r O

f. – Q

p. 11 R

ff. 7rv S

## [§ I.4]

باب چهارم (*bāb-i čahārum*):  
Fourth chapter

Begins with

در معرفت تاریخ فرس مبدء این تاریخ روز  
سهشنبه بوده اول سال جلوس یزدگرد بن  
شهریار که آخر ملوک عجم است

*dar ma<sup>c</sup>rifat-i tāriḥ-i furs mabda<sup>2</sup>-i īn tāriḥ  
rūz-i sih-šanba būda avval-i sāl-i julūs-i  
yazdajird bin šahryār ki āḥir-i mulūk-i ‘a-  
jam ast*

On the knowledge of the Persian era (*tāriḥ-i furs*), i.e., the Yazdgirdī era. This era starts on a Tuesday, in the first year of the coronation of Yazdgird (*yazdajird*) son of Šahryār, the last king of Iran.

## [§ I.4]

चतुर्थाध्याय (*caturthādhyāya*):  
Fourth chapter

Begins with

अथ चतुर्थाध्याये तारीखफुरसज्ञानं । अस्य  
शकस्यारम्भे भौमवारो बभूव । शहरयारस्य पुत्रो  
यो यज्दजिरदनामा महाप्रभुस्तस्य राज्यसमयादस्य  
शकस्य प्रवृत्तिरासीत् ।

*atha caturthādhyāye tāriḥkaphura-  
sajñānaṃ | asya śakasyārambhe bhauma-  
vāro babhūva | śaharayārasya putro yo  
yajdajiradanāmā mahāprabhus tasya  
rājyasamayād asya śakasya pravṛttir āsīt |*

Now, in the fourth chapter, the knowledge of the Persian era (*tāriḥka-phurasa*). Tuesday was at the beginning of this era. The circulation of this era commenced from the time of the reign of the [Sasanian] king named Yazdgird [III] (*yajdajirada*), son of Shahryār (*śaharayāra*).

SS

f. 12r Al

ff. 13v–14r Kh

f. 12v Pg

ZŠJ

f. 7v D

f. 8r H

f. 7v L

ff. 11rv O

f. – Q

p. 12 R

f. 7v S

## [§ I.5]

باب پنجم (*bāb-i panjum*):  
Fifth chapter

Begins with

در معرفت تاریخ ملکی این تاریخ منسوب  
است بسطان جلال الدین ملکشاه بن الب  
ارسلان سلجوقی

*dar ma<sup>c</sup>rifat-i tāriḥ-i malikī īn tāriḥ  
mansūb ast ba sulṭān jalāl al-dīn malik-šāh  
bin alb arslān saljūqī*

On the knowledge of the Malikī era (*tāriḥ-i malikī*). This era is related to the Seljuk Sultan Jalāl al-Dīn Malik Šāh, son of Alp Arslān of the Seljuk [Em-

## [§ I.5]

पञ्चमाध्याय (*pañcamādhyāya*):  
Fifth chapter

Begins with

अथ पञ्चमाध्याये तारीखमलकीज्ञानं । अलब-  
अरसलानसलजुकीतिनमो यः पुत्रः सुलतानजला-  
लदीनमलकशाहेति नामा महाभूपस्तस्य सम्बन्धेन  
शको ऽयं जातः ।

*atha pañcamādhyāye tāriḥkhamalakī-  
jñānaṃ | alabaarasalānasalajūkītinamo  
yaḥ putraḥ sulatānajalāladdīnamalakaśā-  
heti nāmā mahābhūpas tasya sambandhena  
śako ‘yaṃ jātaḥ |*

Now, in the fifth chapter, the knowledge of the Malakī era (*tāriḥka-malakī*) era. This era was produced in relation to the [Seljuk] King named Sulṭān

SS

f. 12r Al

f. 14r Kh

ff. 12v–13r Pg

pire] (*alb arslān saljūqī*).

Jalāl al-Dīn Malik Šāh [I] (*sulatāna-jalāladdīna-malaka-šāha*), the son of the one called Alp Arslān of the Seljuk [Empire] (*alaba-arasalāna-salajūkī*).

ZŠJ [§ I.6]  
ff. 7v–10r D باب ششم (*bāb-i šišum*):  
ff. 8r–9v H Sixth chapter  
ff. 7v–9r L Begins with  
ff. 11v–13r O  
f. – Q در دانستن این پنج از یکدیگر بطریق عمل  
و بطریق جدول  
pp. 12–15 R  
ff. 7v–8v S *dar dānistan-i īn panj az yak-dīgar ba ṭarīq-i ‘amal u ba ṭarīq-i jadval*  
On determining these five [eras] from one another via calculation and via tables.

[§ I.6] SS  
षष्ठाध्याय (*ṣaṣṭhādhyāya*):  
Sixth chapter ff. 12r–14r Al  
Begins with ff. 14r–16r Kh  
ff. 13r–14v Pg  
अथ षष्ठाध्याये पञ्चतारीखाणां परस्परज्ञानं गणितेन कोष्टैर्वा ।  
*atha ṣaṣṭhādhyāye pañcatārīkhāṇāṃ parasparajñānaṃ gaṇitena koṣṭhair vā* |  
Now, in the sixth chapter, the mutual knowledge of the five eras (*pañcatārīkha*) [from one another] with computation and with tables.

ZŠJ [§ I.7]  
ff. 10rv D باب هفتم (*bāb-i haftum*):  
ff. 9v–10r H Seventh chapter  
f. 9r L Begins with  
f. 13r O  
f. – Q در بیان تاریخ هندی  
pp. 15–16 R *dar bayān-i tāriḥ-i hindī*  
ff. 8v–9r S On the explanation of the Hindī era (*tāriḥ-i hindī*).

[–]  
A corresponding chapter is absent.

**Remark** See Appendix § H for the text and translation of this chapter.

ZŠJ [§ I.8]  
f. 10v D باب هشتم (*bāb-i haštum*):  
f. 10r H Eighth chapter  
ff. 9rv L Begins with  
ff. 13r–14r O  
f. – Q در استخراج تاریخ هندی از تاریخ عربی و  
عکس آن  
pp. 16–17 R  
ff. 9rv S

[§ I.7] SS  
सप्तमाध्याय (*saptamādhyāya*):  
Seventh chapter ff. 14r–15r Al  
Begins with ff. 16rv– Kh  
ff. 14v–15r Pg  
अथ सप्तमाध्याये विक्रमार्कशकतो हिजरीशकज्ञानं हिजरीतो विक्रमार्कशकज्ञानं च ।

*dar istihrāj-i tāriḥ-i hindī az tāriḥ-i ʿarabī* *atha saptamādhyāye vikramārkaśakato*  
*u ʿaks-i ān* *hijarīśakajñānaṃ hijarīto vikramārka-*  
*śakajñānaṃ ca |*

On the derivation of the Hindī era (*tāriḥ-i hindī*) from the Arabic era (*tāriḥ-i ʿarabī*) and vice versa.

Now, in the seventh chapter, the knowledge of the Hijri era (*hijarī-śaka*) from the Vikram Saṃvat era (*vikramārka-śaka*) and the knowledge of the Vikram Saṃvat era from the Hijri [era].

ZŠJ [§ I.9]  
 ff. 10v–15v D باب نهم (*bāb-i nuhum*):  
 ff. 10v–13v H Ninth chapter  
 ff. 9v–12v L Begins with  
 ff. 14r–18v O  
 f. – Q در معرفت تاریخ خطا و ایغور و آن مشتمل  
 pp. 17–24 R بر ده فصل است  
 ff. 9v–13r S *dar maʿrifat-i tāriḥ-i ḥaṭā u uyğūr u ān*  
*muštamil bar dah faṣl ast*

On the knowledge of the Chinese (*tāriḥ-i ḥaṭā*) and Uyghur (*tāriḥ-i uyğūr*) eras. In ten chapters.

[–]  
 A corresponding chapter is absent.

ZŠJ [§ I.10]  
 ff. 15v–16r D باب دهم (*bāb-i dahum*):  
 f. 14r H Tenth chapter  
 f. 13r L Begins with  
 f. 18r O  
 f. – Q در معرفت ایام مشهوره از تاریخ  
 p. 25 R *dar maʿrifat-i ayyām-i mašhūra az tāriḥ*  
 f. 13v S On the knowledge of the public days in  
 these eras.

[–]  
 A corresponding chapter is absent.

**Remark** Contains, inter alia, a Muslim calendar with a number of festivals and commemorations related to the family of the Prophet and Shia imams, and a Hindu calendar with seven festivals; see Appendix § I.

[-]

A corresponding colophon is absent.

[§ I.col]

[Colophon]

SS

f. 15r Al

f. 16v Kh

ff. 15rv Pg

यः श्री शाहिजहाँनृपालमुकुटालङ्कारचूडामणि-  
स्तस्याज्ञामवलम्ब्य दुस्तरममुं सिद्धान्तसिन्धुं  
तरन् । नित्यानन्द इति द्विजोत्तमकृपः  
श्रीदेवदत्तात्मजस्तारीखाख्यविनिर्णयेन सहितं  
काण्डं ह्यगादादिमम् ।

*yaḥ śrī śāhijahāṅṅnṛpālamukuṭālaṅkāra-  
cūḍāmaṇis tasyājñāṃ avalambya dustaram  
amuṃ siddhāntasindhuṃ taran | nityā-  
nanda iti dvijottamakṛpaḥ śrīdeva-  
dattātmajas tārikhākhyavinirṇayena  
sahitaṃ kāṇḍaṃ hy agād ādimam |*

Having obeyed the command of the one who is the jewel in the crown of King Śāh Jahān (*śāhijahāṅṅ*, lit. the Emperor of the World), i.e., Āṣaf Ḥān [and] accomplishing that formidable [task of composing the] *Siddhānta-sindhu* [lit. an ocean of doctrinal truths], Nityānanda, [the one worthy of] the mercy of the best Brahmins, the son of Śri Devadatta, has indeed finished the first part associated with established entities called eras (SAN: *tārikha*, PER: *tārīḥ*).

ZŠJ [§ II]  
 ff. 16r–23v D مقاله دوم (*maqāla-yi durvum*):  
 ff. 15r–22v H Second discourse  
 ff. 13v–20v L  
 ff. 18v–27v O Begins with  
 f. – Q  
 pp. 26–41 R در معرفت اوقات و طالع هر وقت و آنچه  
 ff. 13r–21v S تعلق بدان دارد مشتمل بر بیست و دو  
 باب<sup>11</sup>

*dar ma<sup>c</sup>rifat-i awqāt u ṭālī<sup>c</sup>-i har vaqt u ānči  
 ta<sup>c</sup>alluq badān dārad muštamil bar bīst u  
 dū bāb<sup>11</sup>*

On the knowledge of [finding] the times (*awqāt*) and the ascendant (*ṭālī<sup>c</sup>*) at each time, and whatever belongs to it [i.e., all things related to this topic], including twenty-two chapters.<sup>11</sup>

[§ II]  
 द्वितीयकाण्ड (*dvitīyakāṇḍa*):  
 Second part  
 SS  
 ff. 15r–29r Al  
 ff. 17r–28v Kh  
 ff. 15v–28r Pg<sup>+</sup>  
 + ff. 18v–27r  
 desunt  
 Begins with  
 नित्यानन्दस्वरूपाय सच्चिद्वयमूर्तये ।  
 अद्वितीयाय विभवे ऽनन्ताय ब्रह्मणे नमः ॥ (अनुष्टुभ)

अथ द्वितीयकाण्डे द्वाविंशत्यध्यायैरभिमत्समय-  
 स्तात्कालिकलग्नं च तदुपयोगीन्यपि ज्ञायन्ते ।  
*nityānandasvarūpāya saccidvayamurtaye |  
 advitīyāya vibhave 'nantāya brahmaṇe (anuṣṭubh)  
 namaḥ ||*

*atha dvitīyakāṇḍe dvāviṃśatyadhyaṅyair  
 abhimatasamayās tātkālikalagnaṃ ca  
 tadupayogīny api jñāyante |*

Obeisance to Brahman who is the embodiment of eternal bliss, the One who has the form of both existence and thought, the One who is without a second, the omnipresent One, the One who is infinite.

Now, in the second part, the desired time (*samaya*) and the ascendant (*lagna*) at that time, as well as [things] using that, are understood with twenty-two chapters.

ZŠJ [§ II.1]  
 ff. 16r–17r D باب اول (*bāb-i avval*):  
 ff. 15rv H First chapter  
 ff. 13v–14r L Begins with:  
 ff. 18v–19r O  
 f. – Q  
 pp. 26–27 R در بیان معرفت جنس هر یک از حاصل  
 ff. 13r–14r S ضرب و خارج قسمت و جذر یعنی دانستن  
 آنکه حاصل ضرب یا خارج قسمت یا جذر

[§ II.1]  
 प्रथमाध्याय (*prathamādhyāya*):  
 First chapter  
 SS  
 ff. 15r–16r Al  
 ff. 17r–18r Kh  
 ff. 15v–16v Pg  
 Begins with:

तत्र प्रथमाध्याये गुणनभजनफले मूलं च  
 परिवर्तादिस्थानैः कलादिस्थानैर्वा किं जातीयं  
 स्यादिति ज्ञायते । तत्र गणितसौकर्यार्थं  
 यवनप्रसिद्धप्रकारेणाङ्कस्थानानां संस्कृतशब्दैः  
 संज्ञा कल्प्यते ।

<sup>11</sup> MSO reads: باب و سه بیست... (...*bīst u sih bāb*) "...[including] twenty-three chapters."

از کدام مرتبه است از مراتب مرفوعات و  
درج و اجزاء درج مثل دقایق و ثوانی و غیر  
آن

*dar bayān-i maʿrifat-i jins-i har yak az  
ḥāṣil-i ẓarb u ḥārij-i qismat u jaḍr yaʿnī  
dānistān-i ānki ḥāṣil-i ẓarb yā ḥārij-i qis-  
mat yā jaḍr az kudām martaba ast az  
marātib-i marfūʿāt u daraj u ajzāʾ-i daraj  
miṭl-i daqāyiq u ṭavānī u ḡayr-i ān*

On the expression of the knowledge of each genus (*jins*) [of digits] from the result of multiplication, and the quotient of division, and the square root. In other words, to know what is the position of [the digits in] the result of multiplication, or the quotient of division, or the square root, from the positions (*marātib*) of elevated [ranks] (*marfūʿāt*) [sc. integer number of revolutions], and the degree, and the fractional parts of a degree like minutes and seconds and so on.

ZŠj  
ff. 17rv D  
ff. 15v–16r H  
ff. 14rv L  
ff. 19v–20r O  
f. – Q  
pp. 27–28 R  
ff. 14r–15r S

[§ II.2]  
باب دوم (*bāb-i duvum*):

Second chapter

Begins with:

در عمل تعدیل ما بین السطرين که بناء آن  
بر اربعة اعداد متناسبه است

*dar ʿamal-i taʿdīl-i mā bayna l-saṭrayn ki  
bināʾ-i ān bar arbʿa aʿdād-i mutanāsiba ast*

On the method of interpolation (*ʿamal-i taʿdīl*) between two lines [of a table], which is constructed via the four correlated numbers (*aʿdād-i mutanāsiba*) [i.e., the rule of three].

*tatra prathamādhyāye guṇanabhajana-  
phale mūlaṃ ca parivartādisthānāiḥ  
kalādisthānair vā kiṃ jātīyaṃ syād iti  
jñāyate | tatra gaṇitasaukaryārtham  
yavanaprasiddhaprakāreṇāṅkasthānānām  
saṃskṛtaśabdaiḥ saṃjñā kalpyate |*

Then, in the first chapter, what [digits] should belong to a particular genus (*jātīya*) in the result of multiplication and division, and the square root, that is understood by [inspecting] the positions of revolution etc. (*parivartādisthāna*) or by the positions of minute etc. (*kalādi-sthāna*). There, for the purpose of facilitating ease in computations with the method famous amongst the Muslims, the name of the positions of the digits (*aṅka-sthāna*) is declared with Sanskrit words.

[§ II.2]  
द्वितीयाध्याय (*dvitīyādhyāya*):

Second chapter

Begins with:

अथ द्वितीयाध्याये द्विकोष्ठान्तरोत्थफलसाधनम् ।  
तस्य मूलं त्रैराशिकम् । अत्र यवनाः परस्पर-  
सम्बन्धिचतुराशीन्नाणयन्ति । तल्लक्षणं च ।

*atha dvitīyādhyāye dvikoṣṭhāntarottha-  
phalasādhanam | tasya mūlaṃ trairāśikam |  
atra yavanāḥ parasparasambandhicatū  
rāśīn gaṇayanti | tallakṣaṇam ca |*

Now, in the second chapter, the demonstration of the result derived from the difference between two cells. The basis of this is the rule of three quantities

SS  
ff. 16rv Al  
f. 18r Kh  
ff. 16v–17r Pg

(*trai-rāśika*). Here, the Muslims take into account four correlated digits (*paraspara-sambandhi-rāśi*), and their definitions.

ZŠJ ff. 17v–18r D ff. 16rv H ff. 14v–15r L ff. 20rv O f. – Q pp. 28–29 R ff. 15rv S	[§ II.3] باب سيوم ( <i>bāb-i sīvum</i> ): Third chapter Begins with:  در معرفت جيب و سهم <i>dar ma<sup>c</sup>rifat-i jayb u sahm</i> On the knowledge of the Sine ( <i>jayb</i> ) and the Sagitta ( <i>sahm</i> ) [i.e., the versed Sine].	[§ II.3] तृतीयाध्याय ( <i>tr̥tīyādhyāya</i> ): Third chapter Begins with:  अथ तृतीयाध्याये ज्याशरज्ञानम् । <i>atha tr̥tīyādhyāye jyāśarajñānam</i>   Now, in the third chapter, the knowledge of the Sine ( <i>jyā</i> ) and the versed Sine ( <i>śara</i> ).	SS ff. 16v–17v Al ff. 18r–19r Kh ff. 17rv Pg
ZŠJ ff. 18rv D ff. 16v–17r H ff. 15rv L ff. 20v–21r O f. – Q pp. 29–30 R ff. 15v–16r S	[§ II.4] باب چهارم ( <i>bāb-i čahārum</i> ): Fourth chapter Begins with:  در معرفت ظل مقياس <i>dar ma<sup>c</sup>rifat-i zill-i miqyās</i> On the knowledge of the shadow ( <i>zill</i> ) of a gnomon.	[§ II.4] चतुर्थाध्याय ( <i>caturthādhyāya</i> ): Fourth chapter Begins with:  अथ चतुर्थाध्याये छायाज्ञानम् । <i>atha caturthādhyāye chāyājñānam</i>   Now, in the fourth chapter, the knowledge of the shadow ( <i>chāyā</i> ) [of a gnomon].	SS ff. 17v–18v Al ff. 19rv Kh ff. 17v–18r Pg (incomp.)
ZŠJ ff. 18v–19r D ff. 17rv H f. 15v L ff. 21rv O f. – Q pp. 30–31 R f. 16r S	[§ II.5] باب پنجم ( <i>bāb-i panjum</i> ): Fifth chapter Begins with:  در معرفت ميل اجزاء فلك البروج از معدل النهار <i>dar ma<sup>c</sup>rifat-i mayl-i ajzā<sup>2</sup>-i falak al-burūj az mu<sup>c</sup>addil al-nahār</i> On the knowledge of the declination ( <i>mayl</i> ) of parts of the ecliptic ( <i>falak al-burūj</i> ) from the celestial equator ( <i>mu<sup>c</sup>addil al-nahār</i> ).	[§ II.5] पञ्चमाध्याय ( <i>pañcamādhyāya</i> ): Fifth chapter Begins with:  अथ पञ्चमाध्याये क्रान्तिज्ञानम् । तत्र तावत्क्रान्ति-सूत्रादिसंज्ञोच्यते । <i>atha pañcamādhyāye krāntijñānam</i>   <i>tatra tāvat krāntisūtrādisaṃjñocyate</i>   Now, in the fifth chapter, the knowledge of the declination ( <i>krānti</i> ). There, firstly, the [technical] terms like circle of declination ( <i>krānti-sūtra</i> ) etc. are stated.	SS ff. 18v–19r Al ff. 19v–20r Kh f. – Pg

ZŠJ f. 19r D f. 17v H ff. 15v–16r L ff. 21v–22r O f. – Q p. 31 R f. 16r S	[§ II.6] باب ششم ( <i>bāb-i šišum</i> ): Sixth chapter Begins with: در معرفت بعد کواکب از معدل النهار <i>dar ma<sup>c</sup>rifat-i bu<sup>c</sup>d-i kavākib az mu<sup>c</sup>addil al-nahār</i> On the knowledge of the distance ( <i>bu<sup>c</sup>d</i> ) of a celestial object from the celestial equator.	[§ II.6] षष्ठाध्याय ( <i>ṣaṣṭhādhyāya</i> ): Sixth chapter Begins with: अथ षष्ठाध्याये स्पष्टक्रान्तिज्ञानम् । <i>atha ṣaṣṭhādhyāye spaṣṭakrāntijñānam  </i> Now, in the sixth chapter, the knowledge of the true declination ( <i>spaṣṭakrānti</i> ).	SS ff. 19rv Al ff. 20rv Kh f. – Pg
ZŠJ f. 19r D f. 17v H f. 16r L f. 22r O f. – Q pp. 31–32 R ff. 16rv S	[§ II.7] باب هفتم ( <i>bāb-i haftum</i> ): Seventh chapter Begins with: در معرفت غایت ارتفاع و انخفاض کواکب <i>dar ma<sup>c</sup>rifat-i ḡāyat-i irtifā<sup>c</sup> u inhifāz-i kavākib</i> On the knowledge of the maximum elevation ( <i>ḡāyat-i irtifā<sup>c</sup></i> ) and depression ( <i>inhifāz</i> ) of celestial objects.	[§ II.7] सप्तमाध्याय ( <i>saptamādhyāya</i> ): Seventh chapter Begins with: अथ सप्तमाध्याये ग्रहस्य परमोन्नतांशानामधः-स्थपरमभागानां च ज्ञानम् । <i>atha saptamādhyāye grahasya paramonnatāṃśānām adhaḥsthaparamabhāḡānāṃ ca jñānam  </i> Now, in the seventh chapter, the knowledge of the degrees of the maximum elevation ( <i>parama-unnata-aṃśa</i> ) and the degrees of the maximum depression ( <i>adhaḥstha-parama-bhāḡa</i> ) of a planet.	SS f. 19v Al f. 20v Kh f. – Pg
ZŠJ ff. 19rv D ff. 17v–18r H f. 16r L f. 22r O f. – Q p. 32 R f. 16v S	[§ II.8] باب هشتم ( <i>bāb-i haštum</i> ): Eighth chapter Begins with: در معرفت مطالع خط استوا و آنرا مطالع فلک مستقیم نیز گویند <i>dar ma<sup>c</sup>rifat-i maṭāli<sup>c</sup>-i haṭṭ-i istivā u ān rā maṭāli<sup>c</sup>-i falak-i mustaqīm nīz ḡūyand</i> On the knowledge of the ascensions ( <i>maṭāli<sup>c</sup></i> ) [of the ecliptic] at the line	[§ II.8] अष्टमाध्याय ( <i>aṣṭamādhyāya</i> ): Eighth chapter Begins with: अथ अष्टमाध्याये व्यक्षोयांशज्ञानम् । तेषां लङ्को-दयांशसंज्ञाप्युच्यते । तल्लक्षणमाह । <i>atha aṣṭamādhyāye vyakṣoyāṃśajñānam   teṣāṃ laṅkodayaṃśasamjñāpy ucyate   tallakṣaṇam āha  </i> Now, in the eighth chapter, the knowledge of the rising [of zodiacal signs]	SS ff. 19v–20r Al ff. 20v–21r Kh f. – Pg



of the terrestrial equator (*ḥaṭṭ-i istivā*) [i.e., the right ascensions of the zodiacal signs]. And that is also called the ascensions [of the ecliptic] in the right sphere (*falak-i mustaqīm*).

at the terrestrial equator in degrees (*vyakṣa-udaya-aṃśa*) [i.e., the right ascensions of the degrees of the ecliptic]. All of them are also called the rising [of the zodiacal signs] at Laṅkā in degrees (*laṅkā-udaya-aṃśa*) by name. Their definitions are stated [as follows].

ZŠJ

## [§ II.9]

ff. 19v–20r D

باب نهم (*bāb-i nuhum*):

ff. 18rv H

Ninth chapter

ff. 16rv L

Begins with:

ff. 22r–23r O

f. – Q

pp. 32–33 R

ff. 16v–17v S

در معرفت تعديل النهار و قوس النهار و قوس الليل و ساعات النهار و ساعات الليل  
*dar ma<sup>c</sup>rifat-i ta<sup>c</sup>dīl al-nahār u qaws al-nahār u qaws al-layl u sā<sup>c</sup>āt al-nahār u sā<sup>c</sup>āt al-layl*

On the knowledge of the equation of daylight (*ta<sup>c</sup>dīl al-nahār*); and the arc of daylight (*qaws al-nahār*) and the arc of night (*qaws al-layl*); and the hours of daylight (*sā<sup>c</sup>āt al-nahār*) and the hours of night (*sā<sup>c</sup>āt al-layl*).

## [§ II.9]

नवमाध्याय (*navamādhyāya*):

Ninth chapter

Begins with:

अथ नवमाध्याये चरदिनरात्रिवामानां दिनरात्रि-  
 होरादीनां च ज्ञानम् । तत्र तावत्तेषां लक्षणम् ।  
*atha navamādhyāye caradinarātrivāmānāṃ dinarātrihorādīnāṃ ca jñānam | tatra tāvat teṣāṃ lakṣaṇam |*

Now, in the ninth chapter, the knowledge of the ascensional difference (*cara*) of the oblique diurnal circle (*dina-rātri-vāma-[vrtta]*) and of the hours of day and night (*dina-rātrihorā*) etc. There, firstly, all of their definitions [are stated].

SS

ff. 20rv Al

ff. 21rv Kh

f. – Pg

ZŠJ

## [§ II.10]

f. 20r D

باب دهم (*bāb-i dahum*):

f. 18v H

Tenth chapter

ff. 16v–17r L

Begins with:

f. 23r O

f. – Q

p. 33 R

f. 17v S

در معرفت مطالع بلد  
*dar ma<sup>c</sup>rifat-i maṭāli<sup>c</sup>-i balad*

On the knowledge of the ascensions (*maṭāli<sup>c</sup>*) [of the ecliptic] of a locality (*balad*) [i.e., the oblique ascensions of the zodiacal signs].

## [§ II.10]

दशमाध्याय (*daśamādhyāya*):

Tenth chapter

Begins with:

अथ दशमाध्याये निजोदयांशज्ञानम् । तल्लक्षणं च ।  
*atha daśamādhyāye nijodayāṃśajñānam | tallakṣaṇam ca |*

Now, in the tenth chapter, the knowledge of the rising [of the zodiacal signs] in one's own location (*nija-udaya-aṃśa*) [i.e., the oblique ascensions of the degrees of the ecliptic], and their definitions.

SS

ff. 20v–21r Al

ff. 21v–22r Kh

f. – Pg

ZŠJ

ff. 20rv D

ff. 18v–19r H

f. 17r L

ff. 23rv O

f. – Q

pp. 33–34 R

ff. 17v–18r S

## [§ II.11]

باب یازدهم (*bāb-i yāzdahum*):

Eleventh chapter

Begins with:

در عمل عکس مطالع یعنی معرفت طوابع  
از مطالع بعمل

*dar ʿamal-i ʿaks-i maṭāli<sup>c</sup> ya<sup>c</sup>nī maʿrifat-i ṭavāli<sup>c</sup> az maṭāli<sup>c</sup> ba ʿamal*

On the inverse method (*ʿamal-i ʿaks*) [of] ascensions (*maṭāli<sup>c</sup>*); in other words, the knowledge of the [ecliptic degrees of the] ascendants (*ṭavāli<sup>c</sup>*) from the [local] ascensions [i.e., from the oblique ascensions of the ascendants] by direct calculation.

## [§ II.11]

एकादशाध्याय (*ekādaśādhyāya*):

Eleventh chapter

Begins with:

अथैकादशाध्याये स्वोदयांशेभ्यो विनैव कोष्ठकै-  
र्विलोमक्रियातो विलग्रांशकज्ञानम् । विलोमक्रिया-  
लक्षणम् ।

*athaikādaśādhyāye svodayāṃśebhyo  
vinaiva koṣṭhakair vilomakriyāto  
vilagnāṃśakajñānam | vilomakriyā-  
lakṣaṇam |*

Now, in the eleventh chapter, the knowledge of the [ecliptic] degrees of the ascendants (*vilagna-amśaka*) from the rising [of the zodiacal signs] in one's own location (*sva-udaya-amśa*) [i.e. from the oblique ascensions of the ascendants] without [using] the tables [and] by using the inverse procedure (*viloma-kriyā*). The definition of the inverse procedure [is first stated].

SS

ff. 21rv Al

ff. 22rv Kh

f. – Pg

ZŠJ

f. 20v D

f. 19r H

ff. 17rv L

f. 23v O

f. – Q

p. 34 R

f. 18r S

## [§ II.12]

باب دوازدهم (*bāb-i davāzdahum*):

Twelfth chapter

Begins with:

در معرفت مطالع ممر و درجه ممر کوکب

*dar maʿrifat-i maṭāli<sup>c</sup>-i mamarr u daraja-yi  
mamarr-i kawkab*

On the knowledge of the ascensions (*maṭāli<sup>c</sup>*) of [the degrees of the meridian] transit (*mamarr*)—[i.e., the right ascension of the zodiacal sign culminating with a celestial object]—and the [ecliptic] degree of the [meridian]

## [§ II.12]

द्वादशाध्याय (*dvādaśādhyāya*):

Twelfth chapter

Begins with:

अथ द्वादशाध्याये नक्षत्रस्य लङ्कायामुदये जाते  
सति भोदयलग्नव्यक्षोदयांशभोदयलग्रांशयोर्ज्ञानम् ।  
तल्लक्षणम् ।

*atha dvādaśādhyāye nakṣatrasya laṅkāyām  
udaye jāte sati bhodayalagnavyakṣo-  
dayāṃśabhodayalagnāṃśayor jñānam |  
tallakṣaṇam |*

Now, in the twelfth chapter, when a celestial object rises at Laṅkā [i.e., at the terrestrial equator], the knowledge of the degrees of equatorial ascension (*vyakṣa-udaya-amśa*) of the [meridian] ecliptic point (*lagna*) at the [time of]

SS

ff. 21v–22r Al

ff. 22v–23r Kh

f. – Pg

transit [at the time of rising] of a celestial object—[i.e., the ecliptic longitude of the zodiacal sign culminating with a celestial object].

rising of a celestial object—[i.e., the right ascension of the zodiacal sign culminating with the celestial object]—and the degrees of the [meridian] ecliptic point at the [time of] rising of a celestial object—[i.e., the ecliptic longitude of the zodiacal sign culminating with the celestial object]. Their definitions [are first stated].

ZŠJ [§ II.13]  
 f. 20v D باب سیزدهم (*bāb-i sīzdahum*):  
 ff. 19rv H Thirteenth chapter  
 f. 17v L Begins with:  
 ff. 23v–24r O در مطالع طالع و غروب کواکب  
 f. – Q  
 pp. 34–35 R  
 f. 18r S

*dar maṭāli<sup>c</sup>-i ṭulū<sup>c</sup> u ġurūb-i kavākib*

On the [right] ascensions (*maṭāli<sup>c</sup>*) of the rising (*ṭulū<sup>c</sup>*) and setting (*ġurūb*) of celestial objects.

[§ II.13] SS  
 त्रयोदशाध्याय (*trayodaśādhyāya*): ff. 22rv Al  
 Thirteenth chapter f. 23r Kh  
 Begins with: f. – Pg

अथ त्रयोदशाध्याये नक्षत्रस्योदयसमये ऽस्तसमये च निजोदयांशकज्ञानम् । तल्लक्षणं पूर्वार्धमध्ये प्रोक्तमेव ।

*atha trayodaśādhyāye nakṣatrasyoḍaya-samaye 'stasamaye ca nijodayāṃśaka-jñānam | tallakṣaṇaṃ pūrvārdhamadhye proktameva |*

Now, in the thirteenth chapter, at the time of rising (*udaya-samaya*) and time of setting (*asta-samaya*) of a celestial object, the knowledge of the rising [of the zodiacal signs] in one's own location in degrees (*nija-udaya-aṃśaka*)—[i.e., the oblique ascensions of the degrees of the ecliptic]. The definition of that has already been declared in the first half [of § II].

ZŠJ [§ II.14]  
 ff. 20v–21r D باب چهاردهم (*bāb-i čahārdahum*):  
 f. 19v H Fourteenth chapter  
 ff. 17v–18r L Begins with:  
 ff. 24rv O در معرفت سمت از ارتفاع یا انخفاض  
 f. – Q  
 p. 35 R  
 ff. 18rv S

[§ II.14] SS  
 चतुर्दशाध्याय (*caturdaśādhyāya*): f. 22v–23r Al  
 Fourteenth chapter ff. 23rv Kh  
 Begins with: f. – Pg

अथ चतुर्दशाध्याये ऽभीप्सितोन्नतांशाधरांशेभ्यः स्वदिगंशज्ञानम् ।

*dar ma<sup>c</sup>rifat-i samt az irtifā<sup>c</sup> yā inḥifāz*

On the knowledge of the azimuth (*samt*) from the elevation (*irtifā<sup>c</sup>*) or the depression (*inḥifāz*) [of a celestial object].

ZŠJ

f. 21r D

ff. 19v–20r H

f. 18r L

f. 24v O

f. – Q

pp. 35–36 R

f. 18v S

[§ II.15]

باب پانزدهم (*bāb-i pānzdahum*):

Fifteenth chapter

Begins with:

در معرفت ارتفاع از سمت

*dar ma<sup>c</sup>rifat-i irtifā<sup>c</sup> az samt*

On the knowledge of the elevation (*irtifā<sup>c</sup>*) [of a celestial object] from [its] azimuth (*samt*).

ZŠJ

ff. 21rv D

f. 20r H

f. 18r L

f. 24v O

f. – Q

p. 36 R

ff. 18v–19r S

[§ II.16]

باب شانزدهم (*bāb-i šānzdahum*):

Sixteenth chapter

Begins with:

در معرفت خط نصف النهار

*dar ma<sup>c</sup>rifat-i ḥaṭṭ-i niṣf al-nahār*

*atha caturdaśādhyāye 'bhīpsitonnatāmśā-dharāmśebhyaḥ svadigaṃśajñānam |*

Now, in the fourteenth chapter, the knowledge of the degrees of the azimuth in one's own location (*sva-diś-amśā*) from the desired degrees of elevation (*unnata-amśā*) and the degrees of depression (*adharā-amśā*) [of a celestial object].

[§ II.15]

पञ्चदशाध्याय (*pañcadaśādhyāya*):

Fifteenth chapter

Begins with:

अथ पञ्चदशाध्याये दिग्शेभ्यो ऽभीष्टोन्नतांशा-धरांशज्ञानम् । तत्रानन्यत्वप्रकारोपपत्तिः ।

*atha pañcadaśādhyāye digamśebhya 'bhīṣṭonnatāmśādharāmśajñānam | tatrā-nanyatvaprakāropapattiḥ |*

Now, in the fifteenth chapter, the knowledge of the desired degrees of elevation (*unnata-amśā*) and the degrees of depression (*adharā-amśā*) [of a celestial object] from the degrees of the azimuth in one's own location (*sva-diś-amśā*). There, a demonstration (*upapatti*) by the method of identity (*ananyatva-prakāra*) [is stated].

SS

f. 23rv Al

ff. 23v–24r Kh

f. – Pg

[§ II.16]

षोडशाध्याय (*ṣoḍaśādhyāya*):

Sixteenth chapter

Begins with:

अथ षोडशाध्याये याम्योतररेखाज्ञानम् । तस्य एव नाम मध्याह्नरेखेति । तदायनप्रकारा बहवो भवन्ति तेषां सुगमतरौ ऽयम् ।

*atha ṣoḍaśādhyāye yāmyotararekhā-jñānam | tasya eva nāma madhyāhna-*

SS

ff. 23v–24r Al

ff. 24rv Kh

f. – Pg

*rekheti | tadāyanaparakārā bahavo bhavanti teṣāṃ sugamataro 'yam |*

On the knowledge of the line of mid-day (*ḥaṭṭ-i niṣf al-nahār*) [i.e., the local meridian line].

Now, in the sixteenth chapter, the knowledge of the line of the meridian (*yāmya-uttara-rekhā*). It is even called the line of midday (*madhyāhna-rekhā*). There are many methods of computing this, of which, this is among the easier [one].

ZŠJ  
ff. 21v D  
ff. 20rv H  
ff. 18rv L  
ff. 24v–25r O  
f. – Q  
pp. 36–37 R  
ff. 19rv S

[§ II.17]  
باب هفدهم (*bāb-i hifdahum*):  
Seventeenth chapter

Begins with:

در معرفت طول و عرض بلد

*dar ma<sup>c</sup>rifat-i ṭūl u <sup>c</sup>arż-i balad*

On the knowledge of the [terrestrial] longitude (*ṭūl*) and latitude (*<sup>c</sup>arż*) of a locality (*balad*).

[§ II.17]  
सप्तदशाध्याय (*saptadaśādhyāya*):  
Seventeenth chapter

Begins with:

अथ सप्तदशाध्याये देशान्तराक्षांशज्ञानम् । तल्लक्षणं च ।

*atha saptadaśādhyāye deśāntarākṣāṃśa-jñānam | tallakṣaṇaṃ ca |*

Now, in the seventeenth chapter, the knowledge of the degrees of [terrestrial] longitude (*deśāntara*) and latitude (*akṣa*) [in one's own location], and their definitions.

SS  
ff. 24rv Al  
ff. 24v–25r Kh  
f. – Pg

ZŠJ  
ff. 21v–22r D  
f. 20v H  
f. 18v L  
ff. 25rv O  
f. – Q  
p. 37 R  
f. 19v S

[§ II.18]  
باب هژدهم (*bāb-i hiḏdahum*):  
Eighteenth chapter

Begins with:

در معرفت عرض اقلیم رؤیت

*dar ma<sup>c</sup>rifat-i <sup>c</sup>arż-i iqlīm-i ru<sup>2</sup>yat*

On the knowledge of the latitude (*<sup>c</sup>arż*) of the visible climate (*iqlīm*) [i.e., the zenith distance of the nonagesimal point].

[§ II.18]  
अष्टादशाध्याय (*aṣṭādaśādhyāya*):  
Eighteenth chapter

Begins with:

अथाष्टादशाध्याये दृक्क्षेपदृग्गतिज्ञानम् । तल्लक्षणं च ।

*athāṣṭādaśādhyāye dṛkkṣepadṛggatijñānam | tallakṣaṇaṃ ca |*

Now, in the eighteenth chapter, the knowledge of the zenith distance of the nonagesimal point (*dṛkkṣepa*) and the zenith distance of the ecliptic pole (*dṛggati*), and their definitions.

SS  
ff. 24v–25r Al  
ff. 25rv Kh  
f. – Pg

ZŠJ	[§ II.19]		[§ II.19]	SS
f. 22r D	باب نوزدهم (bāb-i nūzdahum):		एकोनविंशाध्याय (ekonaviṃśādhyāya):	ff. 25r–26v Al
ff. 20v–21r H	Nineteenth chapter		Nineteenth chapter	ff. 25v–26v Kh
ff. 18v–19r L	Begins with:		Begins with:	f. – Pg
f. 25v O				
f. – Q	در استخراج بعد میان دو کوكب		अथैकोनविंशाध्याये द्विनक्षत्रान्तरांशकज्ञानम् ।	
pp. 37–38 R			तल्लक्षणम् ।	
ff. 19v–20r S	dar istilhrāj-i bu <sup>c</sup> d miyān-i dū kawkab		athaikonaviṃśādhyāye dvinakṣatrāntarāṃśakajñānam   tallakṣaṇam	
	On the determination of the distance (bu <sup>c</sup> d) between two celestial object.		Now, in the nineteenth chapter, the knowledge of the interior degrees (antara-aṃśa) [of separation] between two celestial objects. Its definition [is first stated].	
ZŠJ	[§ II.20]		[§ II.20]	SS
ff. 22r–23r D	باب بیستم (bāb-i bīstum):		विंशाध्याय (viṃśādhyāya):	ff. 26v–27v Al
ff. 21rv H	Twentieth chapter		Twentieth chapter	ff. 26v–27r Kh
ff. 19rv L	Begins with:		Begins with:	f. – Pg
ff. 25v–26v O				
f. – Q	در معرفت سمت قبله و انحراف او		अथ विंशाध्याये स्वपुरे सौम्ययाम्यदिग्भ्यां दिग्शैः	
pp. 38–40 R			काशी कास्तीति ज्ञायते ।	
ff. 20rv S	dar ma <sup>c</sup> rifat-i samt-i qibla u inḥirāf-i ū		atha viṃśādhyāye soapure saumyayāmya-digbhyāṃ digamśaiḥ kāsī kvāstīti jñāyate	
	On the knowledge of the azimuth (samt) of Qibla [i.e., the direction of Mecca] and its inclination (inḥirāf).		Now, in the twentieth chapter, [the direction of] Kāśī is understood with the degrees of azimuth (diś-aṃśa) [measured] from both the northern and southern directions (saumya-yāmya-diś) in one's own city.	
ZŠJ	[§ II.21]		[§ II.21]	SS
ff. 23rv D	باب بیست و یکم (bāb-i bīst u yakum):		एकविंशतितमाध्याय (ekaviṃśatitamādhyāya):	ff. 27v–28v Al
ff. 21v–22r H	Twenty-first chapter		Twenty-first chapter	ff. 27r–28r Kh
ff. 19v–20r L	Begins with:		Begins with:	f. 27v Pg
ff. 26v–27r O				(incomp.)
f. – Q	در معرفت طالع از ارتفاع		अथ एकविंशतिमे ऽध्याये ऽभीष्टोन्नतांशेभ्यो	
p. 40 R			लभज्ञानम् । उन्नतज्यायाः पर्यायः शङ्करपि	
ff. 20v–21r S	dar ma <sup>c</sup> rifat-i ṭālī <sup>c</sup> az irtifā <sup>c</sup>		प्रथमतस्तु नतकलांशाः शोध्याः । तल्लक्षणम् ।	
			atha ekaviṃśatīme 'dhyāye 'bhīṣṭonnatāṃśebhyo lagnajñānam   unnatajyāyāḥ	

*paryāyaḥ śaṅkurapi prathamatas tu  
natakālāmśāḥ śodhyāḥ | tallakṣaṇam |*

On the knowledge of the ascendant (*ṭāli<sup>c</sup>*) from the elevation (*irtifā<sup>c</sup>*).

Now, in the twenty-first chapter, the knowledge of the ascendant (*lagna*) from the desired degrees of elevation (*unnata-aṃśa*). But firstly, the method of [determining the height of] the gnomon (*śaṅku*) [corresponding to the altitude of the celestial object] from the Sine of [the degrees of] the elevation (*unnata-jyā*) [and then] the corrected degrees of hour angle (*natakāla-aṃśa*). Their definitions [are first stated].

ZŠJ

[§ II.22]

f. 23v D

ff. 22rv H

ff. 20rv L

ff. 27rv O

f. – Q

pp. 40–41 R

ff. 21rv S

باب بیست و دوم *bāb-i bīst u duvum*):  
Twenty-second chapter

Begins with:

در معرفت ارتفاع یا انخفاض کواکب از  
مطالع/طالع

*dar ma<sup>c</sup>rifat-i irtifā<sup>c</sup> yā inhifāz-i kavākib az  
maṭāli<sup>c</sup>/ṭāli<sup>c</sup>*

On the knowledge of the elevation (*irtifā<sup>c</sup>*) or depression (*inhifāz*) of celestial objects from the ascendant(s) (*maṭāli<sup>c</sup>/ṭāli<sup>c</sup>*).

[§ II.22]

द्वाविंशतितमाध्याय (*dvāvīṃśatitamādhyāya*):  
Twenty-second chapter

Begins with:

अथ द्वाविंशतिमे ऽध्याये खगस्य स्वोदयांशेभ्यो  
ऽभीष्टोन्नतांशानामधरांशकानां च ज्ञानम् ।  
एतल्लक्षणं पूर्वमेषोक्तम् ।

*atha dvāvīṃśatime 'dhyāye khagasya  
svodayāṃśebhyo 'bhīṣṭonnatāṃśānāma-  
dharāṃśakānāṃ ca jñānam | etallakṣaṇam  
pūrvameṣoktam |*

Now, in the twenty-second chapter, the knowledge of the desired degrees of elevation (*unnata-aṃśa*) and of the degrees of depression (*adhara-aṃśaka*) from the rising [of the zodiacal signs] in one's own location in degrees (*sva-udaya-aṃśa*) of a celestial object. The definition of this has already been declared in the first half [of § II].

SS

ff. 28v–29r Al

ff. 28rv Kh

ff. 27v–28r Pg

[-]

A corresponding colophon is absent.

[§ II.col]

[Colophon]

SS

f. 29r Al

f. 28v Kh

f. 28r Pg

(finis)

यः श्री शाहजहाँनृपालमुकुटालङ्कारचूडामणि-  
स्तस्याज्ञामवलम्ब्य दुस्तरममुं सिद्धान्त-  
सिन्धुं तरन् । नित्यानन्द इति द्विजोत्तमकृपः  
श्रीदेवदत्तात्मजस्त्रिप्रश्नचुरोक्तियुक्तिसहितं काण्डं  
द्वितीयं ह्यगात् ।

*yaḥ śrī śāhajahāṅnṛpālamukuṭālaṅkāra-  
cūḍāmaṇis tasyājñām avalambya dustaram  
amum siddhāntasindhum taran | nityā-  
nanda iti dvijottamakṛpaḥ śrīdeva-  
dattātmajas tripraśnapracuroktyukti-  
sahitaṁ kāṇḍaṁ dvitīyaṁ hy agāt |*

Having obeyed the command of the one who is the jewel in the crown of King Śāh Jahān (*śāhijahāṅ*, lit. the Emperor of the World), i.e., Āṣaf Ḥān [and] accomplishing that formidable [task of composing the] *Siddhānta-sindhu* [lit. an ocean of doctrinal truths], Nityānanda, [the one worthy of] the mercy of the best Brahmins, the son of Śri Devadatta, has indeed finished the second part accompanied by many statements and rationales on the *tripraśna*—[i.e., on topics related to the ‘three questions’ on determining the direction (*diś*), location (*deśa*), and time (*kāla*)].



ZŠJ [§ III]  
 ff. 78r–87v D مقاله سیوم (*maqāla-yi sīvum*):  
 ff. 72r–80v H Third discourse  
 ff. 90r–97v L Begins with  
 ff. 78r–87v O در معرفت روش ستارگان و مواضع ایشان  
 ff. 75r–83r Q در طول و عرض و توابع آن  
 pp. 53–72 R  
 ff. 27v–36r S

*dar ma<sup>cr</sup>rifat-i raviš-i sitāragān u mavāzi<sup>c</sup>-i  
 īšān dar ḫūl u <sup>c</sup>arž u tavābi<sup>c</sup>-i ān*

On the knowledge of the movement of the stars, their positions in longitude (*ḫūl*) and latitude (*<sup>c</sup>arž*) and other things pertaining to this matter.

[§ III]  
 तृतीयकाण्ड (*tr̥tīyakāṇḍa*):  
 Third part  
 Begins with  
 श्री गणपतये नमः ।  
 वन्दे तं परमानन्दं यो ऽव्यक्तो व्यक्तकारणम् ।  
 परमो निर्गुणः शान्तो नितान्तं योगिवल्लभः ॥ (अनुष्टुभ)

अथ तृतीयकाण्डे पञ्चदशभिरध्यायैर्ग्रहाणां षड्विध-  
 वारेण स्फुटत्वं तदुपयोगि च तत्संगत्यान्यदपि  
 ज्ञायते ।

*śrī gaṇapataye namaḥ |*

*vande taṃ paramānandaṃ*

*yo 'vyakto vyaktakāraṇam |*

*paramo nirguṇaḥ śānto*

*nītāntaṃ yogivalabhāḥ ||*

(*anuşṭubh*)

*atha tr̥tīyakāṇḍe pañcadaśabhir adhyāyair  
 grahāṇām ṣaḍvidhavāreṇa sphuṭatvaṃ  
 tadupayogi ca tatsaṃgatyaṇyad api  
 jñāyate |*

Obeisance to Gaṇapati.

Salutations to the One who is the greatest bliss, the One who is unmanifested [despite being] the cause of all things manifest, the Supreme Being, the One without attributes, the One who is free of passion, the One dearly beloved by ascetics.

Now, in the third part, with fifteen chapters, the true position (*sphuṭatva*) [i.e., the longitude] of the planets with six methods repeatedly and its application, even though different by chance, is understood.

ZŠj f. 78r D f. 72r H f. 90r L f. 78r O f. 75r Q f. 53 R f. 27v S	[§ III.1] باب اول ( <i>bāb-i avval</i> ): First chapter Begins with: در معرفت تعدیل ایام <i>dar ma<sup>c</sup>rifat-i ta<sup>c</sup>dīl-i ayyām</i>	[§ III.1] प्रथमाध्याय ( <i>prathamādhyāya</i> ): First chapter Begins with: तत्र प्रथमे ऽध्याये दिनफलज्ञानम् । तल्लक्षणम् । <i>tatra prathame 'dhyāye dinaphalajñānam   tallakṣaṇam  </i>	SS f. – Al ff. 98v–99r Kh f. – Pg
	On the knowledge of the equation of time ( <i>ta<sup>c</sup>dīl-i ayyām</i> ).	Then, in the first chapter, the knowledge of the equation of time ( <i>dinaphala</i> ). Its definition [is first stated].	
ZŠj ff. 78rv D ff. 72rv H ff. 90rv L ff. 78rv O ff. 75rv Q pp. 53–54 R ff. 27v–28r S	[§ III.2] باب دوم ( <i>bāb-i duvum</i> ): Second chapter Begins with: در استخراج اوساط کواکب <i>dar istihrāj-i awṣāt-i kavākib</i>	[§ III.2] द्वितीयाध्याय ( <i>dvitīyādhyāya</i> ): Second chapter Begins with: अथ द्वितीये ऽध्याये मध्यमग्रहानयनम् । <i>atha dvitīye 'dhyāye madhyamagrahānayanam  </i>	SS f. – Al ff. 99rv Kh f. – Pg
	On the determination of mean longitudes ( <i>awṣāt</i> ) of celestial objects.	Now, in the second chapter, calculating the mean ( <i>madhyama</i> ) [longitudes of] planets.	
ZŠj ff. 78v–80r D ff. 72v–73v H ff. 90v–91v L ff. 78v–79v O ff. 75v–76v Q pp. 54–56 R ff. 28r–29r S	[§ III.3] باب سیوم ( <i>bāb-i sīvum</i> ): Third chapter Begins with: در بیان استخراج تقاویم سبعة سیاره و راس میزان آن <i>dar bayān-i istihrāj-i taqāvīm-i sab<sup>ca</sup>a sayyāra u rās-i mīzān-i ān</i>	[§ III.3] तृतीयाध्याय ( <i>tr̥tīyādhyāya</i> ): Third chapter Begins with: अथ तृतीये ऽध्याये स्फुटग्रहानयनम् । तत्र सूर्यस्य द्विविधं स्फुटीकरणं । एकं तुङ्गफलदानेन द्वितीयं च सारण्या तत्र फलदानेनाह । <i>atha tr̥tīye 'dhyāye sphuṭagrahānayanam   tatra sūryasya dvoividhaṃ sphuṭikaraṇam   ekaṃ tuṅgaphaladānena dvitīyaṃ ca sāranyā tatra phaladānenāha  </i>	SS f. – Al ff. 99v– 100v Kh f. – Pg
	On the expression of the determination of the true longitudes ( <i>taqāvīm</i> ) of the seven planets and the head of Libra ( <i>rās-i mīzān</i> ) [fortasse, autumnal equinox or 0° Libra?].	Now, in the second chapter, calculating the true ( <i>sphuṭa</i> ) [longitudes of] planets. There, the determination of true longitude of the Sun is of two kinds: first, by means of the equation of apo-	

<p>ZŠJ f. 80r D f. 73v H f. 91v L ff. 79v–80r O f. 76v Q pp. 56–57 R ff. 29rv S</p>	<p>[§ III.4] باب چهارم (<i>bāb-i čahārum</i>): Fourth chapter Begins with: در دانستن عروض کواکب متحیره و قمر <i>dar dānistan-i ʿurūz-i kavākib-i mutahayyira u qamar</i> On knowing the latitudes (<i>ʿurūz</i>) of celestial objects and the Moon.</p>	<p>gee (<i>tuṅga-phala</i>) and then secondly, by means of the equation (<i>phala</i>) said to be obtained with tables.</p>	<p>[§ III.4] चतुर्थाध्याय (<i>caturthādhyāya</i>): Fourth chapter Begins with: अथ चतुर्थाध्याये विना सूर्य ग्रहशरज्ञानम् । <i>atha caturthādhyāye vinā sūryaṃ grahaśa-rajñānam</i>   Now, in the fourth chapter, the knowledge of the latitude (<i>śara</i>) of the planets excluding the Sun.</p>	<p>SS f. – Al f. 100v Kh f. – Pg</p>
<p>ZŠJ ff. 80rv D ff. 73v–74r H f. 91v L f. 80r O f. 76v Q p. 57 R f. 29v S</p>	<p>[§ III.5] باب پنجم (<i>bāb-i panjum</i>): Fifth chapter Begins with: در دانستن ابعاد نیران از مرکز عالم <i>dar dānistan-i abʿād-i nayyirān az markaz-i ʿālam</i> On knowing the distances of the [two] luminaries from the centre of the world (<i>markaz-i ʿālam</i>).</p>	<p>[§ III.5] पञ्चमाध्याय (<i>pañcamādhyāya</i>): Fifth chapter Begins with: अथ पञ्चमाध्याये सूर्येन्द्रोर्भूगर्भादिव पर्यन्तकर्णानयनम् । <i>atha pañcamādhyāye sūryeṅdroṛbhūgarbhādiva paryantakarṇānayanam</i>   Now, in the fifth chapter, calculating the radius of the circumference [of the orbit] of the Sun and the Moon precisely from the centre of the Earth (<i>bhūgarbha</i>).</p>	<p>SS f. – Al ff. 100v–101r Kh f. – Pg</p>	
<p>ZŠJ f. 80v D f. 74r H ff. 91v–92r L ff. 80rv O ff. 76v–77r Q pp. 57–58 R f. 29v S</p>	<p>[§ III.6] باب ششم (<i>bāb-i šišum</i>): Sixth chapter Begins with: در دانستن نطاقت و مقامات کواکب <i>dar dānistan-i niṭāqāt u maqāmāt-i kavākib</i></p>	<p>[§ III.6] षष्ठाध्याय (<i>ṣaṣṭhādhyāya</i>): Sixth chapter Begins with: अथ षष्ठाध्याये ग्रहाणां केन्द्रपदचतुष्टयारम्भवक्रमार्गस्थानानयनम् । <i>atha ṣaṣṭhādhyāye grahāṇāṃ kendrapadacatuṣṭayārambhavakramārgasthānānayanam</i>  </p>	<p>SS f. – Al ff. 101rv Kh f. – Pg</p>	

On knowing the zones (*niṭāqāt*) and the stations (*maqāmāt*) of celestial objects [during retrograde motion].

Now, in the sixth chapter, calculating the stations (*sthāna*) during the retrograde motion (*vakra-mārga*) [and] the beginnings of the four quarters [of the eccentric] with respect to the anomaly (*kendra*) of the planets.

ZŠJ

[§ III.7]

ff. 80v–81v D باب هفتم (*bāb-i haftum*):

ff. 74rv H Seventh chapter

ff. 92rv L Begins with:

ff. 80v–81r O

ff. 77rv Q در قسمت تقویم کواکب و عروض آنها

pp. 58–59 R

ff. 29v–30r S *dar qismat-i taqvim-i kavākib u ʿurūz-i ānhā*

On the division of the true longitudes (*taqvim*) of celestial objects and their latitudes (*ʿurūz*).

[§ III.7]

सप्तमाध्याय (*saptamādhyāya*):

Seventh chapter

Begins with:

अथ सप्तमाध्याये ग्रहाणां प्रत्यहस्फुटत्वं शरभुक्त्या च शरः साध्यते ।

*atha saptamādhyāye grahāṇāṃ pratyaha-sphuṭatvaṃ śarabhuktyā ca śaraḥ sādhyate* |

Now, in the seventh chapter, the daily true [longitude] (*sphuṭatva*) divided by the latitude (*śara*), and the latitude of planets is calculated.

SS

f. – Al

ff. 101v–

102r Kh

f. – Pg

ZŠJ

[§ III.8]

ff. 81v–82v D باب هشتم (*bāb-i haštum*):

ff. 74v–75v H Eighth chapter

ff. 92v–93v L Begins with:

ff. 81r–82r O

ff. 77v–78r Q در دانستن اوقات اتصالات کواکب با یکدیگر و تحویلات

pp. 59–61 R

ff. 30r–31r S *dar dānistan-i awqāt-i ittiṣālāt-i kavākib bā yak-dīgar u taḥvīlāt*

On knowing the times of conjunction (*awqāt-i ittiṣālāt*) of the celestial objects with one another and their return.

[§ III.8]

अष्टमाध्याय (*aṣṭamādhyāya*):

Eighth chapter

Begins with:

अथ अष्टमाध्याये परस्परग्रहयोगसंक्रान्तिसमयानयनम् ।

*atha aṣṭamādhyāye parasparagrahayoga-samkrāntisamayānayanam* |

Now, in the eighth chapter, calculating the times of zodiacal ingress (*saṃkrānti*) and conjunction (*yoga*) of planets with one another.

SS

f. – Al

ff. 102r–

103v Kh

f. – Pg

ZŠJ	[§ III.9]	[§ III.9]	SS
f. 82v D	باب نهم ( <i>bāb-i nuhum</i> ):	नवमाध्याय ( <i>navamādhyāya</i> ):	f. – Al
ff. 75v–76r H	Ninth chapter	Ninth chapter	f. 103v Kh
f. 93v L	Begins with:	Begins with:	f. – Pg
ff. 82rv O			
f. 78v Q	در بیان ساعات بست و بهدره	अथ नवमाध्याये बुस्तभद्रयोर्होरानयनम् । अथ यवनमते बुस्तचक्रं भद्रासादृश्येन प्रायो ऽङ्गीकृतं तस्य सप्तविभागैः परिभ्रमणं भवति प्रत्येकभागस्य द्वादशविषमहोरा गण्यते ।	
pp. 61–62 R			
ff. 31rv S			
	<i>dar bayān-i sācāt-i bust u bhadra</i>	<i>atha navamādhyāye bustabhadrayor horānayanam   atha yavanamate busta-cakram bhadrāsādṛśyena prāyo 'ṅgīkṛtaṃ tasya saptavibhāgaiḥ paribhramaṇaṃ bhavati pratyekabhāgasya dvādaśaviṣama-horā gaṇyate  </i>	
	On the hours ( <i>sācāt</i> ) of <i>bust</i> and <i>bhadra</i> (SAN: <i>bhadrā</i> ).	Now, in the ninth chapter, calculating the hours ( <i>horā</i> ) of <i>busta</i> (PER: <i>bust</i> ) and <i>bhadrā</i> . Now, according to the opinion of the Muslims, the cycle including the <i>busta</i> is commonly agreed to resemble the [Indian] <i>bhadrā</i> . Its revolution occurs with seven parts, [where] twelve unequal hours should be regarded as each of its part.	
ZŠJ	[§ III.10]	[§ III.10]	SS
ff. 82v–83v D	باب دهم ( <i>bāb-i dahum</i> ):	दशमाध्याय ( <i>daśamādhyāya</i> ):	f. – Al
ff. 76r–77r H	Tenth chapter	Tenth chapter	ff. 103v–
ff. 93v–94v L	Begins with:	Begins with:	105v Kh
ff. 82v–83v O			f. – Pg
ff. 78v–79v Q	در معرفت خسوف	अथ दशमाध्याये चन्द्रग्रहणानयनम् ।	
pp. 62–64 R	<i>dar ma<sup>c</sup>rifat-i ḥusūf</i>	<i>atha daśamādhyāye candragrahaṇā-nayanam  </i>	
ff. 31v–32v S			
	On the knowledge of lunar eclipses ( <i>ḥusūf</i> ).	Now, in the tenth chapter, calculating the lunar eclipses ( <i>candra-grahaṇa</i> ).	

<p>ZŠJ [§ III.11]  ff. 83v–85v D باب یازدهم (<i>bāb-i yāzdahum</i>):  ff. 77r–79r H Eleventh chapter  ff. 94v–96v L Begins with:  ff. 83v–86r O  ff. 79v–81v Q در معرفت کسوف  pp. 64–69 R <i>dar ma<sup>c</sup>rifat-i kusūf</i>  ff. 32v–34v S On the knowledge of solar eclipses  (<i>kusūf</i>).</p>	<p>[§ III.11] SS  एकादशाध्याय (<i>ekādaśādhyāya</i>):  Eleventh chapter  Begins with:  अथ एकादशाध्याये सूर्यग्रहणानयनम् ।  <i>atha ekādaśādhyāye sūryagrahaṇānayanam</i>    Now, in the eleventh chapter, calculat-  ing solar eclipse (<i>sūrya-grahaṇa</i>).</p>
<p>ZŠJ [§ III.12]  ff. 85v–86v D باب دوازدهم (<i>bāb-i davāzdahum</i>):  ff. 79r–80r H Twelfth chapter  ff. 96v–97v L Begins with:  ff. 86r–87r O  ff. 81v–82r Q در معرفت وقت رؤیه هلال و ظهور و خفای  کواکب  pp. 69–70 R  ff. 34v–35v S <i>dar ma<sup>c</sup>rifat-i vaqt-i ru<sup>3</sup>ya-yi hilāl u zūhūr</i>  <i>u ḥafā-yi kavākib</i>    On the knowledge of the time of sight-  ing (<i>vaqt-i ru<sup>3</sup>ya</i>) of the crescent of the  new Moon (<i>hilāl</i>), and the appearance  (<i>zūhūr</i>) and disappearance (<i>ḥafā</i>) of ce-  lestial objects.</p>	<p>[§ III.12] SS  द्वादशाध्याय (<i>dvādaśādhyāya</i>):  Twelfth chapter  Begins with:  अथ द्वादशाध्याये नवचन्द्रोदयानयनम् । पुनरत्रैव  ग्रहाणामुदयास्तानयनम् ।  <i>atha dvādaśādhyāye navacandrodayā-</i>  <i>nayanam   punar atra iva grahāṇāmudayā-</i>  <i>stānayanam</i>    Now, in the twelfth chapter, calcu-  lating the rising of the new Moon  (<i>nava-candra-udaya</i>). And also in  this [chapter], calculating the rising  (<i>udaya</i>) and setting (<i>asta</i>) of planets.</p>
<p>ZŠJ [§ III.13]  ff. 86v–87r D باب سیزدهم (<i>bāb-i sīzdahum</i>):  ff. 80r H Thirteenth chapter  f. 97v L Begins with:  ff. 87rv O  ff. 82rv Q در معرفت طالع از ساعات و تسویه البيوت  pp. 70–71 R  ff. 35v–36r S <i>dar ma<sup>c</sup>rifat-i ṭāli<sup>c</sup> az sā<sup>c</sup>āt u tasvīyat</i>  <i>al-buyūt</i>  On the knowledge of the ascendant  (<i>ṭāli<sup>c</sup></i>) from the hours (<i>sā<sup>c</sup>āt</i>) and the  equalisation of the houses (<i>tasvīyat</i>  <i>al-buyūt</i>).</p>	<p>[§ III.13] SS  त्रयोदशाध्याय (<i>trayodaśādhyāya</i>):  Thirteenth chapter  Begins with:  अथ त्रयोदशाध्याये त्रिविधभाचक्रानयनम् ।  <i>atha trayodaśādhyāye trividhabhācakrā-</i>  <i>nayanam</i>    Now, in the thirteenth chapter, calcu-  lating [the division of the] ecliptic (<i>bhā-</i>  <i>cakra</i>) in three ways.</p>

ZŠJ	[§ III.14]	[§ III.14]	SS
ff. 87rv D	باب چهاردهم ( <i>bāb-i čahārdahum</i> ):	[चतुर्दशाध्याय ( <i>caturdaśādhyāya</i> ):	f. – Al
f. 80v H	Fourteenth chapter	Fourteenth chapter]	ff. 111rv Kh
f. 97v L	Begins with:	A corresponding chapter title is absent.	f. – Pg
f. 87v O			
ff. 82v–83r Q	در معرفت مواضع ثوابت در طول و عرض		
pp. 71–72 R			
f. 36r S	<i>dar maʿrifat-i mavāzi<sup>c</sup>-i tavābit dar tūl u ʿarż</i>		
	On the knowledge of the positions of the fixed stars ( <i>tavābit</i> ) in longitude ( <i>tūl</i> ) and latitude ( <i>ʿarż</i> ).		
ZŠJ	[§ III.15]	[§ III.15]	SS
f. 87v D	باب پانزدهم ( <i>bāb-i pānzdahum</i> ):	पञ्चदशाध्याय ( <i>pañcadaśādhyāya</i> ):	f. – Al
f. 80v H	Fifteenth chapter	Fifteenth chapter	f. 111v Kh
f. 97v L	Begins with:	Begins with:	f. – Pg
f. 87v O <sup>†</sup>			
f. 83r Q	در بیان تقویم کید	अथ पञ्चदशाध्याये कैदानयनम् ।	
p. 72 R	<i>dar bayān-i taqvīm-i kayd</i>	<i>atha pañcadaśādhyāye kaidānayanam  </i>	
f. 36r S	On the expression of the true longitude ( <i>taqvīm</i> ) of Kayd.	Now, in the fifteenth chapter, calculating the [true longitude of] <i>Kayd</i> (SAN: <i>kaida</i> , PER: <i>kayd</i> , an inauspicious fictional star).	
<sup>†</sup> The text of the chapter is highly corrupted.			
	[–]	[§ III.col]	SS
	A corresponding colophon is absent.	[Colophon]	f. – Al
		[यः श्री शा]हजहाँनृपालमुकुटालङ्कारचूडामणि- स्तस्याज्ञामवलम्ब्य दुस्तरममुं सिद्धान्तसिन्धुं तरन् । नित्यानन्द इति द्विजोत्तमकृपः श्रीदेवदत्तात्मजो मध्यस्पष्टशरोपरागसहितं काण्डं तृतीयं त्वगात् । शुभमस्तु । [ <i>yaḥ śrī śā</i> ]hajahān̄n̄rpālamukutaḷāṅkāra- cūḍāmaṇis tasyājñām avalambya dustaram amuṃ siddhāntasindhum taran   nityānanda iti dvijottama- krpaḥ śrīdevadattātmajo madhya- spaṣṭaśaroparāgasahitaṃ kāṇḍaṃ tṛtīyaṃ tv agāt   śubhamastu	f. 111v Kh f. – Pg

Having obeyed the command of the one who is the jewel in the crown of King Śāh Jahān (*śāhjahān*, lit. the Emperor of the World), i.e., Āṣaf Ḥān [and] accomplishing that formidable [task of composing the] *Siddhānta-sindhu* [lit. an ocean of doctrinal truths], Nityānanda, [the one worthy of] the mercy of the best Brahmins, the son of Śri Devadatta, has indeed finished the third part accompanied [by discussions on] eclipses (*uparāga*), planetary latitudes (*śara*), true planetary longitudes (*spāṣṭa*), and mean planetary longitudes (*madhya*). May all things be auspicious.



- ZŠJ [§ IV] [-]  
 ff. 385r– مقاله چهارم (*maqāla-yi čahārum*): A corresponding fourth part is absent  
 390v D Fourth discourse (as witnessed in MS Kh)
- ff. 404r– Begins with  
 410r H  
 ff. 418r– در باقی اعمال نجومی و این مشتمل بر دو  
 419r L باب است  
 f. – O *dar bāqī-yi a<sup>c</sup>māl-i nujūmī u īn muštamil*  
 ff. 402r– *bar dū bāb ast*  
 409v Q On the remaining astronomical calculations. In two chapters.  
 pp. 675–  
 687 R  
 ff. 408r–  
 416r S
- ZŠJ [§ IV.1] [-]  
 ff. 385r– باب اول (*bāb-i avval*): A corresponding chapter is absent  
 388v D First chapter
- ff. 404r– Begins with  
 407v H  
 f. – L در آنچه تعلق بطالع موالید دارد و آن پنج  
 f. – O فصل است  
 ff. 402r– *dar ānči ta<sup>c</sup>alluq ba ṭāli<sup>c</sup>-i mavālīd dārad u*  
 405r Q *ān panj faṣl ast*  
 pp. 675– On things related to the ascendant  
 682 R (*ṭāli<sup>c</sup>*) at the nativity (*mavālīd*). In five  
 ff. 408r– sections.  
 411v S
- ZŠJ [§ IV.1.i] [-]  
 ff. 385r– فصل اول (*faṣl-i avval*): A corresponding section is absent  
 386r D First section
- ff. 404r– Begins with  
 405r H  
 f. – L در نمودارات  
 f. – O *dar namūdārāt*  
 ff. 402r– On indicators (*namūdārāt*) [i.e, a technique to determine a person's nativity].  
 403r Q  
 pp. 675–  
 677 R  
 ff. 408r–  
 409r S

- ZŠJ [§ IV.1.ii] [-]  
 f. 386r D فصل دوم (*faṣl-i duvum*): A corresponding section is absent  
 f. 405r H Second section  
 f. - L Begins with  
 f. - O  
 f. 403r Q در معرفت عرض افق حادث هر کواکبی  
 pp. 677- بحسب موضع او در صورت طالع  
 678 R *dar maʿrifat-i ʿarż-i ufuq-i ḥādīt-i har*  
 ff. 409rv S *kawkabī ba ḥasb-i mawẓiʿ-i ū dar ṣūrat-i*  
*ṭāliʿ*  
 On the knowledge of the latitude (*ʿarż*)  
 of the horizon of event (*ufuq-i ḥādīt*)  
 of each celestial object according to its  
 place in the figure of the ascendant  
 (*ṣūrat-i ṭāliʿ*).
- ZŠJ [§ IV.1.iii] [-]  
 ff. 386rv D فصل سوم (*faṣl-i sīvum*): A corresponding section is absent  
 ff. 405rv H Third section  
 f. - L Begins with  
 f. - O  
 ff. 403rv Q در معرفت درجه مصحح و مطالع مصحح  
 p. 678 R کواکب  
 f. 409v S *dar maʿrifat-i daraja-yi muṣahḥaḥ u*  
*maṭāliʿ-i muṣahḥaḥ-i kavākib*  
 On the knowledge of the corrected de-  
 gree (*daraja-yi muṣahḥaḥ*) and the cor-  
 rected ascensions (*maṭāliʿ-i muṣahḥaḥ*)  
 of celestial objects.
- ZŠJ [§ IV.1.iv] [-]  
 ff. 386v- فصل چهارم (*faṣl-i čahārum*): A corresponding section is absent  
 387r D Fourth section  
 ff. 405v- Begins with  
 406r H  
 f. - L در اعمال مطارح شعاعات و انوار کواکب  
 f. - O و غیر آن  
 ff. 403v- *dar aʿmāl-i maṭāriḥ-i šuʿāʿāt u anvār-i*  
 404r Q *kavākib u ġayr-i ān*  
 pp. 678-  
 679 R  
 ff. 409v-  
 410r S

On the calculations of the places of projection of the beams (*šucācāt*) and lights (*anvār*) of celestial objects, etc.

ZŠJ	[§ IV.1.v]	[-]
ff. 387r– 388r D	فصل پنجم ( <i>faṣl-i panjum</i> ): Fifth section	A corresponding section is absent
ff. 406r– 407r H	Begins with	
ff. 418rv L		در تسییرات
ff. 372rv O	<i>dar tasyīrāt</i>	
ff. 404r– 405r Q	On prorogations ( <i>tasyīrāt</i> ).	
pp. 679– 682 R		
ff. 410r– 411r S		

ZŠJ	[§ VI.1.vi]	[-]
ff. 388rv D	فصل ششم ( <i>faṣl-i šišum</i> ): Sixth section	A corresponding section is absent
ff. 418v– 419r L	Begins with	
ff. 372v– 373r O		در انتہات موالید
f. 405r Q	<i>dar intihā<sup>2</sup>āt-i mavālīd</i>	
p. 682 R	On the final term of nativities ( <i>inti-</i> <i>hā<sup>2</sup>āt-i mavālīd</i> ).	
ff. 411rv S		

ZŠJ	[§ IV.1.vii]	[-]
f. 388v D	فصل هفتم ( <i>faṣl-i haftum</i> ): Seventh section	A corresponding section is absent
ff. 407rv H	Begins with	
f. 419r L		در فرداریات موالید و سالهای ترتیب
f. 373r O	<i>dar firdārāt-i mavālīd u sālḥā-yi tartīb</i>	
f. 405r Q	On the fixed planetary periods of nativities ( <i>firdārāt-i mavālīd</i> ) and the [planets governing] the years of disposition ( <i>sālḥā-yi tartīb</i> ) [from birth].	
p. 682 R		
f. 411v S		

ZŠJ	[§ IV.2]	[-]
f. 390v D <sup>†</sup>	باب دوم ( <i>bāb-i duvum</i> ):	A corresponding section is absent
ff. 409v–	Second chapter	
410r H	Begins with	
f. – L		
ff. 375r–	در لیالی که تعلق بطالع عالم دارد	
376v O	<i>dar layālī ki ta<sup>c</sup>alluq ba ṭālī<sup>c</sup>-i ʿālam dārad</i>	
ff. 409rv Q	On the nights which are related to the	
pp. 686–	ascendant of the world ( <i>ṭālī<sup>c</sup>-i ʿālam</i> ).	
687 R		
ff. 415v–		
416r S		
†The end of the chapter is missing in MS D.		

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MMSM	Pingree, David (2003), <i>A Descriptive Catalogue of the Sanskrit Astronomical Manuscripts Preserved at the Maharaja Man Singh II Museum in Jaipur, India</i> (Philadelphia: American Philosophical Society), ISBN: 9780871692504.
RORI	Menaria, O. L., et al. (1985) (eds.), <i>Catalogue of Sanskrit and Prakrit Manuscripts (Alwar-Collection)</i> (Rajasthan Puratan Granthmala No. 151; Jodhpur: Rajasthan Oriental Research Institute).

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Abbreviation Text

AŞ	<i>‘Amal-i Şālih</i> Yazdānī, Ġulām (1923–27) (ed.), <i>‘Amal-i Şālih al-mawsūm ba Şah-jahān-nāma of Muḥammad Şālih Kambū</i> (Calcutta: The Asiatic Society of Bengal).
ĀA	<i>Āʿīn-i Akbarī</i> Blochmann, Heinrich (1872–77) (ed.), <i>Āʿīn-i Akbarī of Abū l-Faẓl</i> (Calcutta: Baptist Mission Press).
MR	<i>Maʿāṭir-i Raḥīmī</i> Ḥusayn, Hidāyat (1910–31) (ed.), <i>Maʿāṭir-i Raḥīmī of ‘Abd al-Bāqī Nahāvandī</i> (Calcutta: The Asiatic Society).
MŞjn	<i>Mulaḥḥaş-i Şāhjahān-nāma</i> al-Raḥmān, Jamīl (2009) (ed.), <i>Mulaḥḥaş-i Şāhjahān-nāma of Mīrzā Muḥammad Ṭāhīr Ḥān Āšnā “‘Ināyat Ḥān”</i> (New Delhi: Markaz-i Taḥqīqāt-i Fārsī, Rāyzanī-yi Farhangī-yi Sifārat-i Jumhūrī-yi Islāmī-yi Īrān (Centre for Persian Research, Office of the Cultural Counsellor, Embassy of Islamic Republic of Iran)).
Nḥ	<i>Nuzhat al-ḥawāṭir</i> <i>al-Iʿlām biman fī tāriḥ al-hind min al-aʿlām al-musammā bi-Nuzhat al-ḥawāṭir wa-bahjat al-masāmiʿ wa-l-nawāzīr of ‘Abd al-Ḥayy b. Faḥr al-Dīn al-Ḥasanī</i> (1999) (1 ed., Beirut: Dār ibn Ḥazm li-l-Ṭibāʿa wa-l-Naşr wa-l-Tawzīʿ).

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TM	<i>Tārīḥ-i Muḥammadī</i> b. Rustam b. Qubād, Muḥammad (n.d.), <i>Tārīḥ-i Muḥammadī</i> , MS Or. 1824 (London: The British Library).
TŠJ	<i>Ṭabaqāt-i Šāh Jahānī</i> Ḥān, Muḥammad Aslam (1990) (ed.), <i>Ṭabaqāt-i Šāh Jahānī: ṭabaqa-yi avval of Muḥammad Kašmīrī Hamadānī</i> (Delhi: Dānišgāh-i Dihlī).
ZUB	<i>Zīj-i Uluḡ Bīg</i> Sédillot, Louis-Amélie (1847a) (ed.), <i>Prologomènes des tables astronomiques d'Oloug-Beg: Publiés avec notes et variantes et précédés d'une introduction par M. L. P. E. A. Sédillot</i> (Paris: l'Institut de France).

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## APPENDICES

## A DISTRIBUTION OF THE CHAPTERS OF THE CANONS

Table A1: Distribution of the chapters of the canon in Mullā Farīd’s *Zīj-i Šāh Jahānī* (ZŠJ) vis-à-vis Nityānanda’s *Siddhāntasindhu* (SS). This distribution is based on the (near-)complete manuscripts of ZŠJ and the SS made available to us for this study; see § 2.

ZŠJ	SS	ZŠJ	SS	ZŠJ	SS
[§ P]	[§ P]	[§ II]	[§ II]	[§ III]	[§ III]
[-]	[§ P.1]	[§ II.1]	[§ II.1]	[§ III.1]	[§ III.1]
[§ P.1]	[§ P.2]	[§ II.2]	[§ II.2]	[§ III.2]	[§ III.2]
[§ P.2]	[§ P.3]	[§ II.3]	[§ II.3]	[§ III.3]	[§ III.3]
[§ P.4]	[§ P.5]	[§ II.4]	[§ II.4]	[§ III.4]	[§ III.4]
[§ ID]	[§ ID]	[§ II.5]	[§ II.5]	[§ III.5]	[§ III.5]
[§ ID.1]	[§ ID.1]	[§ II.6]	[§ II.6]	[§ III.6]	[§ III.6]
[§ ID.2]	[§ ID.2]	[§ II.7]	[§ II.7]	[§ III.7]	[§ III.7]
[§ ID.3]	[§ ID.3]	[§ II.8]	[§ II.8]	[§ III.8]	[§ III.8]
[§ ID.4]	[§ ID.4]	[§ II.9]	[§ II.9]	[§ III.9]	[§ III.9]
[§ ID.5]	[§ ID.5]	[§ II.10]	[§ II.10]	[§ III.10]	[§ III.10]
[§ I]	[§ I]	[§ II.11]	[§ II.11]	[§ III.11]	[§ III.11]
[§ I.1]	[§ I.1]	[§ II.12]	[§ II.12]	[§ III.12]	[§ III.12]
[§ I.2]	[§ I.2]	[§ II.13]	[§ II.13]	[§ III.13]	[§ III.13]
[§ I.3]	[§ I.3]	[§ II.14]	[§ II.14]	[§ III.14]	[§ III.14]
[§ I.4]	[§ I.4]	[§ II.15]	[§ II.15]	[§ III.15]	[§ III.14]
[§ I.5]	[§ I.5]	[§ II.16]	[§ II.16]	[-]	[§ III.col]
[§ I.6]	[§ I.6]	[§ II.17]	[§ II.17]	[§ IV]	[-]
[§ I.7]	[-]	[§ II.18]	[§ II.18]	[§ IV.1]	[-]
[§ I.8]	[§ I.7]	[§ II.19]	[§ II.19]	with	
[§ I.9]	[-]	[§ II.20]	[§ II.20]	[§ IV.1.i]-	
[§ I.10]	[-]	[§ II.21]	[§ II.21]	[§ IV.1.vii]	[-]-[-]
[-]	[§ I.col]	[§ II.22]	[§ II.22]	[§ IV.2]	[-]
		[-]	[§ II.col]		

## B LIST OF EARLIER ZĪJES

In the First part of the Introduction of the *Zīj-i Šāh Jahānī* (i.e., the *qism-i avval* [§ ID.1] from the *muqaddama*), and correspondingly in the First part of the Introduction of the *Siddhāntasindhu* (i.e., the *prathamaprakāra* [§ ID.1] from the *grantha-mukha*), we find a list of Islamicate *zīj*es from earlier times. These are described below, and whenever possible, apposite modern references are appended in footnotes. It is worth noting that Nityānanda expressly states in Sanskrit that the basis of both the *Zīj-i sanjarī* (*Jīca-saṃjarī*) and *Zīj-i ʿalāʿī* (*Jīca-ālāyī*) is the *Zīj-i šīrvān-šāhī* (*Jīca-šīrvān-šāhī*), whereas, Mullā Farīd’s Persian suggests that only the *Zīj-i ʿalāʿī* is based on the *Zīj-i šīrvān-šāhī*.

ZŠJ f. 3r D ff. 3rv H f. 4r L f. 6v O f. – Q p. 6 R f. 3r S	<b>Ten <i>zīj</i>es based (<i>mabnī</i>) on the observations (<i>raṣadhā</i>) of [al-]Battānī</b> <i>Zīj-i jāmi</i> <sup>c1</sup> and <i>Zīj-i bālīg</i> <sup>2</sup> of Kūšyār <i>Zīj-i mufrad</i> <sup>3</sup> of Muḥammad Ayyūb Ṭabarī <i>Zīj-i kāmīl</i> <sup>4</sup> of Abū Rašīd Dānišī <i>Zīj-i sālār</i> <sup>5</sup> of Ḥusām Sālār <i>Zīj-i muḡnī</i> , <sup>6</sup> <i>Zīj-i muḡkam</i> , <sup>7</sup> <i>Zīj-i mustawī</i> , <sup>8</sup> and <i>Zīj-i zāhidī</i> <sup>9</sup> of ʿAlī b. ʿAbd al-Karīm Šīrvānī Bakūhī <i>Zīj-i fāḡhīr</i> <sup>10</sup> of ʿAlī Mustawfī	<b>Ten <i>jīcas</i> derived (<i>jāta</i>) from the observations (<i>rasada</i>) of Battānī</b> <i>Jīca-jāme</i> and <i>Jīca-bālīgaṃ</i> of Gošiyāra <i>Jīca-mapharada</i> of Mahammada Ayuba Tabarī <i>Jīca-kāmīla</i> of Abū Rasīda Dānašī <i>Jīca-salāra</i> of Hisāma Salāra <i>Jīca-muḡaṃnī</i> , <i>Jīca-muḡhakama</i> , <i>Jīca-mastauphī</i> and <i>Jīca-jāhadī</i> of Alī, son of Abdala Karīma Šīrvānī Bākohī <i>Jīca-phākhaja</i> of Alī Mauštauphī	SS f. 6v Al ff. 7v–8r Kh ff. 7rv Pg
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1 See Kennedy (1956: no. 9 on p. 125) and <https://ismi.mpiwg-berlin.mpg.de/text/147173>.

2 See Kennedy (1956: no. 7 on p. 125).

3 See Kennedy (1956: no. 65 on p. 134) and <https://ismi.mpiwg-berlin.mpg.de/text/481724>.

4 See Kennedy (1956: no. 49 on p. 132).

5 Also known as *Zīj-i šāhī*; see Kennedy (1956: no. 32 on p. 130) and <https://ismi.mpiwg-berlin.mpg.de/text/137424>.

6 See Kennedy (1956: no. 64 on p. 134) and <https://ismi.mpiwg-berlin.mpg.de/text/99703>.

7 See Kennedy (1956: no. 53 on p. 132) and <https://ismi.mpiwg-berlin.mpg.de/text/66489>.

8 See Kennedy (1956: no. 58 on p. 133) and <https://ismi.mpiwg-berlin.mpg.de/text/73738>.

9 Also known as *al-Zīj al-zāḡhīr* of Farīd al-Dīn Abū l-Ḥasan ʿAlī b. ʿAbd al-Karīm al-Šīrvānī al-Fahhād; see Kennedy (1956: no. 23 on p. 128) and <https://ismi.mpiwg-berlin.mpg.de/text/59095>.

10 Most probably, the *al-Zīj al-Fāḡhīr* of Abū l-Ḥasan ʿAlī b. Aḡmad al-Nasawī; see Kennedy (1956: no. 44 on p. 131) and <https://ismi.mpiwg-berlin.mpg.de/text/122261>.

**One *zīj* of unspecified basis**

*Zīj-i sanjarī*<sup>11</sup> of ʿAbd al-Raḥmān Ḥāzinī

**One *zīj* based (*mabnī*) on the *Zīj-i šīrvān-šāhī*<sup>12</sup>**

*Zīj-i ʿalāʾī*<sup>13</sup>  
[of unnamed authorship]

**Other *zījes***

*Zīj-i ʿumda-yi ilḥānī*<sup>14</sup>

*Zīj-i ḥāqānī takmīl-i zīj-i ilḥānī*<sup>15</sup> of Mawlānā Jamšīd Kāšī

*Zīj-i sulṭānī*<sup>16</sup> of Imām Muḥammad b. Ḥwāja ʿAlī Vābkanavī

*Zīj* of Abū l-Vafā Būzjānī<sup>17</sup>

*Zīj* of Abū Ḥāmid Anṣārī

*Zīj* of Abū l-Faraj Šīrāzī

*Zīj* of Abū l-Ḥasan Ṭūsī<sup>18</sup>

**Two *jīcas* derived (*jāta*) from the *Jīca-šeravānšāhī***

*Jīca-sanjarī* of Amāma Abdala Rahamā Khājanī

*Jīca-ālāyī*  
[of unnamed authorship]

**Other *jīcas***

*Jīca* of Ali-šāha Khvārajamī, resembling the great treatise famously called *Jīca-yīlakhānī* [of Naṣīr al-Dīn al-Ṭūsī]

*Jīca-khākānī-takamīla-jīca-yīlakhānī* of Maulānā Jamašeda Kāšī

*Jīca-sulātānī* of Amāma Mahammada, son of Khvāja Alī Yaknavī

*Jīca-abala-vaphā-būjajānī*

*Jīca-abū-hāmīda-aṃsārī*

*Jīca-abū-khala-pharaja-šīrājī*

*Jīca-abūla-hasan-tūsī*

<sup>11</sup> See Kennedy (1956: no. 27 on p. 129) and <https://ismi.mpiwg-berlin.mpg.de/text/150288>.

<sup>12</sup> See Kennedy (1956: no. 30 on pp. 129–30).

<sup>13</sup> Most probably, the *Zīj-i ʿAlāʾī* of al-Ḥasan b. Muḥammad b. al-Ḥusayn Nizām al-Dīn al-ʿAraḥ al-Nisābūrī; see Kennedy (1956: no. 42 on p. 131) and <https://ismi.mpiwg-berlin.mpg.de/text/152130>.

<sup>14</sup> See Kennedy (1956: no. 32 on p. 130), and also see <http://isamveri.org/pdfdkm/02/DKM021059.pdf> (last accessed: 20th December 2023) for collated biblio-

graphic references on the works of Alī-šāh Ḥwārazmī [al-Buḥārī].

<sup>15</sup> See Kennedy (1956: no. 20 on pp. 127–28) and <https://ismi.mpiwg-berlin.mpg.de/text/74283>.

<sup>16</sup> Also known as *al-Zīj al-muḥaqqaq al-sulṭānī ʿalā uṣūl al-raṣad al-Ilḥānī*; see Kennedy (1956: no. 35 on p. 130) and <https://ismi.mpiwg-berlin.mpg.de/text/153227>.

<sup>17</sup> See Kennedy (1956: no. 73 on p. 134).

<sup>18</sup> Most probably, the *Zīj-i Ilḥānī* of Abū Jaʿfar Naṣīr al-Dīn Muḥammad b. Muḥammad b. al-Ḥasan al-Ṭūsī; see Kennedy (1956: no. 6 on p. 125) and <https://ismi.mpiwg-berlin.mpg.de/index.php/text/154844>.



<i>Zīj-i kāfī</i> <sup>19</sup> [of unnamed authorship]	<i>Jīca-kāphī</i> [of unnamed authorship]
<i>Zīj-i sikandarī</i> <sup>20</sup> [of unnamed authorship]	<i>Jīca-sikandarī</i> [of unnamed authorship]
<i>Zīj-i advār akvār</i> <sup>21</sup> [of unnamed authorship]	<i>Jīca-adavāra-akavāra</i> [of unnamed authorship]
<i>Zīj-i ašrafī</i> <sup>22</sup> [of unnamed authorship]	<i>Jīca-ašaraphī</i> [of unnamed authorship]
<i>Zīj-i rahīmī</i> <sup>23</sup> [of unnamed authorship]	<i>Jīca-rahīmī</i> [of unnamed authorship]
<i>Zīj-i mazharī</i> <sup>24</sup> [of unnamed authorship]	<i>Jīca-mujaharī</i> [of unnamed authorship]
<i>Zīj-i kāšifī</i> <sup>25</sup> [of unnamed authorship]	<i>Jīca-kāšaphī</i> [of unnamed authorship]
<i>Zīj-i šāṭirī</i> <sup>26</sup> [of unnamed authorship]	<i>Jīca-šāṭarī</i> [of unnamed authorship]

19 Most probably, the *al-Zīj al-kāfī* of ʿUṭārid b. Muḥammad al-Ḥāsib; see Kennedy (1956: no. 103 on p. 136) and <https://ismi.mpiwg-berlin.mpg.de/index.php/text/130305>.

20 Speculatively, the *Lubāb-i Iskandarī* (alias: *Muḥtaṣar dar ʿilm-i hayʿat*) of Giyāṭ al-Dīn Jamšīd b. Masʿūd b. Maḥmūd al-Kāšī; see <https://ismi.mpiwg-berlin.mpg.de/node/2672949>.

21 Most probably, the *Adwār al-anwār madā l-duḥūr wa-l-akwār* of Muḥyī al-Milla wa-l-Dīn Yaḥyá b. Abī l-Šukr al-Maḡribī al-Andalusī; see Kennedy (1956: no. 108 on p. 137) and <https://ismi.mpiwg-berlin.mpg.de/text/41182>.

22 Most probably, the *Zīj-i Ašrafī* of Muḥammad b. Abī ʿAbd Allāh Sanjar al-Kāmīlī; see Kennedy (1956: no. 4 on p. 124) and <https://ismi.mpiwg-berlin.mpg.de/text/79219>.

23 Most probably, the *Zīj-i Raḥīmī* of Mullā Farīd al-Dīn Masʿūd Ḥāfiẓ Ibrāhīm Dihlavī; see § 1.2.1.

24 Most probably, the *Zīj-i Mazharī* of Mazhar al-Dīn Muḥammad Qārī b. Bahāʾ al-Dīn ʿAlī; see Ansari (2015: no. 3.8 on p. 591–93) for a brief description of the *Zīj-i mazharī*.

25 Speculatively, the *Kašf-i ḥaqāʾiq-i Zīj-i ʾIlḥānī* (alias: *Kašf al-ḥaqāʾiq Zīj-i ʾIlḥānī*) of al-Ḥasan b. Muḥammad b. al-Ḥusayn Nizām al-Dīn al-Aʿraj al-Nīsābūrī; see <https://ismi.mpiwg-berlin.mpg.de/text/101627>.

26 Most probably, the *al-Zīj al-jadīd* of ʿAlāʾ al-Dīn Abū l-Ḥasan ʿAlī b. Ibrāhīm al-Anṣārī (commonly known as Ibn al-Šāṭir); see, Kennedy (1956: no. 11 on p. 125) and <https://ismi.mpiwg-berlin.mpg.de/index.php/text/118322>.

*Zīj-i quṭbī*<sup>27</sup>

[of unnamed authorship]

*Jīca-kutabī*

[of unnamed authorship]

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<sup>27</sup> Most probably, the *Zīj-i sulṭānī* of Quṭb al-Dīn Maḥmūd b. Masʿūd b. Muṣliḥ al-Širāzī; see Kennedy (1956: no. 25 on

p. 129) and <https://ismi.mpiwg-berlin.mpg.de/text/141286>.

C LIST OF EARLIER FACILITATORY TABLES  
(PER: *TASHĪL*, SAN: *SĀRAṆĪ*)

In the First part of the Introduction of the *Zīj-i Šāh Jahānī* (i.e., the *qism-i avval* [§ ID.1] from the *muqaddama*), and correspondingly in the First part of the Introduction of the *Siddhāntasindhu* (i.e., the *prathamaprakāra* [§ ID.1] from the *granthamukha*), we find the following five Islamicate simplification tables (PER: *tashīl*, SAN: *sāraṇī*) from earlier times. These are described below, and when possible, apposite modern references are appended in footnotes. We note that both the Persian original and its Sanskrit translation state that there are several other such tables based on ancient and recent observations (PER: *rašad*, SAN: *rasada*) at the end of this short list.

ZŠJ f. 3r D f. 3v H f. 4r L f. 6v O f. – Q f. 6 R f. 3v S	<p><i>Tashīl</i> of the Moon and Mercury by Mullā ʿImād,<sup>1</sup> based (<i>mabnī</i>) on the <i>Zīj-i Gūrgānī</i> [i.e., the <i>Zīj-i Uluġ Bīġ</i>]</p> <p><i>Tashīl</i> of the five planets by ʿUmar Ḥayyām<sup>2</sup></p> <p>Two <i>tashīls</i> of the Moon known as <i>Ḥasanča</i> [of unnamed authorship]</p> <p><i>Tashīl</i> of the seven planets by Ḥusayn b. Mūsà Hurmuzī<sup>3</sup></p> <p><i>Tashīl</i> of the Sun [of anonymous authorship]</p>	<p><i>Sāraṇī</i> of the Moon and Mercury by Mullā Imāda, in agreement (<i>anumata</i>) with the <i>Jīca-koraġānī</i></p> <p>Five <i>sāraṇīs</i> of the five planets beginning with Mars by Umara Khayāma</p> <p>Two <i>sāraṇīs</i> of the Moon called <i>Hasančaya</i> [of unnamed authorship]</p> <p><i>Sāraṇī</i> of the seven planets by Husaina, son of Mūse Huramajī</p> <p><i>Sāraṇī</i> of the Sun [of anonymous authorship]</p>	SS ff. 6v–7r Al ff. 8rv Kh f. 7v Pg
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<sup>1</sup> Identified as the *Kitāb Jadwal tashīl al-qamar wa-jadwal tashīl ʿuṭārid* of ʿImād al-Dīn al-Buḥārī (fl. fifteenth century); see Şen and Fleischer (2019: no. [23] on p. 784).

<sup>2</sup> Most probably, part of the *al-Zīj Malik-šāhī* of Ġiyāṭ al-Dīn Abū l-Faṭḥ ʿUmar b. Ibrāhīm al-Ḥayyāmī al-Nīšāpūrī ʿUmar Ḥayyām; see Kennedy (1956: no. 22 on

p. 128) and <https://ismi.mpiwg-berlin.mpg.de/text/97813>.

<sup>3</sup> Most probably, part of the *Zīj-i Šastġah* of Ḥusayn b. Mūsà al-Hurmuzdī al-Ḥāsib; see Kennedy (1956: no. 33 on p. 130) and <https://ismi.mpiwg-berlin.mpg.de/text/70224>.

## D ON THE ETYMOLOGY OF THE WORD ZĪJ

In the First part of the Introduction of Mullā Farīd's *Zīj-i Šāh Jahānī* (i.e., the *qism-i avval* [§ ID.1] from the *muqaddama*), and correspondingly in the First part of the Introduction of Nityānanda's *Siddhāntasindhu* (i.e., the *prathamaprakāra* [§ ID.1] from the *granthamukha*), we find their discussion on the etymology of the word *zīj*.<sup>1</sup> These are presented below with the original text and corresponding English translations in parallel columns.

ZŠJ

f. 3r D  
f. 3v H  
f. 4r L  
f. 6v O  
f. - Q  
f. - R  
ff. 3rv S

## In the words of Mullā Farīd

زیج معرب زیگ است بکاف فارسی پس  
بجیم عربی باشد و آنکه او را بجیم فارسی  
میخوانند غلط عامه است و زیگ پیارسی نام  
آن ریسمانها است که نقشبندان بآنها پارچهها  
نقش میندند و آن قانون است جامه باف را  
در معرفت بافتن پارچههای منقش همچنانکه  
زیج قانونی است منجم را در شناختن نقوش  
و اوضاع فلکی و خطوط جداول زیج در  
طول و عرض در هم کشیده که کیفیت  
نقوش ثیاب ازان پیدا شود و راصد درین  
صنعت بمنزله نقشبند است

*zīj mu'arrab-i zīg ast ba kāf-i fārsī pas  
zīj ba jīm-i 'arabī bāšad u ānki ū rā ba  
jīm-i fārsī mīhwānand ḡalat-i 'amma ast  
u zīg ba pārsī nām-i ān rīsmānhā ast ki  
naqš-bandān ba ānhā bar pārcāhā naqš  
mībandand u ān qānūn ast jāma-bāf rā dar  
ma'rifat-i bāftan-i pārcāhā-yi munaqqaš  
hamčunānki zīj qānūnī ast munajjim rā dar  
šināhtan-i nuqūš u awzāc-i falakī u huṭūṭ-i  
jadāvīl-i zīj dar ṭūl u 'arṣ dar ham kašīda ki  
kayfīyat-i nuqūš-i tīyāb az ān paydā šavad*

## In the words of Nityānanda

प्रथमं फारसीजीगशब्दः प्रसिद्धः आरबदेशे  
तस्यापभ्रंशेन जीज इति आरबदेशे  
गकारस्याभावात् । गकारस्थानजकारमेव  
तद्देशवासिनः पठन्ति । तस्मादेतस्य नाम जीज  
इति यवनलिपौ जकारचकारयोरभेदाज्जीचशब्दो  
रूढितः । प्रसिद्धो जातो वास्तवेनाशुद्धशुद्धं  
तु जीज इति फारसीदेशे तन्तुवायानां  
वस्त्रविशेषचित्ररचनायां जीग इति नाम्न्यो रज्जवो  
भवन्ति । ताभिस्तन्तुवायाश्चित्रकाश्चित्राणि  
रचयन्ति । तन्तुवायचित्रकानां वस्त्रचिन्तनारम्भे  
चित्रज्ञानार्थं ता रज्जव उपकरणानि भवन्ति ।  
यथा ज्योतिर्विदां चित्ररूपगोलसंस्थाज्ञानार्थं जीच  
इति । पुनर्येभ्यः कोष्ठकेभ्यो ग्रहभुक्तिपरिमाणं प्रकटं  
भवति तद्द्वैर्घ्यायामरेखा एतादृशा भवन्ति यथा  
जीगारख्यरज्जव आयामविस्तारगता भवन्ति । अत्र  
रसदकर्ता चैतादृशो यादृग्वस्त्रचित्रकः ।

SS

f. 6v Al  
f. 8r Kh  
f. 7v Pg

*prathamam phārasījīgaśabdah prasiddhah  
ārabadeśe tasyāpabhraṃśena jīja iti  
ārabadeśe gākārasyaābhāvāt | gākāsthāna-  
jakāram eva taddeśavāsinaḥ paṭhanti |  
tasmād etasya nāma jīja iti yavana-  
lipau jakāracakārayor abhedāj jīca-  
śabdo rūḍhitaḥ | prasiddho jāto  
vāstavenāśuddham śuddham tu jīja  
iti phārasīdeśe tantuvāyānām vastra-  
viśeṣacitraracanāyām jīga iti nāmnyo  
rajjavo bhavanti | tābhis tantuvāyāś*

<sup>1</sup> Originally, the etymology of the word *zīj* derives from the *Zīj-i muḥaqqaq-i sulṭānī* of Muḥammad ibn 'Alī al-Munajjim al-Wāb-

kanawī (more commonly, Šams al-Munajjim) written in Persian, c. 1320.

*u rāṣid dar īn ṣan<sup>c</sup>at ba manzila-yi naqṣ-  
band ast*

*citrakāś citrāṇi racayanti | tantuvāya-  
citrakānāṃ vastracintanārambhe citra-  
jñānārtham tā rajjava upakaraṇāni bhav-  
anti | yathā jyotirvidāṃ citrarūpagola-  
samsthājñānārtham jīca iti | punar  
yebhyaḥ koṣṭhakebhyo grahabhukti-  
parimāṇam prakāṣam bhavati tad  
dairghyāyāmarekhā etādṛśā bhavanti  
yathā jīgākhyarajjava āyāmavistāragatā  
bhavanti | atra rasadakartā ca itādṛśo yādṛg  
vastracitrakah |*

*Zīj* is the Arabicization of *zīg*, written with a Persian *kāf*. It becomes *zīj* with an Arabic *jīm*. It is a common mistake to pronounce it with a Persian *jīm*. In Persian *zīg* is the name given to the strings (*rīsmān*) with which embroiderers sew pictures on clothes. This is for the weaver the basic principle in the knowledge of weaving embroidered clothes in exactly the same manner as the *zīj* is for the astronomer the basic principle in his knowledge of the celestial pictures and positions. Having drawn together both in length and breadth the lines of the tables in the *zīj* from which are produced the details of the pictures on the clothes. In this craft, the observer is in the position of the embroiderer.

Firstly, the Persian word *jīga* (PER: *zīg*) that is famous in the Arab world, by its corruption, becomes *jīja* (ARA: *zīj*) due to the absence of the letter *ga* (i.e., PER: *gāf*) in the Arab world. Indeed, the residents of those countries [i.e., Arab native speakers] read the letter *ja* (i.e., ARA: *jīm*) in place of the letter *ga*. [And] from that, the name *jīja* of this [word *zīj*] becomes the word *jīca* in common usage due to absence of distinction between the letter *ja* and the letter *ca* in the Muslim [Arabic] script (*yavana-lipi*). The famous [word] that, although genuinely inaccurate, was [though as] correct [and] called *jīja*; in the Persian world, the string (*rajju*) in the creation of special figures on cloth by the weavers are [called] *jīga* by name. With those [strings], weavers [like] painters create figures. When beginning to think about [the design on] the cloth, these strings become instruments of the weavers and painters for the sake of understanding the figure just as *jīca* [becomes the instrument] of the astronomers for the sake of understanding the arrangement of [the movement of] the celestial sphere in the form of figures. Moreover,

all those tables from which the measure of the daily motion of the planets becomes evident, the lines constituting their length and breadth are thus formed, just as the strings called *jiga* outline the length and breadth [of the woven figures]. And here, the observers (*rasada-kartr*, lit. makers of *rasada* 'observations') are in a way similar to the painters of cloth.

E ON THE UTILITY OF ALMANACS (*TAQVĪM*) AND *ZĪJES*, AND  
OF OBSERVATIONS (*RAṢAD*)

In the First part of the Introduction of Mullā Farīd's *Zīj-i Šāh Jahānī* (i.e., the *qism-i avval* [§ ID.1] from the *muqaddama*), and correspondingly in the First part of the Introduction of Nityānanda's *Siddhāntasindhu* (i.e., the *prathamaparakāra* [§ ID.1] from the *granthamukha*), we find their statements on the utility (PER: *fāyida* 'advantage', SAN: *prayojana* 'use') of almanacs (PER: *taqvīm*, SAN: *takavīma*) and *zījes* (SAN: *jīca*), and of observations (PER: *raṣad*, SAN: *rasada*). These are presented below with the original text and corresponding English translations in parallel columns.

ZŠJ

f. 3v D

f. 3v H

f. 4r L

ff. 6v–7r O

f. – Q

f. – R

f. 3v S

**On the advantage of an almanac**  
(*taqvīm*)

و فایده تقویم آن است که اختیارات جزوی  
و روزهای سال و احوال گردش روزگار و  
صلح بادشاهان با یکدیگر و حرب و ایمنی  
و تندرستی و رنجوری مردمان و ارزانی و  
گرانی نرخها و بارندگی و خشکی سال معلوم  
گردد

*u fāyida-yi taqvīm ān ast ki ihtiyārāt-i  
juzvī-yi rūzhā-yi sāl u aḥvāl-i gardiṣ-i  
rūzgār u ṣulḥ-i bādšāhān bā yak-dīgar u  
ḥarb u imnā u tan-durustī u ranjvarī-yi  
mardumān u arzānī u garānī-yi nirḥhā u  
bārandagī u ḥuškī-yi sāl ma'lūm gardad*

An almanac (*taqvīm*) is useful in knowing how to choose the parts of the day in the year [on which to perform successful actions], and to know the details of the motions of fortune, peace between emperors, war, security, the health and infirmity of men, the cheapness and expensiveness of commodities, [and] the rain and drought periods in the year.

**On the use of an almanac** (*takavīma*) SS

f. 7r Al

f. 8v Kh

f. 8r Pg

प्रतिदिनमुहूर्तादिविचारः समयविचारो यथाराज्ञा-  
मस्मिन्वर्षे परस्परं संधिर्युद्धं वा सशङ्कत्वं निःशङ्कत्वं  
वा सातुज्यं नैतुज्यं वा लोकानां च काण्डस्य समर्घत्वं  
महार्घत्वं वा वर्षणमवर्षणं वेत्यादि तकवीमस्य  
प्रयोजनम् ।

*pratidinamuhūrtādivicārah samayavicāro  
yathārājñām asmin varṣe parasparam  
saṃdhir yuddham vā saśaṅkatvaṃ  
niḥśaṅkatvaṃ vā sātujaṃ naitujaṃ  
vā lokānām ca kāṇḍasya samarḡhatvaṃ  
mahārḡhatvaṃ vā varṣaṇam avarṣaṇam  
vetyādi takavīmasya prayojanam |*

The use of an almanac (*takavīma*) is, among other things, for investigating daily [time divisions of] *muhūrta* etc. [and] for investigating opportune times, just as [the moments] in this year [when there could be] a mutual peace treaty between kings or war, a state of doubt or certainty, vitality or languor among men, the cheapness or expensiveness of a commodity, and [the chance of] rain or drought.

ZŠJ

f. 3v D  
f. 3v H  
f. 4r L  
ff. 6v-7r O  
f. - Q  
f. - R  
f. 3v S

**On the advantage of a zīj**

و از جمله فواید زیج آنکه هر فرزندی که در وجود آید طالع مولود و تحویل وی از انجا استخراج کنند تا احوال او از درازی عمر و کوتاهی و نیکبختی و بدبختی و تندرستی و بیماری و توانگری و درویشی و رنج و راحت او دانسته شود

*u az jumla-yi favāyid-i zīj ānki har farzandī ki dar vujūd āyad ṭālī<sup>c</sup>-i mawlūd u taḥvīl-i vāy az ānjā istihraj kunand tā aḥvāl-i ū az darāzī-yi <sup>c</sup>umr u kūṭāhī u nīk-baḥtī u bad-baḥtī u tan-durustī u bīmārī u tavāngarī u darvīšī u ranj u rāḥat-i ū dānista šavad*

Amongst the advantages in zījes, is the derivation from it of the Ascendant at birth and of annual revolution for every child who is born so that his circumstances may be known, such as length and shortness of life, good or bad fortune, health and illness, wealth, poverty, suffering, tranquillity.

**On the use of a zīj (jīca)**

अथ यस्य बालस्य जन्मसमयो ज्ञायते तस्य जन्मलग्नं यतो गण्यते वर्षलग्नादिकमायुर्दायादिकं शुभाशुभफलं ज्ञायत इत्यादि जीचस्य प्रयोजनम् ।

*atha yasya bālasya janmasamayō jñāyate tasya janmalagnaṃ yato gaṇyate varṣalagnādikama yurdāyādikaṃ śubhā-śubhaphalaṃ jñāyata ityādi jīcasya prayojanam |*

Now, the use of a zīj (jīca) is, among other things, to calculate for a child whose time of birth is known, the natal Ascendant, the Ascendant of annual revolution etc. to predict the length of [their] life from the aspect of the stars etc. [and] to determine the auspicious and inauspicious [astrological] effects.

SS

f. 7r Al  
f. 8v Kh  
f. 8r Pg

ZŠJ

f. 3v D  
f. 3v H  
f. 4r L  
ff. 6v-7r O  
f. - Q  
f. - R  
f. 3v S

**On the advantage of observations (rašad)**

فایده رصد آنکه اگر در مواضع کواکب بمرور ایام خللی ظاهر شود آنرا صاحب رصد راست کند تا درین احکام که گفته شد خطا کمتر واقع شود چه اگر یکدرجه در تقویم کوبی خطا باشد یکسال در احکام تسییرات تفاوت افتد و اگر یکدقیقه خطا باشد شش روز این است

*fāyida-yi raṣad ānki agar dar mavāzī<sup>c</sup>-i kavākib ba murūr-i ayyām ḥalalī zāhir šavad ān rā ṣāḥib-i raṣad rāst kunad tā dar īn aḥkāṃ ki gufta šud ḥaṭā kamtar vāqī<sup>c</sup> šavad čī agar yak-daraja dar taqvim-i kawkabī ḥaṭā bāšad yak-sāl dar aḥkāṃ-i tasyīrāt*

**On the use of observations (rasada)**

अथ कियान्निर्दिनेर्गतेर्ग्रहेषु किञ्चिदन्तरं यदि पतति तदा रसदकर्ता सम्यक्तदन्तरं जानाति साधयति च ततः सर्वाण्युक्तानि फलानि मिलन्ति । यद्यन्तरमंशप्रमाणं ग्रहे चलति तदा तसीरातसंज्ञे वर्षमेकं चलति यदि कलैका चलति तदा षड्विनानि चलन्तीत्यादि रसदस्य प्रयोजनम् ।

*atha kiyādbhir dinair gatair graheṣu kiñcid antaram yadi patati tadā rasadakartā samyak tadantaram jānāti sādhayati ca tataḥ sarvāṅgy uktāni phalāni milanti | yady antaram aṃśapramāṇaṃ grahe calati tadā tasīrātasamjñē varṣam ekaṃ calati yadi*

SS

f. 7r Al  
f. 8v Kh  
f. 8r Pg



*tafāvut uftad u agar yak-daḡīqa ḡaṡā bāšad  
šiš rūz ast*

The advantage of observation (*rašad*) is that if a defect appears in the positions of planets with the passing of days, the observer (*ṡāḡib-i rašad*) will rectify it so that in making prognostications, less errors will arise. Indeed if one degree is wrong in the table of positions of the planets, there is will be a one-year discrepancy in the astrological judgement (*aḡkām*) of the prorogations (*tasyīrāt*), and if one minute is wrong, it will be a six-day [difference].

*kalaikā calati tadā ṡaḡḡināni calantīyādi  
rasadasya prayojanam |*

Now, the use of observations (*rasada*) is, among other things, that if there occurs a little difference in the [attested and observed positions of the] planets with some amount of elapsed days, then an observer (*rasadakarṡr*) knows and corrects that difference completely [and] thereupon, all declared results concur. If an amount of [one] degrees of arc difference deviates in the [attested and observed positions of the] planet [in the tables], then one year deviates in [what is called] *tasīrata* (PER: *tasyīrāt* 'prorogations') by name; if [the amount of difference of] one minute of arc deviates, then six days deviate.

## F ON VARIOUS CALENDRIAL TERMS IN DIFFERENT TRADITIONS

In the Fifth part of the Introduction of Mullā Farīd's *Zīj-i Šāh Jahānī* (i.e., the *qism-i panjum* [§ ID.5] from the *muqaddama*), and correspondingly in the Fifth part of the Introduction of Nityānanda's *Siddhāntasindhu* (i.e., the *pañcamaparakāra* [§ ID.5] from the *granthamukha*), we find descriptions of calendrical terms according to the different traditions of Arabic (PER: *arabī*, SAN: *ārabīya*), Byzantine Roman (PER: *rūm*, SAN: *romaka*), Chinese (PER: *ḥaṭā*, SAN: *khitā/khitāya*), Greek (PER: *yūnān*, SAN: *yūnāna*), Hindu (PER: *hind*, SAN: *hindu*), Persian (PER: *fārs*, SAN: *phārasa*), Turkic (PER: *turkī*, SAN: *turakī*), Uyghur (PER: *uyğur*, SAN: *yağūra*), and more generally, Muslim (PER: *ahl-i šar*<sup>c</sup> 'people of Islamic law', SAN: *yavana*) astronomers. These are presented below as enumerated lists in parallel columns.

In his *Zīj-i Šāh Jahānī*, Mullā Farīd describes:

1. the tropical solar year (*sāl-i āftābī*) with respect to the vernal equinox (0° Aries or *avval-i ḥamal*, lit. 'beginning of Aries');
2. the lunar year (*sāl-i qamarī*) of twelve synodic lunar months (*māh*);
3. the sidereal solar month (*māh-i šamsī*) with respect to the ingress of the Sun into a zodiacal sign (i.e., the beginning of the *sayr-i āftāb dar yak burj* 'course of the Sun in a zodiacal sign');
4. the nychthemeron (*šabāna-rūz*), according to the Persian and Greek astronomers, measured from the preceding midday (*nīm-i rūz*) to the succeeding midday;
5. the nychthemeron, according to the Chinese, Uyghur and Hindu astronomers, measured from the

In his *Siddhāntasindhu*, Nityānanda describes:

1. the tropical solar year (*saura-abda*) with respect to the vernal equinox (0° Aries or *meśa-mukha*, lit. 'beginning of Aries');
2. the lunar year (*cāndra-varṣa*) of twelve synodic lunar months (*candra-māsa*);
3. the sidereal solar month (*sauramāsa*) with respect to the ingress of the Sun into a zodiacal sign (i.e., the beginning of the *saṃkrānti* 'zodiacal transit of the Sun');
4. the nychthemeron (*ahorātra*), according to the astronomers born in the Persian lands who were influenced by [the astronomers in] the Greek lands, measured from the preceding midday (*dyumadhyāhna*) to the succeeding midday;
5. the nychthemeron (*dyuniśa*), according to the astronomers of the Chinese and Hindu mainlands, measured from the pre-

- preceding midnight (*nīm-i šab*) to the succeeding midnight;
6. the nychthemeron, according to the Arabs and to the people of the Law [astronomers], measured from the preceding evening (*avval-i šab*) to the succeeding evening;
  7. the nychthemeron, according to other peoples, measured from the preceding sunrise (*avval-i rūz*) to the succeeding sunrise;
  8. the mean nychthemeron (*šabāna-rūz-i vasaṭī*), equal to one revolution of the highest celestial sphere (*falak-i aʿzam*) with the mean motion of the Sun, which, according to the observations made in Samarqand, is equal to  $0^{\circ}59'8''19'''37''''48''''''$ ;
  9. the length of day (*rūz*) for the Persian and Byzantine Roman astronomers, from the rising of the centre of [the disc of] the Sun (*ṭulū<sup>c</sup>-i markaz-i šams*) till its setting (*ḡurūb*);
  10. the length of day (*rūz*) for people who follow Islamic law as measured from the rising of the true dawn (*ṭulū<sup>c</sup>-i ṣubḥ-i šādiq*) until the setting of the entire body of the Sun (*ḡurūb-i tamām-i jirm-i šams*); [with] the length of a night (*šab*) as the opposite of both preceding items;
- ceding midnight (*dyu-rātrārdha*) to the succeeding midnight (*dyu-rātrimadhya*);
  6. the nychthemeron (*dyurātra*), according to the Arabic [astronomers] who are famous among the Muslims, measured from the preceding evening (*sāya*) to the succeeding evening, always according to the teachings of their own religion;
  7. the nychthemeron, according to those born in other Hindu regions, measured from the preceding sunrise (*arka-udaya*) to the succeeding sunrise;
  8. the mean nychthemeron (*madhya-dyuniśa*), according to the best of the sages and the best of Muslims, as the revolution of time (*kālacakra*) of 4 sidereal seconds (*prāṇa*) [approximately] equal to the arcminutes (*lipta*) of daily mean motion of the Sun;
  9. the length of day and night (*dina-rātri*) for the Persian and Byzantine Roman astronomers, and those born in the land of the Hindus, from the rising of the centre of the disc of the Sun (*dineśa-bimbārdha-samudgama*) till its setting (*asta*) reciprocally;
  10. the length of day (*vāsara*) for those coming from the Arab lands and those following the religion of the greater Muslim [regions] as measured from dawn (*anūru*) to the time of the setting of the disc of the Sun (*kharāṃśu-bimba-asta-kāla*), with the other part being entirely night (*rātri*);

11. the length of equal hours (*sā<sup>c</sup>āt-i mustavīya u mu<sup>c</sup>tadila*) either mean (*vasatī*) or true (*ḥaqīqī*) as the twenty-fourth parts of the mean or exact nychthemeron (*šabānrūz-i vasatī u ḥaqīqī*);
  12. the twelve unequal hours (*sā<sup>c</sup>āt-i mu<sup>c</sup>vajja u zamānī*) dividing equally either the day or the night;
  13. the twelve divisions of the whole nychthemeron, known as *čāḡ*, according Chinese and Uyghur astronomers;<sup>1</sup>
  14. the period of an eighth part of a *čāḡ* called *kih* and the definition of its smaller unit *fank* (CHIN: *fēn*), and the names of the different *čāḡ* following their Chinese and Uyghur nomenclature; and
  15. on the commencement of the nychthemeron from the first *kih* of the first *čāḡ*.
11. the length of equal hours (*tulya-horā*) for those born in Persia and Byzantine Rome as the twenty-fourth part of some precise or imprecise nychthemeron (*sphuṭa-asphuṭa-dyuniśa*);
  12. the twelve unequal hours (*atulya-horā*) of the measures of the day and the night (*vāsara-rātrimiti*) according to the best of the Muslims;
  13. the twelve equal divisions of two hours (*horikā*) each of the length of the nychthemeron, famously known as *cāga* (TUR: *čāḡ*), according to wise men from the Sino-Uyghur [region];
  14. the period of an eighth part of a *cāga* called *kiha* (TUR: *kih*) and the definition of its smaller unit *phaṃga* (CHIN: *fēn*), and the names of the different *cāga* following their Chinese and Turkic nomenclature; and
  15. on the commencement of the nychthemeron from the middle of the first *cāga*.

<sup>1</sup> See (Kennedy 1964) for discussions on the Chinese-Uyghur calendars in Islamicate *zījes*; in particular, for definitions of *čāḡ* (a

Turkic word synonymous with the Chinese word *shí*) consisting of eight *kih* (CHIN: *kè*).

## G ON THE DESCRIPTION OF THE ERA OF ŠĀH JAHĀN

In the First chapter of the First discourse of Mullā Farīd's *Zīj-i Šāh Jahānī* (i.e., the *bāb-i avval* [§ I.1] from the *maqāla-yi avvalīn*), and correspondingly in the First chapter of the First part of Nityānanda's *Siddhāntasindhu* (i.e., the *prathamādhyāya* [§ I.1] from the *prathamakāṇḍa*), we find their descriptions of the era (PER: *tārīḥ-i ilāhī* 'divine era', SAN: *śaka*) of Šāh Jahān.<sup>1</sup> These are presented below with the original text and corresponding English translations in parallel columns.

ZŠJ

f. 6r D

ff. 6v–7r H

f. 6v L

ff. 9v–10r O

f. – Q

ff. 3v–5r R

ff. 6rv S

## In the words of Mullā Farīd

باب اول در معرفت تاریخ الهی شاهجهانی  
*bāb-i avval dar ma'rifat-i tārīḥ-i ilāhī-yi*  
*šāh-jahānī*

First chapter, on the divine era of Šāh Jahān.

ابتداء آن از اول سال جلوس همایون روز  
دوشنبه اول فروردین ماه الهی موافق پانزدهم  
ماه رجب المرجب بحسب امر اوسط و  
سیزدهم آن بحسب رؤیه سنه ۱۰۳۷ هجری  
است بعد از چهار ساعت و هفت دقیقه از  
اول روز مذکور بطول دار الخلافه اگره

*ibtidā<sup>2</sup>-i ān az avval-i sāl-i julūs-i*  
*humāyūn rūz-i dū-šanba avval-i farvardīn*  
*māh-i ilāhī muvāfiq-i pānzdahum-i māh-i*  
*rajab al-murajjab ba ḥasb-i amr-i awsaṭ u*  
*sīzdahum-i ān ba ḥasb-i ru<sup>2</sup>ya sana 1037*  
*hijrī ast ba<sup>c</sup>d az čahār sā<sup>a</sup>t u haft daqīqa az*

1 The era of Šāh Jahān began on AH 1037, Rajab 15 (20 March 1628), on the day of the vernal equinox (*naw-rūz*), and imitated the old Persian (Yazdgirdi/Qadīmī) era (epoch 16 June 632) and the Jalālī era of Saljūq King Malik Shāh I (epoch 15 March 1079) in its naming of the months (beginning with Far-

## In the words of Nityānanda

तत्र प्रथमाध्याये शाहजहानीयशकविवर्णम् ।  
*tatra prathamādhyāye śāhajahānīyaśaka-*  
*vivarṇam* |

Then, in the first chapter, the description of the era of Šāh Jahān.

सप्तत्रिखेन्दु १०३७ प्रमितारबीय-  
शाके प्रवृत्ते खलु चान्द्रवर्षैः ॥  
मासे तथा रजबसङ्गिके ऽस्मिन्  
मध्याह्नये पञ्चदशे दिने च ॥ १ ॥  
त्रयोदशे ऽत्यन्तपरिस्फुटारख्ये  
विधोर्दिने खेन्दु १० घटीषु तद्वत् ॥  
पलेषु मेघप्रमितेषु १७ भूयो  
दिनस्य यातेषु दलान्वितेषु ॥ २ ॥  
शाकोद्भवः शाहजहानुपस्या-  
सीदाद्यमासप्रथमाहसंज्ञे ॥  
पुरे ऽर्गलाख्ये नृपराजधान्यां  
श्रीसूरसेनाभिधदेशसंस्थे ॥ ३ ॥

*saptatrikheṇḍu 1037 pramitārabīya-*  
*śāke pravṛtte khalu cāndravarṣaiḥ* ॥  
*māse tathā rajjabasāṅgike 'smin*  
*madhyāhvāye pañcadaśe dine ca* ॥ 1 ॥  
*trayodaśe 'tyantaparispḥuṭākhye*  
*vidhor dine khendu 10 ghaṭīṣu tadvat* ॥

vardīn). The epoch of Šāh Jahān's era corresponded to the 996th year in the Yazdgirdī era and the 550th in Jalālī era. A fuller discussion on Šāh Jahān's regnal era vis-à-vis the older eras is to appear in Misra (forthcoming).

SS

ff. 10rv Al

ff. 12rv Kh

ff. 11r Pg

(इन्द्रवज्रा)

(उपेन्द्रवज्रा)

(उपजाति)  
बाला

(indravajrā)

*avval-i rūz-i madkūr ba tūl-i dār al-ḥilāfa  
agra*

*paleṣu meghapramiteṣu 17 bhūyo  
dinasya yāteṣu dalānriteṣu || 2 ||*

(upendravajrā)

*śākodbhavaḥ śāhajahānrpasyā-  
sīd ādyamāsaprathamāhasamjñe ||  
pure 'rgalākhye nrparājadhānyām  
śrīsūrasenābhidhadeśasamsthe || 3 ||*

(upajāti  
bālā)

This era begins from the start of the year of the fortunate enthronement, that is on the Monday, first of the divine month of Farvardin, which corresponds to the 15th of the month of Rajab according to the mean position (*amr-i awsaṭ*) and to the 13th of this month according to the sighting (*ru<sup>2</sup>ya*), on the year of Hegira 1037, after 4 hours and 7 minutes from the beginning of the above-mentioned day on the longitude of the imperial capital Agra.

Indeed, in [the year] 1037 of the Arabic era with lunar years that has commenced, and in the month called *rajjaba* (PER: Rajab) in this [year], on the 15th day [following what is] called the mean (*madhya*) [position] and... 1

...on the 13th [day following what is] known as exceedingly manifest (*atyanta-parisphuṭa*), on Monday, and likewise at 10 *ghaṭis* and 17 *palas* in the elapsed half of the day,... 2

...the birth of the era of King Śāh Jahān occurred in the first month known as the first *māha* (PER: *māh*) in the regnal capital city called Agra situated in the region known as Śrī Sūrasena [i.e., the Braj region of modern-day Uttar Pradesh]. 3<sup>2</sup>

و سال و ماه این تاریخ شمسی حقیقی  
است چه سال مدت سیر آفتاب است از  
نقطه اول حمل تا باز رسیدن بهمان نقطه  
و اول فروردین ماه الهی که نوروز و سر  
سال است روزی بود که پیش از نیمروز آن  
روز آفتاب در اول حمل تحویل نماید و اگر  
بعد از نیمروز تحویل کند نوروز روز دومش  
باشد و همچنین تحویل آفتاب در هر برجی  
مدخل ماه شمارند و ماه مدت بودن آفتاب  
است در یک برج و آن از بیست و نه روز

एतस्य वर्षाणि तथैव मासाः  
सौराः स्फुटाख्याः परिचिन्तनीयाः ॥  
यदा स्फुटार्कः खलु सायनांशो  
मेघं ब्रजेन्मध्यदिनात्पुरस्तात् ॥ ४ ॥

(उपजाति  
शाला)

तदैव तस्मिन्दिवसे प्रकल्प्यं  
सौराब्दवेशस्य दिनं सदाद्यम् ॥  
दिनार्धतश्चेद्रविसंक्रमो ऽयं  
पश्चत्तदा स्यात्परवासरं हि ॥ ५ ॥  
सर्वेषु मासेष्वपि तन्त्रविज्ञै-  
रेवं विधानं परिकल्पनीयम् ॥

(विपरीता-  
ख्यानिकी)

2 In the Islamic (Hijri) calendar, the day begins at sunset, and hence 4<sup>h</sup> 7<sup>m</sup> past sunset (at 18:53) on 15 Rajab AH 1037 (20 March 1628) at Agra corresponds to a time of 23:00. Following Nityānanda's description using

Indian time units, a time of 10 *ghaṭis* and 17 *palas* (i.e., 246.8 minutes or 10<sup>h</sup> 17<sup>m</sup>) in the elapsed half of that day at Agra (i.e., at 12:48 in the afternoon) corresponds to a time of 23:05.

کمتر و از سی و دو روز بیشتر نباشد و  
منجمان برای آسانی راندن اوساط کواکب در  
دستور العمل ماهها را سی سی روز گیرند  
*u sāl u māh-i īn tārīḥ šamsī ast čī sāl mad-*  
*dat-i sayr-i āftāb ast az nuqṭa-yi avval-i*  
*ḥamal tā bāz rasīdan ba hamān nuqṭa*  
*u avval-i farvardīn māh-i ilāhī ki naw-*  
*rūz u sar-i sāl ast rūzī buvad ki pīš*  
*az nīm-rūz-i ān rūz āftāb dar avval-i*  
*ḥamal taḥvīl namāyad u agar ba<sup>c</sup>d az nīm-*  
*rūz taḥvīl kunad naw-rūz rūz-i duvvu-*  
*maš bāšad u hamčunīn taḥvīl-i āftāb dar*  
*har burjī madḥal-i māh šumārān u māh*  
*maddat-i būdan-i āftāb ast dar yak burj*  
*u ān az bīst u nuh rūz kamtar u az sī*  
*u dū rūz bīštar nabāšad u munajjimān*  
*barā-yi āsānī-yi rāndan-i awṣāt-i kavākib*  
*dar dastūr al-<sup>c</sup>amal māhhā rā sī sī rūz*  
*gīrand*

The year and month of this year are solar, i.e., the year has the duration of the passage of the Sun from the first point of Aries to its return to the same point. The beginning of the divine month of Farvardīn which is the 'new day' (*naw-rūz*) and the extremity of the year should be on the day on which, before midday, the Sun transfers in 0° Aries and if it does so after midday, the 'new day' will be on the second day [of this month]. In the same way, we consider the beginning (*madḥal*) of the month as the transfer of the Sun in every zodiac constellation. One month is the duration of the staying of the Sun in one zodiac constellation and it is minimum 29-day long and maximum 32-day long. Astronomers take 30-day long months to simplify the driving of the mean motions (*awsāt*) of planets in [their] practical rules (*dastūr al-<sup>c</sup>amal*).

ज्योतिर्विदः सद्गणितप्रसिद्धै  
त्रिंशद्दिनं मासमुशन्ति सर्वम् ॥ ६ ॥

(उपजाति)  
वाणी

*etasya varṣāṇi tathaiva māsāḥ*  
*saurāḥ sphuṭākhyāḥ paricintanīyāḥ ॥*  
*yadā sphuṭārkaḥ khalu sāyanāmśo*  
*meṣaṃ vrajen madhyadināt purastāt ॥ 4 ॥*

(upajāti)  
śālā

*tadaiva tasmin divase prakalpyaṃ*  
*saurābdaveśasya dinaṃ sadādyam ॥*  
*dinārdhataś ced ravisamīkramo 'yaṃ*  
*paścat tadā syāt paravāsaram hi ॥ 5 ॥*

(viparītā-)  
khyānikī

*sarveṣu māseṣvapi tantravijñair*  
*evaṃ vidhānaṃ parikalpanīyam ॥*  
*jyotiroidaḥ sadgaṇitaprasiddhyai*  
*triṃśaddīnaṃ māsam uśanti sarvam ॥ 6 ॥*

(upajāti)  
vāṇī

The years and similarly the months of this [era] are to be considered as true solar [i.e., tropical or *sāyana* solar year]. Indeed, if the true [position of the] Sun with the degrees of equinoctial precession attains Aries before midday... 4

...then on that very day, the true first day (*sat-ādya-dina*) of the ingress of the solar year should be maintained. And if this passage of the Sun is after midday, then, perhaps, the next day [should be considered]. 5

In this way, [this] rule [for the determining the beginning of a month] should be maintained in all the [solar] months by men learned in the sciences. An astronomer considers a 30-day month entirely for the sake of accomplishing real computations (*sat-gaṇita*). 6

و در آخر سال پنج روز افزایند و آنرا خسته  
مستترقه خوانند و گاهی برای اعمال دیگر  
بترتیب فروردین لا اردی بهشت لا خرداد  
لب تیر لا امرداد لا شهریور لا مهر ل ابان  
ل اذر کط دی کط بهمن ل اسفندارمذ ل  
شمارند

*u dar āḥir-i sāl panj rūz afzāyand u  
ān rā ḥamsa-yi mustariqa ḥwānand u  
gāhī barā-yi a‘māl-i dīgar ba tartīb-i far-  
vardīn 31 ardī-bihīšt 31 ḥwurdād 32 tīr 31  
amurdād 31 šahrīvar 31 mihr 30 abān 30  
adar 29 day 29 bahman 30 isfandārmaḍ 30  
šumārānd*

At the end of the year, five days are ad-  
ded and they are called the five supple-  
mentary [days]. Sometimes for other  
calculations, they count [months] in  
this manner: Farvardīn 31, Ardī-Bihīšt  
31, Ḥwurdād 32, Tīr 31, Amurdād 31,  
Šahrīvar 31, Mihr 30, Abān 30, Aḍar  
29, Day 29, Bahman 30, [and] Is-  
fandārmaḍ 30.

پس ماهها بر هر دو تقدیر شمسی اصطلاحی  
باشد و نام ماهها بعینه نام ماههای قدیمی  
است الا در امرداد ا و خرداد و اضافه نموده  
و ماهها بالهی مقید سازند و نام روزهای  
ماه هم همان نامهای قدیمی است الا روز  
سی و یکم را روز و سی و دوم را شب  
گویند

*pas māhhā bar har dū taqdīr-i šamsī iṣṭilāḥī  
bāšad u nām-i māhhā bi-‘aynihi nām-i  
māhhā-yi qadīmī ast illā dar amurdād a u  
ḥurdād v izāfa namūda u māhhā ba ilāhī  
muqayyad sāzand u nām-i rūzhā-yi māh*

वर्षान्त्यसंस्थं दिनपञ्चकं च  
बुधोर्विचिन्त्यं खलु भिन्नमेवम् ॥  
किंवा कुरामैः ३१ कुगुणै ३१ रदाख्यै- ३२  
भूवह्निभि ३१ भूमिगुणै ३१ दिनेश्च ॥ ७ ॥  
भ्रामसङ्घैः ३१ खगुणैः ३० खरामै- ३०  
गौवाहुभि २९ गौनयनैः २९ खलोकैः ३० ॥  
व्योमाग्नि ३० तुल्यैः क्रमशः प्रकल्प्या  
मासा इलाहीति जगत्प्रसिद्धाः ॥ ८ ॥

(उपजाति)

(इन्द्रवज्रा)

*varsāntyasamsthāṃ dinapañcakam ca  
budhor vicintyaṃ khalu bhinnam evam ॥  
kiṃvā kurāmaiḥ 31 kuguṇai 31 radā-  
khyair 32 bhūvahṇibhir 31 bhūmiguṇair 31  
dinaiśca ॥ 7 ॥*

(upajāti)

*bhūrāmasaṅkhyaiḥ 31 khaguṇaiḥ 30 kha-  
rāmair 30 gobāhubhir 29 gonayanaiḥ 29  
khalokaiḥ 30 ॥*

*vyomāgni 30 tulyaiḥ kramaśaḥ prakalpyā  
māsā ilāhīti jagatprasiddhāḥ ॥ 8 ॥*

(indravajrā)

And five days are situated at the end of  
the year [that] are indeed regarded by  
wise men as different. Otherwise, with  
31, 31, 32, 31, and 31 days,... 7

...[and] with equivalent numbers 31,  
30, 30, 29, 29, 30 [and] 30 sequentially,  
the months that are world-famous [in  
the calendar] called *ilāhī* (PER: *ilāhī* ‘di-  
vine’) should be supposed. 8

यन्नामकाः सन्ति च पारसीका-  
स्तन्नामका एव सदेहा मासाः ॥  
तथैव नामानि च वासराणां  
कित्त्वत्र रोजं च शवं विशेषः ॥ ९ ॥

(उपजाति)  
शाला

*yannāmakāḥ santi ca pārasikāś-  
tannāmakā eva sadeha māsāḥ ॥  
tathaiṣva nāmāni ca vāsaraṇāṃ  
kiṃtv atra rojaṃ ca śavaṃ viśeṣaḥ ॥ 9 ॥*

(upajāti)  
śālā



*ham hamān nāmihā-yi qadīmī ast illā rūz-i  
sī u yakum rā rūz u sī u duvum rā šab gū-  
yand*

Thus, months are used in both solar measures. The names of the months are identical to the old names, except in Amurdād and Hurdād where an *alif* and a *vāv* are added respectively. The names are called 'divine'. The names of the days of the month are the same of the old names, except the 31st day is called 'day' and the 32nd is called 'night'.

And the names that are Persian, those very names are always [the names of] the months in this case, and similarly, [are also] the names of the years. But here, there is distinction [in the words] *roja* (PER: *ruz* 'day') and *šaba* (PER: *šab* 'night'). 9

و مدت سالش سیصد شصت و پنج روز  
بود که موافق عدد اسم مبارک اقدس است  
و بعد از چهار سال بجهت کسور زائده ی  
لج ز لب رابعه است یک روز کیسه کنند تا  
سیصد و شصت و شش روز شود و چون  
هفت بار یا هشت بار کیسه در چهار سال  
شود بعد ازان یکبار در سال پنجم شود  
*u maddat-i sālaš sīšad u šašt u panj rūz  
buvad ki muvāfiq-i 'adad-i ism-i mubārak-i  
aqdas ast u ba<sup>d</sup> az čahār sāl ba jihat-i kusūr  
zāyida 14 33 7 32 rābi'a ast yak rūz kabīsa  
kunand tā sīšad u šašt u šiš rūz šavad u  
čūn haft bār yā hašt bār kabīsa dar čahār sāl  
šavad ba<sup>d</sup> az ān yak-bār dar sāl-i panjum  
šavad*

The year is 365 days long, which corresponds to the number [in abjad valuation] of the blessed and sanctified name [of 'Šāh Jahān']. After four years, because of an excess fractional part (*kusūr*) of 14 33 7 32 [up to the] fourth, one intercalary day (*kabīsa*) is added so that there are 366 days. And when there is an intercalary day [added after] every four years [for] seven or eight times, it is [added] once in the fifth year after.<sup>3</sup>

و اگر خواهند که مدخل سال یا ماه تاریخ الهی شاهجهانی بدانند سالهای تامه این تاریخ را درین جدول در آرند و ایام و دقائق که در مقابل سالهای مجموعه مبسوطه یابند بر گیرند و جنس بر جنس افزایند و چون کسور از شصت دقیقه زیاده شود آنرا بیک روز مرفوع کنند آنچه باقی ماند آنرا نیز یک روز اعتبار کنند و از ایام حاصل هفت هفت طرح کنند تا هفت یا کمتر ازان بماند دو

بر آن افزایند حاصل مدخل سال بود

*u agar h̄vāhand ki madḥal-i sāl yā māh-i tāriḥ-i ilāhī-yi šāh-jahānī badānand sālḥā-yi tāmma-yi īn tāriḥ rā dar īn jadval dar ārand u ayyām u daqāyiq ki dar muqābil-i sālḥā-yi majmū'a-yi mabsūṭa yāband bar gīrand u jins bar jins afzāyand u čūn kusūr az šašt daqīqa ziyāda šavad ān rā ba yak rūz marfūc kunand ānci bāqī mānad ān rā nīz yak rūz i'tibār kunand u az ayyām-i ḥāšil haft haft ṭarḥ kunand tā haft yā kamtar az ān bamānad dū bar ān afzāyand ḥāšil madḥal-i sāl buvad*

And if one wants to know the beginning (*madḥal*) of the year or of the month in the divine era of Šāh Jahān, one can take the complete years in this era from the following table, and [then] take the days and minutes found in front of the extended aggregate years and add them unit upon unit.

3 As Table G1 (reproduced from what is seen in both the *Zī-i Šāh Jahānī* and the *Siddhāntasindhu*) shows, the fractional excess of days over 365 in each calendar year is 0;14,33,7,32. Hence, after every four years, the cumulative fractional excess is 0;58,12,30,8, which in turn implies that an intercalary day is added in the day count of the fourth year (when we start counting the intercalation interval from the end of the

श्रीशाहशाकस्य गताब्दवृन्दा-  
देतैः प्रकोष्ठैर्गतवासरौघः ॥  
साध्यः पुरावद्वियुतो विधेयः  
सप्तावशेषो ऽब्दमुखस्य वारः ॥ १० ॥

(इन्द्रवज्रा)

*śrīśāhaśākasya gatābdavṛndād  
etaiḥ prakoṣṭhair gatavāsaraughaiḥ ॥  
sādhyaiḥ purāvād dviyuto vidheyaiḥ  
saptāvāśeṣo 'bdamukhasya vāraḥ ॥ 10 ॥*

(indravajrā)

From the score of elapsed years in the calendrical era of the venerable Šāh [Jahān], the number of elapsed days should be calculated with these tables as before. The weekday at the beginning of the year should be determined as the remainder among seven added to two. 10

first year). This cycle repeats itself up to seven or eight times at which point the offset increases to five years instead of four. For example, in the cumulative count of days beginning from the end of the first year, an intercalary day is added after six intervals of four years (i.e., in years five, nine, thirteen, seventeen, twenty-one, and twenty-five) followed by an interval of five years (i.e., in the thirtieth year).

When the fractional parts exceed sixty minutes, it is carried over as one day. The remainder is to be considered as one day. And from the number of days that are obtained one should repeatedly deduct seven until seven or less remains and add two to this number. The result will be the beginning of the year.<sup>4</sup>

پس دران روز تقویم شمس استخراج کنند  
اگر باول حمل باشد فیها و الا یک روز کم  
یا زیاده کنند مدخل سال بود

*pas dar ān ruz taqvim-i šams istihrāj kun-  
and agar ba avval-i ḥamal bāšad fabihā u  
illā yak rūz kam yā ziyāda kunand madḥal-i  
sāl buvad*

Afterwards, one can derive the true longitude of the Sun on this day. If it in  $0^\circ$  Aries, this is well and good! If not, one should add or remove one day to obtain the beginning of the year.<sup>5</sup>

پس بجهت هر ماهی که خواهند ایام آن  
ماهها بر مدخل سال افزایند و هفت هفت  
طرح کنند باقی مدخل ماه مطلوب بود

*pas ba jihat-i har māhī ki ḥwāhand ayyām-i  
ān māhhā bar madḥal-i sāl afzāyand u  
haft haft ṭarḥ kunand bāqī madḥal-i māh-i  
maṭlūb buvad*

Also, to find the month that one is looking for, one should add the days of these months to the beginning of the year and remove seven repeatedly and the remainder will be the beginning of the desired month.<sup>6</sup>

तस्मिन्दिने स्पष्टरविर्गतो ऽभू-  
न्मेषानने चेतसतु शुद्ध एव ॥  
नो चेतदा पूर्वपराख्य वारः  
प्रकल्पनीयो गणकप्रमुख्यैः ॥ ११ ॥

*tasmin dine spaṣṭaravir gato 'bhūn-  
meṣānane cet sa tu śuddha eva ॥  
no cet tadā pūrvaparākhyā vāraḥ  
prakalpanīyo ganakapramukhyaiḥ ॥ 11 ॥*

On that day, if the true [position of the] Sun has gone to the beginning of Aries, then that is just precise; if not, then the weekday before or after should be supposed [as the first day of the year] by the foremost of astronomers. 11

एवं हि मासोद्भववासराणि  
गतानि वर्षाद्यदिनान्वितानि ॥  
सप्तावशिष्टानि च मासवेशे  
वारो विचिन्त्यः स्फुटतास्य तद्वत् ॥ १२ ॥

*evaṃ hi māsodbhavavāsaraṇi  
gatāni varṣādyadinānvitāni ॥  
saptāvaśiṣṭāni ca māsaveśe  
vāro vicintyaḥ sphuṭatāsyā tadvat ॥ 12 ॥*

In just the same way, the days of months are those that have elapsed since the day at the beginning of the year, and the weekday at the beginning of the month should be regarded from [among their] remainders among seven. Likewise, is its correctness [determined]. 12

(उपजाति)  
बाला

(upajāti)  
bālā

(उपजाति)

(upajāti)

و جدول ایام سالهای تامه الهی شاهجهانی  
این است

*u jadval-i ayyām-i sālḥā-yi tāmma-yi  
ilāhī-yi šāh-jahānī īn ast*

अथ तदर्थमेकदशशतसहस्रवर्षाणां यथा  
पृथक्पृथग्दिनानि लभ्यन्ते कोष्ठका लिख्यन्ते ।  
पूर्व सहस्रस्थानं वर्षाणां गवेष्यं तदभावे शतस्थानं  
तदभावे दशस्थानं तदभावैकस्थानं गवेष्यं ।  
यद्यत्स्थानस्य दिवसा लभ्यन्ते तत्तत्स्थानस्य  
दिनानि घटिकाश्चैकत्रकृत्वा प्राग्वच्चिन्तयेत् ।

*atha tadartham ekadaśaśatasahasra-  
varsāṇāṃ yathā pṛthakpṛthagdināni  
labhyante koṣṭhakā likhyante | pūrvam  
sahasrasthānaṃ varsāṇāṃ gavesyam  
tadabhāve śatasthanam tadabhāve daśa-  
sthānaṃ tadabhāvaikasthānaṃ gavesyam |  
yadyatsthānasya divasā labhyante-  
tattatsthānasya dināni ghaṭikāś caikat-  
rakṛtvā prāgvac cintayet |*

4 For example, 1 January 2023 is 394 years, 9 months, and 12 days from the beginning of the calendrical era of Šāh Jahān on Monday, 20 March 1628. Hence, to determine the weekday on which, say, the year 394 in Šāh Jahān's regnal era began, we aggregate the number of days in 394 years from Table G1. This value is 143905;33,31,28,8. The integer-part of this number is 143905, which when added to 1 (rounded up from the remaining fraction part of the number) gives 143906. This number is equivalent to 0 in modulo seven arithmetic (i.e.,  $0 \equiv 143906 \pmod{7}$ ). Now, in Šāh Jahān's regnal-era calendar, like in the solar Hijri calendar, the week begins with Saturday (PER: *šanba*, day 0) and hence the epoch weekday of Monday corresponds to day 2. To determine any corresponding weekday from this epoch, two is added to the modulo remainder and the resulting number corresponds to the ordinary weekday number (starting from day 0). In the present case, that resulting number is 2; in other words, the day commencing the year 394 in Šāh Jahān's regnal era is a Monday by this calculation. This agrees with Gregorian date of Monday, 21 March 2022, the day of the vernal equinox (*naw-rūz*).

5 For example, by the calculation in note 4, the year 394 in the regnal era of Šāh Jahān

begins on Monday, 21 March 2022. However, the ingress of the Sun into  $0^\circ$  Aries occurs (for Agra) on Sunday, 20 March 2022, at 21:03. Hence, the beginning of the year 394 could be rectified to Sunday, 20 March 2022; however, a further correction is applicable here as the 'new day' (*naw-rūz*) marking 1 Farvardīn should be on the day when the vernal equinox occurs *before* midday (see page 191). This implies that the true beginning (1 Farvardīn) of the 394th year in the regnal era of Šāh Jahān is, in fact, on Monday, 21 March 2022.

6 For example, as worked out in note 5, the year 394 in the regnal era of Šāh Jahān began on Monday, 21 March 2022. To calculate, say, the weekday at the beginning of the fifth month in this calendar (i.e., 1 Amurdād), we note that the number of days since the beginning of the year are 125 (aggregated by adding the days in the months of Farvardīn, Ardī-Bihīšt, Ḥwurdād, and Tīr; see page 192). This is equivalent to 6 in modulo seven arithmetic. In other words, the weekday at the beginning of the month of Amurdād in the year 394 of the regnal era of Šāh Jahān is a Sunday (counting sequentially to day 6 from Monday, day 0). This corresponds with Gregorian date of Sunday, 24 July 2022.

And here is the table of the days of the complete years in the divine era of Šāh Jahān.

Now, towards that end, tables of unit, tens, hundreds, and thousand years are written in order that different successive days be obtained. First, the group of thousands (*sahasra-sthāna*) of years is to be sought; in its absence, the group of hundreds (*śata-sthāna*); in its absence, the group of tens (*daśa-sthāna*); [and] in its absence the group of ones (*eka-sthāna*) is to be sought. The days of whichever group [of years] are obtained, one should regard the days and *ghaṭikās* of those respective groups, having brought them together, as previously [described].

Table G1: Cumulative number of days in successive scores of years in the calendrical era of Šāh Jahān.

Years	Number of days					Years	Number of days				
	integer	sexagesimal fraction					integer	sexagesimal fraction			
1	365	14	33	7	32	60	21914	33	7	32	0
2	730	29	6	15	4	70	25566	58	38	47	20
3	1095	43	39	22	36	80	29219	24	10	2	40
4	1460	58	12	30	8	90	32871	49	41	18	0
5	1826	12	45	37	40	100	36524	15	12	33	20
6	2191	27	18	45	12	200	73048	30	25	6	40
7	2556	41	51	52	44	300	109572	45	37	40	0
8	2921	56	25	0	16	400	146097	0	50	13	20
9	3287	10	58	7	48	500	182621	16	2	46	40
10	3652	25	31	15	20	600	219145	31	15	20	0
20	7304	51	2	30	40	700	255669	46	27	53	20
30	10957	16	33	46	0	800	292194	1	40	26	40
40	14609	42	5	1	20	900	328718	16	53	0	0
50	18262	7	36	16	40	1000	365242	32	5	33	20

## H MULLĀ FARĪD ON THE INDIAN CALENDAR

In the Seventh chapter of the First discourse of his *Zīj-i Šāh Jahānī* (i.e., the *bāb-i haftum* [§ I.7] from the *maqāla-yi avvalīn*), Mullā Farīd describes the two Indian eras (PER: *tārīḥ-i hindī*) of *bikramājīt* (SAN: *vikramāditya*) and *sālibahān* (SAN: *sāli-vāhana*). The Persian text of this chapter and its English translation is presented below.

باب هفتم بر بیان تاریخ هندی اهل هند را تواریخ در کثرت بحدی است که از حدّ و عدّ خارج است و آنچه درین زمان بکار دارند تواریخ بکرماجیت است که آنرا سنبت گویند و تواریخ سکاکال که آنرا سالیهان خوانند و سال ایشان شمسی است و ماه قمری و روز وضعی و ابتداء سال از روزی گیرند که دران روز اجتماع نزدیک بنقطه اعتدال ربیعی بحساب آنها شده باشد و ابتداء ماه از اجتماع کنند و بعد هر دوازده درجه میان ماه و آفتاب را روزی گیرند و آنرا تته نامند و هر ماهی را سی تته گیرند و آنرا بدو قسم سازند و هر یک را پاکه نامند پس پانزده روز را که از اجتماع است تا استقبال پاکه سد خوانند و پانزده روز دیگر را که از استقبال است تا اجتماع دیگر پاکه بد نامند و تمام سال را سیصد و شصت روز شمارند پس فضل میان این سال و سال شمسی حقیقی یازده روز وضعی و سی و یک جز از چهارصد و هشتاد جز روز است و چون سی روز را در ۴۸۰ ضرب کنند و حاصل را در ایام یکسال که ۳۶۰ است ضرب کنند و بر ۵۳۱۱ پنج هزار و سیصد و یازده که عدد ادوار شمس در مدت چهل و سه لک و بیست هزار سال است قسمت کنند خارج قسمت ۹۷۶ روز و ۴۶۴ جز و از پنج هزار و سیصد و یازده جزو حاصل آید پس چون این مقدار مدت بگذرد بجهت رفع تفاوت مذکور میان سال مذکور و سال شمسی حقیقی یکماه کیسه کنند و آنرا ماه لوند خوانند و در هر ماهی که کیسه افتد آن ماه را دو بار شمارند مثلاً اگر کیسه از اول ماه اساره شروع شود آن ماه را و ماه آینده را نیز اساره خوانند و بعد ازان ماه آینده ساون بود و چون بر تواریخ سکاکال ۴۲۳۶ افزایشند و مبلغ را رفع کنند حرکت اوج بحساب آنها بیرون آید و چون از وی دو برج و هژده درجه نقصان کنند باقی را این انس گویند و در تاریخ ذکر سالهای تامه کنند نه ناقصه

*bāb-i haftum bar bayān-i tāriḥ-i hindī ahl-i hind rā tavārīḥ dar kaṭrat ba ḥaddī ast ki az ḥadd u ʿadd ḥārij ast u ānči dar īn zamān ba kār dārānd tāriḥ-i bikramājīt ast ki ān rā sanbat gūyānd u tāriḥ-i sakākāl ki ān rā sālibahān ḥwānānd u sāl-i īšān šamsī ast u māh qamarī u rūz vaẓʿī u ibtidā<sup>2</sup>-i sāl az rūzī gīrand ki dar ān rūz ijtīmā<sup>c</sup>-i nazdīk ba nuḡṭa-yi iʿtidāl-i rabīʿī ba ḥisāb-i ānhā šuda bāšad u ibtidā<sup>2</sup>-i māh az ijtīmā<sup>c</sup> kunānd u buʿd-i har davāzdah daraḡa miyān-i māh u āftāb rā rūzī gīrand u ān rā tith nāmānd u har māhī rā sī tith gīrand u ān rā ba dū qism sāzānd u har yak rā pākha nāmānd pas pānzdah rūz rā ki az ijtīmā<sup>c</sup> ast tā istiḡbāl pākha-yi sad ḥwānānd u pānzdah rūz-i dīḡar rā ki az istiḡbāl ast tā ijtīmā<sup>c</sup>-i dīḡar pākha-yi bad nāmānd u tamām-i sāl rā sišad u šašt rūz šumārānd pas faẓl miyān-i īn sāl u sāl-i šamsī-yi ḥaḡiqī yāzdah rūz-i vaẓʿī u sī u yak juz az čahāršad u*

*haštād juz-i rūz ast u čūn sī rūz rā dar 480 žarb kunand u hāšil rā dar ayyām-i yak-sāl ki 360 ast žarb kunand u bar 5311 panj hazār u sīšad u yāzdah ki ʿadad-i advoār-i šams dar maddat-i čihil u sih lak u bīst hazār sāl ast qismat kunand hārij-i qismat 976 rūz u 464 juzv az panj hazār u sīšad u yāzdah juzv hāšil āyad pas čūn in miqdār-i maddat bagudarad ba jihat-i rafʿ-i tafāvut-i madkūr-i miyān-i sāl-i madkūr u sāl-i šamsī-yi haqīqī yak-māh kabīsa kunand u ān rā māh-i lūnd hṡwānand u dar har māhī ki kabīsa uftad ān māh rā dū bār šumārand mataalan agar kabīsa az avval-i māh-i asāra šurūʿ šavad ān māh rā u māh-i āyanda rā nīz asāra hṡwānand u baʿd az ān māh-i āyanda sāvan buvad u čūn bar tāriḡ-i sakākāl 4236 afzāyand u mablaḡ rā rafʿ kunand ḡarakat-yi awoj ba ḡisāb-i ānhā bīrūn āyad u čūn az vay dū burj u ḡiždah daraja nuqšān kunand baqī rā ayan ans ḡūyand u dar tāriḡ dīkr-i sālḡa-yi tāmma kunand na nāqīša*

Seventh chapter on the Indian era. The people of India have such a large quantity of eras that they are beyond count. The one that is used nowadays is the era of *bikramājīt* (SAN: *vikramāditya*), also called *sanbat* (SAN: *saṡvat*), and the era of *sakākāl* (SAN: *śakakāla*) also called *sālibahān* (SAN: *sālivāhana*). The year of these [two eras] is solar, their month lunar and their day civil (*vazʿ* ‘position’). They set the beginning of the year from the day on which, according to their calculation, is the close conjunction [of the Sun] with the point of the vernal equinox. [They set] the beginning of the month [starting] from the conjunction [i.e., the new Moon]. They take the distance of every twelve degrees between the Moon and the Sun as a [lunar] day, which they name *tith* (SAN: *tithi*). In every month, they count thirty *tiths* and they divide it in two parts, which are named *pākha* (SAN: *pakṡa*). Thus, the fifteen days from the conjunction to the opposition are named *sad pākha* (SAN: *śuddhapakṡa*). The fifteen other days from the opposition to the conjunction are named *bad pākha* (SAN: *vadyapakṡa*). They count three hundred sixty [*tithi*] days for the whole year. Thus, the remainder between this [lunar] year and the actual solar year is 11 civil days and 31/480 days. Since when you multiply 30 days by 480 and you multiply the result by the days in one year, i.e., 360, and you divide it by 5311, which is the number of revolutions of the Sun over a period of 43,20,000 years. The result of the division is 976 days and 464/5311 parts.<sup>1</sup> Therefore, since this amount of time elapses, they add an intercalary month to remove the above-mentioned difference between this and the actual solar year. They call it the month of *lūnd*. For every month on which the intercalation happens, they count it twice, e.g., if the intercalation starts from the first of the month of *asāra* (SAN: *āṡāḡha*), they call *asāra* this month as well as the following month. After that, the following month will be *sāvan* (SAN: *śrāvāṡa*). Since they add 4236 to the *sakākāl* era and they remove the sum,

<sup>1</sup> These calculations for the intercalary months in the Indian system have been previously described by al-Bīrūnī in his

*al-Qanūn al-Masʿūdī* (see, e.g., Kennedy et al. 1965).



the movement of the apogee (*awj*) goes outside according to their calculation, and since they remove from it two constellations and 18 degrees, they call the rest *ayan ans* (SAN: *ayanāṃśa*). In dating (*tārīḥ*), they mention [only] full years, not defective ones.

## I MULLĀ FARĪD'S LIST OF FESTIVALS

In the Tenth chapter of the First discourse of his *Zīj-i Šāh Jahānī* (i.e., the *bāb-i dahum* [§ I.10] from the *maqāla-yi avvalīn*), Mullā Farīd lists in a table several festivals or 'well-known days' (*ayyām-i mašhūra*) in accordance with different calendars. Many of these occasions are also mentioned in the *Zīj-i Uluġ Bīg*, albeit not in a tabular form (see, e.g., Sédillot 1847b: 338–40; Akhmedov 1994: 46–7).

The dates of Christian Greek festivals and Persian festivals are reproduced verbatim from the *Zīj-i Uluġ Bīg*; however, the list of 'Arabic festivals' in Mullā Farīd's table is expanded to include dates related to the Islamic religious calendar, the lives of Muḥammad, prophets (Yūsuf, Yaḥyà), Caliphs (ʿUṭmān, ʿUmar), and the family of prophet Muḥammad (Ḥadija, Fāṭima, ʿAlī, Ḥasan, Ḥusayn, ʿAlī Riẓā)—all of which are not found in the *Zīj-i Uluġ Bīg*. Moreover, Mullā Farīd adds a list of festivals related to the position of the Sun in the zodiac, containing, inter alia, the dates of new year in the Malikī and Ḥwārazm Šāhī calendars, dates of the solstice and the equinox, dates of the rainy season, date of the Sadeh festival, etc.

The most interesting addition in Mullā Farīd's table of festivities is the inclusion of the following list of Indian religious festivals (following the Hindu lunisolar calendar):

1. Śrāvaṇa bright (SAN: *śuddha*) fortnight, full Moon (SAN: *paurṇamāsī*): Salūno (Raksha Bandhan);
2. Bhādra dark (SAN: *vadya*) fortnight, eighth day: [Krishna] Janmashtami;
3. Āśvina bright fortnight, tenth day: Dussehra;
4. Kārttika dark fortnight, new Moon (SAN: *amāvāsī*): Diwali;
5. Mārga bright fortnight, fifth day: Vasant Panchami;
6. Phālguna dark fortnight, fourteenth day: Shivaratri; and
7. Phālguna bright fortnight, full Moon: Holi.

The names of the Arabic festivals, Sun-related festivals, and Indian festivals in the Tenth chapter of the First discourse of Mullā Farīd's *Zīj-i Šāh Jahānī* are stated in Persian (in Table I1) and its Latin transcription (in Table I2).

Table I1: Names of Arabic festivals, Sun-related festivals, and Indian festivals in Mullā Farīd's *Zīj-i Šāh Jahānī* in Persian.

باب دهم در معرفت ایام مشهوره از هر تاریخ بعضی ازان متعلق است بموضع آفتاب و بعضی متعلق بایام سال و این مجموع درین جدول نهاده شد		
ایام مشهوره از تاریخ عربی		
ماه رجب و شعبان و رمضان ماه عبادت است و رمضان ماه روزه است و محرم و رجب و ذی قعده و ذی الحجه ماههای حرام اند		
سر سال و تا ده روز ایام معلومات است	ا	محرم
عاشورا	ی	
وفات علی بن موسی الرضا	ه	
مرض رسول علیه السلام	یو	صفر
مولد یحیی بن زکریا	یح	
دفن نبی صلی الله علیه و سلم در مدینه	ج	
تزویج خدیجه رضی الله عنها	ی	ربیع الاول
مولد النبی صلی الله علیه و سلم	یب	
مقتل یحیی بن زکریا	ی	
وفات فاطمه زهرا رضی الله عنها	کج	ربیع الآخر
بیع یوسف علیه السلام	کو	جمادی الاول
مولد فاطمه زهرا رضی الله عنها	ط	جمادی الآخر
وفات حسن رضی الله تعالی عنه	د	
استفتاح	یه	رجب
مبعث و معراج پیغمبر صلی الله علیه و سلم	کز	
مولد حسین رضی الله عنه	ج	
مولد حسن رضی الله عنه	ه	شعبان
شب برات و نقل قبله	یه	
وفات علی رضی الله عنه	کا	رمضان

(continued)

(continued)

	کج	شب قدر
	ا	عید فطر
شوال	د	مباهله
	ج	نزول جبرائیل
ذی القعدة	ه	فتح خیبر
	ا	تا ده روز ایام معلومات است
	ح	روز ترویبه
	ط	روز عرفه
	ی	عید قربان و آنرا عید اضحی گویند و اول ایام نحر تا سه روز
ذی الحججه	یا	اول ایام تشریق و ایام معدودات تا سه روز
	یه	شهادت عثمان رضی الله تعالی عنه
	یح	روز غدیر خم
	که	وفات عمر رضی الله عنه
سیزدهم و چهاردهم و پانزدهم از هر ماه ایام بیض است		
ایام مشهوره که بموضع آفتاب تعلق دارد		
	•	نوروز اول سال ملکی و اول بهار
	یط	نوروز خوارزم شاهی
	ک	آخر ایام مطر
ب	یه	امتزاج فصلین
ج	•	اول تابستان و آن چهله
ج	ط	آب ریزان و آن سیزدهم تیر ماه
	یه	امتزاج فصلین
و	•	اول خزان
ط	•	اول زمستان و اول چهله و شب یلدا
ط	یه	امتزاج فصلین
ی	ی	شب سده
یا	یه	امتزاج فصلین

(continued)

*(continued)*

## ایام مشهوره از تاریخ هندی

پورن ماسی ساون سد	سلونو
بد اشتمی بهادون	جنم اشتمی
سد دسمی اسن	دسهره
بد اماوس کاتک	دیوالی
سد پنچمی ماگه	بسنت پنچمی
بد چودس پهاگن	سیورات
پورن ماسی پهاگن	هولی

Table I2: Names of Arabic festivals, Sun-related festivals, and Indian festivals in Mullā Farīd's *Zij-i Šāh Jahānī* in transcribed Latin.

<i>bāb-i dahum dar maʿrifat-i ayyām mašhūra az har tārīḥ baʿzī az ān mutaʿalliq ast ba mawziʿ-i āftāb u baʿzī mutaʿalliq ba ayyām-i sāl u īn majmūʿ dar īn jadval nihāda šud</i>		
<i>ayyām-i mašhūra az tārīḥ-i ʿarabī</i>		
<i>māh-i rajab u šaʿbān u ramazān māh-i ʿibādat ast u ramazān māh-i rūza ast u muḥarram u rajab u dī l-qaʿda u dī l-ḥijja māhhā-yi ḥarām and</i>		
<i>muḥarram</i>	1	<i>sar-i sāl u tā dah rūz ayyām-i maʿlūmāt ast</i>
	10	<i>ʿāšūrā</i>
<i>šafar</i>	5	<i>vafāt-i ʿalī bin mūsā l-rizā</i>
	16	<i>maraz-i rasūl ʿalayhi l-salām</i>
	18	<i>mawlid-i yaḥyā bin zakaryā</i>
<i>rabīʿ al-avval</i>	3	<i>dafn-i nabī sallā llāh ʿalayhi wa-sallama dar madīna</i>
	10	<i>tazvīj-i ḥadīja ražiya llāh ʿanhā</i>
	12	<i>mawlid al-nabī ṣallā llāh ʿalayhi wa-sallama</i>
<i>rabīʿ al-āḥir</i>	10	<i>maqatal-i yaḥyā bin zakaryā</i>
	23	<i>vafāt-i fāṭima-yi zahrā ražiya llāh ʿanhā</i>
<i>jumādā al-avval</i>	26	<i>bayʿ-i yūsuf ʿalayhi l-salām</i>
<i>jumādā al-āḥir</i>	9	<i>mawlid-i fāṭima-yi zahrā ražiya llāh ʿanhā</i>
<i>rajab</i>	4	<i>vafāt-i ḥasan ražiya llāh taʿālā ʿanhu</i>
	15	<i>istiftāḥ</i>
	27	<i>mabʿaṭ u miʿrāj-i payḡambar ṣallā llāh ʿalayhi wa-sallama</i>
	3	<i>mawlid-i ḥusayn ražiya llāh ʿanhu</i>

(continued)

(continued)

	šā <sup>ʿ</sup> bān	5	mawlid-i ḥasan ražiya llāh ʿanhu
		15	šab-i barāt u naql-i qibla
	ramazān	21	vafāt-i ʿalī ražiya llāh ʿanhu
		23	šab-i qadr
	šavvāl	1	ʿayd-i fiṭr
		4	mubāhala
	ḍī l-qaʿda	3	nuzūl-i jibrāʾīl
		5	fath-i ḥaybar
		1	tā dah rūz ayyām-i maʿlūmāt ast
		8	rūz-i tarvīya
		9	rūz-i ʿarafa
		10	ʿayd-i qurbān u ān rā ʿayd-i azḥā gūyand u avval-i ayyām-i naḥr tā sih rūz
	ḍī l-ḥijja	11	avval-i ayyām-i tašrīq u ayyām-i maʿdūdāt tā sih rūz
		15	šahādat-i ʿuṭmān ražiya llāh taʿālā ʿanhu
		18	rūz-i ḡadīr ḥumm
		25	vafāt-i ʿumar ražiya llāh ʿanhu
sīzdahum u čahārdahum u pānzdahum az har māh ayyām-i bayz ast			
<b>ayyām-i mašhūra ki ba mawziʿ-i āftāb taʿalluq dārad</b>			
	0	0	naw-rūz avval-i sāl-i malikī u avval-i bahār
	0	19	naw-rūz-i ḥwārazm-šāhī
	1	20	āḥir-i ayyām-i maṭar
	2	15	imtizāj-i fašlayn
	3	0	avval-i tābistān u ān čihila
	3	9	āb-rīzān u ān sīzdahum-i tīr māh
	5	15	imtizāj-i fašlayn

(continued)

*(continued)*

	6	0	<i>avval-i ḥazān</i>
	9	0	<i>avval-i zamistān u avval-i čihila u šab-i yaldā</i>
	9	15	<i>imtizāj-i fašlayn</i>
	10	10	<i>šab-i sada</i>
	11	15	<i>imtizāj-i fašlayn</i>

*ayyām-i mašhūra az tāriḥ-i hindī*

<i>sāvan sad</i>	<i>pūran māsī</i>	<i>salūnū</i>
<i>bhādūn</i>	<i>bad aštamī</i>	<i>janam aštamī</i>
<i>asan</i>	<i>sad dasamī</i>	<i>dasahra</i>
<i>kātika</i>	<i>bad amāvas</i>	<i>dīvālī</i>
<i>māga</i>	<i>sad pančamī</i>	<i>basant pančamī</i>
<i>phāgun</i>	<i>bad čawdas</i>	<i>sīvorāt</i>
<i>phāgun</i>	<i>pūran māsī</i>	<i>hūlī</i>



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