Time Measurement in Tibet: A Critical Introduction to the Works on *Kālacakra* Astronomy by Dieter Schuh, Premier Scholar in Contemporary German Tibetology*

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* In May 2011, I completed a 68-page-long article [unpublished, hereafter Jo1] aiming at introducing Dieter Schuh's works published up to that point. I have distributed it to my fellow scholars and professors. In it, I covered his works on Indo-Tibetan astronomy (*skar rtsis*), Sino-Tibetan astrology (*nag rtsis*), Tibetan manuscripts and xylographs, Tibetan documents, diplomatic history with a special emphasis on Tibet-Mongolia relations, Tibetan law, Tibetan demography, the reconstruction of history of western Tibetan enclaves, Tibetan art and so forth. Regarding that article, I should emphasize the following three points. First, when I was working on my dissertation in 2015, I realized that some content and ideas on *skar rtsis* and *nag rtsis* presented in Jo1 were plagiarized by Janet Gyatso in her book, published in 2015 by Columbia University Press. Because she neither asked for permission to use my article nor mentioned my work in her book, her actions deserve to be condemned. Second, I slightly revised Jo1 in early 2017 and gave the new version [unpublished, hereafter Jo2] to some fellow scholars. The current article is based upon Jo2. The *skar rtsis* section was extracted from Jo2 and was also slightly revised to meet the criteria of the *Journal of Indian Philosophy*. Third, I completed my dissertation on Tibetan astronomy in May 2016. Because I had already completed Jo1, I referred to it when I wrote my dissertation. Therefore, sporadic sections of the text in this article may be found in my dissertation; also recall that Jo2 is a slight revision of Jo1. Nevertheless, I believe this article merits publication for two reasons. First, when I cited Schuh in my PhD thesis, I did not translate German and French into English. Because Jo1 and Jo2 originally contained English translations, this article may be a help to English readers. Second, as far as *skar rtsis* is concerned, I did not organize Schuh's works in a systematic and easily accessible way in my dissertation; rather, they appear sporadically in it. Thus, this article may provide the audience with a good overview of Schuh's research on *skar rtsis*.

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Introduction. I. Life and Works. II. Achievements in Indo-Tibetan Astronomy (Skar rtsis). Conclusion

요약문 [주요어: 디터 슈, 갈라짜끄라딴뜨라, 인도-티벳 천문학, 사본과 판본, 비판적 검토]

현재 티벳학의 선도적 업적들은 거칠게 다음 두 전통으로 양분된다. 첫째는 유럽의 문헌학적 전통이다. 일본 역시 불교학에 치중한 책로 대체적으로 이 전통에 속하며, 서구식의 진술한 문헌학은 부재하지만 방대한 자료를 보유하고 있으며 역사 쪽에 치우чис고 있는 중국 역시 이 전통에 속한다고 볼 수 있다. 둘째는 미국의 인문학적 전통이다. 인도학·티벳학 역시 인문학의 한 분야임이 강조되며, 따라서 인문학 제 분야에서 다루는 공통의 이슈라고 할 수 있는 지식의 전수 (the transmission of knowledge), 근대성 (modernity), 젠더 (gender) 등의 이슈들이 인도나 티벳의 문맥에서 어떻게 이해될 수 있는 지의 문제들을 논쟁적 방식으로 검토한다. 후자의 전통에서 학술적이고 지적인 연구는 대중에게 다가갈 수 있는 글쓰기 능력과 유리되어 있지 않다.

이 글에서 필자는 두 전통 중에서 첫번째 전통에 속하는 독일 학술 전통에서 가장 탁월한 학자인 디터 슈 Dieter Schuh가 이룩한 성취들을 중에서 천문학 연구에 대한 비판적 검토를 제시한다. 그의 주된 업적은『티벳 달력 계산의 역사에 관한 연구』Untersuchungen zur Geschichte der tibetischen Kalenderrechnung (1973) 의 출판이다. 인도 후기 밀교 텍스트인 Kalacakratantra 문헌에 기반하고 있는 티벳의 천문학 (인도-티벳 천문학 Indo-Tibetan astronomy; skar rtsis) 연구는 여전히 티벳학의 여러 분야 중에서도 가장 어려운 분야 중의 하나이지만, 그는 당시에 충격적이었고 현재도 놀라음을 던져 주는 상기 단행본을 저술했다. 또한 그는 중국으로부터 영향을 받은 티벳의 점성술 (중국-티벳 점성술 Sino-Tibetan astrology; nag rtsis)에 대한 연구, 티벳어 사본과 판본에 대한 연구, 티벳어로 된 공식 문서들, 티벳-몽골 외교 관계에 대한 연구, 티벳 법률에 관한 연구, 인구학, 서부 티벳에 관한 지역학적 연구 등등 다방면에 걸쳐 높은 수준의 문헌학에 기초하여 선구적인 업적들을 보여 주었는데 필자의 후속 논문에서 나머지 저작들을 대한 소개도 예정되어 있다.
Introduction

Since the Hungarian Orientalist Alexander Csoma de Kőrös (1784-1842) began academic Tibetan studies in the European setting, a minority of excellent scholars have steadfastly followed in their predecessors’ footsteps and have increased knowledge and understanding of Tibetan philosophy, religion, history and culture. Among them, both the Italian Giuseppe Tucci (1894-1984) and German Rolf Stein (1911-1999), who mostly worked in France after World War II, made great contributions to setting the wheels in motion to solidify the foundation of Tibetan studies as an academic discipline. After them, the German academic, Dieter Schuh, who is the main topic of this article, was handed the baton in the field of unique, untouched and arcane areas, and Dutch-Canadian Leonard van der Kuijp, who is doing great work at Harvard University, is continuing the time-honored tradition of European philology. Last but not least, American David Seyfort Ruegg has produced quality works on Buddhist philosophy and history, being armed with solid philology and a philosophical mindset. We owe the remarkable development of Tibetology, Tibetan Studies, Buddhist Studies and Buddhist Philosophy to the salient intellectual capacities and academic passion of these researchers.

In the following, I critically examine Dieter Schuh’s works on
Indo-Tibetan astronomy, which is based upon Kālacakratantra literature such as Mchog gi dang po’i sangs rgyas las phyung ba rgyud kyi rgyal po chen po dpal dus kyi ’khor lo¹ [< S. Paramādibuddhodhṛtaśriklālacakranāmatantrarāja (simply Laghukālacakra), Bsdus pa’i rgyud kyi rgyal po dus kyi ’khor lo’i ’grel bshad rtsa ba’i rgyud kyi rjes su ’jug pa stong phrag bcu pa bcu gnyis pa dri ma med pa’i ’od²] [< S. Vimalaprabhā-nāma-mūlatantrānusārinī-dvādaśasāhasrikālāghukālacakranāmatantrājāti (simply Vimalaprabhā), and so forth. This paper is composed of two parts: In the first part, I introduce his personal history and travel pertaining to his research on Indo-Tibetan astronomy; in the second section, I critically investigate his works according to the chronological order in which they were published.

I. Life and Works

1. Personal Profile

Dieter Schuh was born in 1942. He studied mathematics and physics at Universität zu Köln, graduated from the Rheinische

²) See P. Bstan’gyur No. Ōtani. 2064 rgyud ’grel, ka, 1b ~ kha, 297a./ D. Bka’gyur No. Tōh. 845, dus ’khor ’grel bshad, 1b ~ 469a / D. Bstan’gyur No. Tōh. 1347, rgyud, tha, 107b ~ da, 297a.
Friedrich-Wilhelms Universität in Bonn in 1972, and submitted his Habilitationsschrift in 1975. He had been a professor of Tibetan Studies at Rheinische Friedrich-Wilhelms Universität in Bonn since 1978 and retired in 2007. He is currently a managing director at IITB GmbH.

2. Travels and Academic Results Pertaining to Indo-Tibetan Astronomy (skar rtsis)


4) International Institute for Tibetan and Buddhist Studies GmbH (Gesellschaft mit beschränkter Haftung; a limited liability company). It was founded in 1976 by a group of scholars under the name of Vereinigung für Geschichtswissenschaft Hochasiens Wissenschaftsverlag GmbH (VGH Wissenschaftsverlag GmbH: Association for Historical Sciences on High Asia Wissenschaftsverlag GmbH), and renamed to the present name in 2005. The main aim of this association is scientific research into Tibet and Buddhism and the publication of the results. It is headed by Dieter Schuh. The advisory committee consists of Peter Schwieger (Rheinische Friedrich-Wilhelms Universität in Bonn) and Karl-Heinz Everding (Rheinische Friedrich-Wilhelms Universität in Bonn). In 2010, it moved from Halle in Germany to Andiast in Switzerland.

5) For a list of Schuh’s monographs and articles published up to 2007, see Maurer, Petra & Peter Schwieger, eds. (2007). Festschrift für Dieter Schuh zum 65. Geburtstag. Bonn: Bier’sche Verlagsanstalt. Schuh himself has uploaded his articles and books to his website: https://uni-bonn.academia.edu/DieterSchuh. His most recent works can also be found there as of December 2017.
For research purposes, Schuh traveled to Tibet and its bordering areas several times: In 1967, Schuh was sent by professors Walther Heissig (1913–2005) and Klaus Ludwig Janert (1922–1994) to Dharamsala to study Indo-Tibetan astronomy. In Dharamsala, he studied Indo-Tibetan astronomy and mathematics with a Tibetan named Blo gros rgya mtsho. The result is his seminal work *Untersuchungen zur Geschichte der tibetischen Kalenderrechnung* (published in 1973) and relevant several articles. In 1968, he traveled to Sikkim and found the treatise of the rde’u rtsis written by 'Dus byung pa whose title is *Mkhas dbang 'dus byung pa'i rde'u'i rtsis gzhung sarga bryad la dag ther byas pa rab sbyang gser gyi me long*. It was studied in his article Schuh (1970). During his stay in India from 1967 to 1969, especially in 1969 in Darjeeling, he collected and microfilmed Tibetan manuscripts and xylographs, which are now held in the Deutsche Staatsbibliothek, Berlin (the State Library at Berlin) together with a small portion of manuscripts from the Khang dkar family of Tshul khrims skal bzang in Kyoto, Japan. The results of the collection and microfilming include a series of publications of *Tibetische Handschriften und Blockdrucke* out of which his

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6) Schuh plays a significant part in organizing and editing *Tibetische Handschriften und Blockdrucke* (*Tibetan Manuscripts and Block Prints*) as a part of *Verzeichnis der orientalischen Handschriften in Deutschland* (*VOHD: Catalogue of Oriental Manuscripts in Germany*). Being initiated under the editorship of Dr. Wolfgang Voigt (1911-1982), *VOHD* covers manuscripts of 32 languages. For example, Band I (Mongolische Handschriften) has been published since 1961, Band II (Indische Handschriften) from 1962, Band X (Sanskrit Handschriften aus den Turfanfunden) from 1965, Band XI (Tibetische Handschriften und

II. Achievements in Indo-Tibetan Astronomy (Skar rtsis)\(^7\)


I. Introduction (pp. 81-5): The Abacus in Tibet has two important roles: first, as an astronomical instrument (sa gzhong, sandabacus), and second, as an instrument for tax calculation: “The sandabacus … the instrument for calculation of Tibetan calendar and … of great significance for the public life in

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\(7\) Schuh’s works are presented in chronological order in this article, which may help readers to gain a clear sense of the development of his research.
During his journey to Sikkim in 1968, Schuh obtained a treatise of rde’u rtsis, Mkhas dbang ’dus byung pa’i rde’u’i rtsis gzhung sarga brgyad la dag ther byas pa rab sbyang gsersgyi me long, which was written by ’Dus byung pa (aka. Ānanda) during the period of the Fifth Dalai Lama (1617-1682), from a bla ma in the monastery of Dben can in Gangtok. Two commentaries on the ’Dus byung pa’s text exist: One is the Kun phan dkyil ’khor written by ’Phyong rgyas Bstan spro ba in the 18th century. Jacques Bacot’s (1877-1965) identification of the text is as follows: “Title - Rdol rtsis skor gyi dpe rtsa ‘grel sogs le tshan par du ’khod pa: The book of arithmetic, theorems and demonstrations, established in divisions arranged. The book of calculation in nine chapters with table. Colophon: ‘This book was written by retired secretary Ldan rje.’”

Regarding this identification, Schuh points out that “… is the text which was falsely marked as Rdol rtsis by J. Bacot.” The other is Mkhas dbang ’dus byung pas mdzad pa’i rde’u rtsis gzhung sarga brgyad kyi zab gnad sgo brgya ’byed pa’i ’grel bshad dper brjod ’phrul gyi lde mig. After having obtained the ’Dus byung pa’s text, Schuh learned Tibetan

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8) p. 82: “Der Sandabakus … das Instrumentarium zur Berechnung des tibetischen Kalenders und … für das öffentliche Leben in Tibet von grosser Bedeutung.”


10) p. 84: “…ist der von J. Bacot fälschlich als Rdol rtsis charakterisierte Text.”
mathematics from Phun tshogs dbang rgyal of Ba gzhis family and a Lha sa Tibetan Ye shes sbyin pa in Dharamsala. He also recorded calculation manuals from them. In the following paragraphs, Schuh deals with the 'Dus byung pa text and the recorded calculation manuals.

**II. Sandabacus (pp. 85-94):** The origin of the sa gzhong is not clear. On the basis of the Vaiḍūrya dkar po written by Sde srid Sangs rgyas rgya mtsho (1653–1705), Schuh explains the four fundamental operations: addition, substraction, multiplication, and division.

**III. Abacus for the rde’u rtsis (pp. 94-113):** The 'Dus byung pa’s text is the oldest text which deals with abacus calculations used for the conversion of units in calculating taxes after harvest. In the text, he explains how the four fundamental operations are performed with the abacus. For example, Schuh shows how 17 bre and 3 phul is equal to \( \frac{7}{8} \) khal.\(^{11}\) According to him, weights and measures were not unified in Tibet. Thus, 'bo, a measuring instrument, had to be standardized in calculating an exact quantity of grains as tax. For that purpose, the *gtan tshigs mkhar ru* was devised.\(^{12}\)

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11) In the Tibetan unit system, the biggest unit is *khal*. 1 *khal* is equal to 20 *bre*. 1 *bre* is equal to 6 *phul*. 1 *phul* is divided into 120 *nang gi rdog ma*.

12) For the term, the *Bod rgya tshig mdzod chen mo* explains that the *gtan tshigs mkhar ru* is the name of *'bo and rgya ma* standardized by Karma Bstan skyong dbang po (1606–1642). See *Bod rgya tshig mdzod chen mo* (2000) p. 1966.
IV. Origin (pp. 114-50): Translation of the 'Dus byung pa's text and the recorded manuals. Manuscripts (pp. 151-69): Photographs of the original manuscripts. Notes (pp. 170-80), postscript (p. 181).


Introduction (pp. i-xxxviii): Schuh first describes his stay in India and efforts to microfilm the collections brought from Tibet. He devotes the main part of the introduction to a study of the life and work of 'Ju Mi pham Rnam rgyal rgya mtsho (1846-1912) on the basis of Bdud 'joms 'Jigs bral ye shes rdo rje’s (1904-1987) Bdud 'joms chos 'byung (pp. xxvii-xxxiv): some facts regarding astronomy include that 'Ju Mi pham began to receive the teachings of religious texts, and introduction to astronomy, divination and so forth around age six or seven (p. xxvii).

The First Part (pp. 1-62; nos. 1-85): This part is a catalogue of

13) This volume is not specific to Tibetan astronomy and astrology, but information on them can be found throughout it: pages 266-309 obviously make an important contribution to clarifying the structure and contents of the Vaidūrya dkar po, one of the most important astronomical and astrological works in Tibet.
85 tape recordings of Tibetan oral literature, among which ro sgrung occupies the major part. The summary of each story has been given. The following volume translated by Schuh contains many stories summarized in this catalogue: Märchen, Sagen und Schwänke vom Dach der Welt. Tibetisches Erzählung in deutscher Fassung. Band 1. Erzählung aus Zentral- und Osttibet erzählt in der Sprache von Lhasa (Fairy Tales, Legends and Merry Tales from the Roof of the World. Tibetan Narratives in German Format. vol. 1. Central and East Tibetan Narratives in Lhasa Tibetan). Beiträge zur tibetischen Erzählungsforschung (Contributions to the Research into Tibetan Narratives) (Sankt Augustin: VGH Wissenschaftsverlag, 1982).14)

14) As of 2005, fifteen volumes have been published in this series:

The Second Part (pp. 63-309; nos. 86-324): This part is a catalogue of the microfilms of the gsung 'bum of 'Ju Mi pham (nos. 86-297). Unfortunately, this catalogue includes only half of the 'Ju mi pham’s works. Dilgo Khyentse Rinpoche’s (1910–1991) later version [or refer to TBRC] would be preferable. As is shown in his gsung 'bum, 'Ju Mi pham, apart from Buddhism, showed a wide range of interests in other subjects: crafts and techniques, Gesar epic, poetry, medicine, astronomy, elemental divination, Svarodaya astrology (dbyangs 'char), Bon tradition, folk traditions, sorcery, magic rituals, etc. His interests were, corresponding to his involvement in the non-sectarian (ris med) movement, unrestrained by tradition.

pp. 266-309; nos. 298-324: Microfilms of Tibetan works on astronomy, astrology, and divination are appended, starting with a detailed analysis of the contents of the Vaidūrya dkar po (pp. 266–77). Regarding Karma nges legs bstan 'dzin’s Nyer mkho bum bzang, Schuh states that it was written in 1732 on

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the basis of its *bstan rtsis* (pp. 290-4; nos. 306-7). The colophon does not indicate the date or year where it was written.

3. Untersuchungen zur tibetischen Kalenderrechnung

The First Part
Introduction (pp. 3-46):

pp. 3-22: This part is filled with Schuh’s criticism and insight. He points out that Claus Vogel (1933-2012) and Emil Schlagintweit (1835-1904), who equate 235 synodic months with 19 Julian years cannot be justified, given the Tibetan practice of calculation: “The rule specified by Schlagintweit and Vogel, which implies that 235 synodic months correspond to 19 solar years, has been known since ancient Greek times as the metonic monthly cycle.”16) Schuh precisely indicates another point, that Tibetan astronomy is not based upon real observations: “... concrete, systematic observations of starry sky and of the movements of planets have been implemented by Tibetan astronomers only to a little extent and that such ob-

15) Because I used and commented on this monograph in my dissertation *passim*, see my following work in case my comments and criticism is needed: Jo Sokhyo (2016).
servations for the development of astronomy in Tibet cannot have been of a great meaning.” 17)

pp. 22-46: Schuh enumerates canonical works translated from Sanskrit and texts and commentaries written in Tibetan. The most eminent authors in the early period include ’Phags pa Blo gros rgyal mtshan (1235–1280) and Bu ston Rin chen grub (1290–1364). The classical period of Tibetan astronomy was initiated by Padma dkar po (1527–1592) 18) and the apogee was reached by Sde srid Sangs rgyas rgya mtsho.

17) p. 20: “… konkrete, systematische Beobachtungen des Sternhimmels und der Planetenbewegungen von Seiten tibetischer Astronomen nur in geringem Maße durchgeführt worden sind und dass solche Beobachtungen für die Entwicklung der Astronomie in Tibet nicht von großer Bedeutung gewesen sein können.”

18) I am curious about what significance his tradition has in Tibet. I conjecture that the reason why Schuh mentions him may be as follows: Schuh argues on pages 113-5 that the cases where solstice/equinox took place differently from the Kālacakra calculations had been continuously recognized by gnomon and ensuingly, some measures were taken by the Fifth Dalai Lama, Padma dkar po, Mkhas grub Nor bzang rgya mtsho (1423–1513), etc. In fact, the astronomical systems of Padma dkar po and Lha dbang blo gros (16th c.) have flourished in Bhutan, not in Tibet, along with the flourishing of the ’Brug pa Bka’ rgyud tradition in Bhutan. See Martin (1997) pp. 95-6; pp. 186-7. For a Tibetan assessment of Padma dkar po and Lha dbang blo gros in the history of Tibetan astronomy, see Kaḥ thog Rig ’dzin Tshe dbang nor bu’s (1698–1755) concise interpretations with a clear sense of difference among different systems. He classifies the grub rtsis systems into seven grub rtsis-s (grub rtsis rnam grangs bdun) according to rtsis ’phro difference. One of them is Pad ma dkar po’s system. See Kaḥ thog Rig ’dzin Tshe dbang nor bu (2006) p. 105. He also enumerates different systems with different bstan rtsis-s, one of which is Lha dbang blo gros’s (S. Sureśamatibhadra) system. See Kaḥ thog Rig ’dzin Tshe dbang nor bu (2006a) p. 40. For more information, see Jo Sokhyo (2016) pp. 41-2; pp. 212–3.
Chapter I (pp. 47-63): Schuh explains the Indian Kālacakra cosmology upon which the Tibetan cosmology is also based: The Tibetan archaic world model was that planets move around the flat earth with the mountain Meru, whose horizon was not distinguished from the equator: “... the world model in the given form never clearly makes a differentiation between the horizontal system of the observer and the equator system.”

Chapter II (pp. 64-70): Based upon the sexagesimal position system, he explains four fundamental operations of the subdivisions of space (ecliptic) and time, and their calculations with sa gzhong.

Chapter III (pp. 71-119): pp. 81-99: The three different types of day-reckoning (T. zhag gsum rnam dbyes) of Indian origin are explained: the nyin zhag from dawn to dawn, the khyim zhag (\(\frac{1}{30}\) of the time for the Sun to pass one zodiac), and the tshes zhag (\(\frac{1}{30}\) of the mean synodic month).

19) p. 54: “... das Weltmodell in der gegebenen Form einen Unterschied zwischen dem Horizontsystem des Beobachters und dem Äquatorialsystem gar nicht deutlich macht.”

20) For example, \(\frac{[3,37,43:2,140]}{27,60,60,6,707}\) in his system means 3 rgyu skar; 37 chu tshod, 43 chu srang, 2 dbugs; 140 cha shas. He uses the system for four fundamental operations. For example, \(1 + \frac{2}{65}\) equals \(\frac{[1,2]}{(-,65)}\).

pp. 117-9: Ten (eleven if old and new Phug systems—according to Schuh’s terms—are counted separately) different calendary systems and different numeral constants for lunar, solar and anomalistic months are explained.\(^{22}\) The discrepancy between all the systems is just fractions of seconds for year- and month reckonings.\(^{23}\)

\(^{22}\) In 2012, Schuh published a four-volume compendium entitled *Contributions to the History of Tibetan Mathematics, Tibetan Astronomy, Tibetan Time Calculation (Calendar) and Sino-Tibetan Divination*. In terms of progress in research and addition of information, Schuh (2012a) is not an essential progression from Schuh (1973a). However, the 2012 work incorporated the articles that have been published on his website (http://www.tibet-encyclopedia.de/astronomie.html) with the material from the earlier work in a more readable and accessible way. I mention Schuh (2012a) here because it also contains nice diagrams that summarize the differences in the ten systems that Schuh assumes. Of course, the constants for lunar (for the diagrams, see Schuh (2012a) pp. 116-8), solar (for the diagram, see Schuh (2012a) pp. 119-20) and anomalous months (for the diagram, see Schuh (2012a) p. 123) and the intercalation methods of each system given in Schuh (2012a) should be critically investigated. Furthermore, Schuh (2012), another work in the compendium, is one of greatest contributions ever made in Western research on Tibetan astronomy and astrology. Together with Bsam ’grub rgya mtsho (2011), all the entries of which are also included in the *Bod rgya tshig mdzod chen mo*, it is an excellent dictionary to which researchers working on Tibetan astronomy and astrology must refer. Lastly, I do not devote any pages to presenting the structure and contents of Schuh (2012) and Schuh (2012a) here in this article. This is negligence on my part, resulting from a period of stress and hardship after the completion of my PhD in May 2016. I hope to work on presenting these additional materials in the format presented in this article in the future.

\(^{23}\) The Phug pa grub rtsis system and the *byed rtsis* system in Tibetan astronomy are basically the same except for the difference of the length of a year and a month. In the former, one sidereal year 365.27065 days and one synodic month 29.53059 days. In the latter, a sidereal year
Chapter IV (pp. 120-30): This chapter gives practical instructions and explanations of the Kālacakratantra and various Tibetan systems. The primary concern is how to match Tibetan calendar dates of different traditions with those of the Gregorian calendar.

Chapter V (pp. 131-41): The instruction of the computer table included in the second part of the book is given.

The Second Part: Computer Table

Dates according to the Old and the New Phug pa School (both grub rtsis, m=1B and m=1A in his notation respectively), the byed rtsis calendar based upon the Kālacakra (m=3), and the byed rtsis calendar of ’Phags pa24) (m=4) are given with

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24) These are the four systems out of the eleven systems classified by Schuh. He classifies the Phug pa system into the Old Phug pa (m=1B in his notation) and the new Phug pa (m=1A) in terms of the difference of intercalation. I am curious how this classification is justified because we do not have textual evidence showing how the three Rgya mtsho-s (= Gtsang chung Chos grags rgya mtsho, Mkhas grub Nor bzang rgya mtsho, Phug pa Lhun grub rgya mtsho [15th c.]) put leap months. – no information is included in the Rtsis gzhung pad dkar zhal lung – Of course, the intercalation of the common Phug pa system (m 1A) seems
the Gregorian date.

**My comments** are as follows: This monograph is one of the greatest achievements of Western tibetology. However, because the field of Indo-Tibetan astronomy is beyond the reach of understanding of nearly all Tibetologists, the computer tables in it have been uncritically used. The four systems in the tables (or, eleven systems—seven systems have been excluded from the tables—while of course, it would be simple to present their tables) have been presented by Schuh’s reading of rtsis texts, which means that the tables are interpretative in nature and are prone to error. As a matter of fact, in the cases where some data and methods were not seen in real texts, Schuh consistently and aggressively attempted to fill in the blanks, which means that his presentations are hypothetical and possibly even incorrect. Therefore, we cannot praise this monograph too much, but we should not use it dogmatically. Rather, it should be critically investigated. Another aspect to be desired in this monograph is that because one of his main

to have been adjusted to tally with the sgang, which was possibly introduced in the late 17th century from China to Tibet. However, it is difficult for me to concur with his opinion that the demarcation between the new Phug pa and old Phug pa systems took place in 1696 C.E. Another issue is his presentation of byed rtsis-s. Aside from $m=5$, $m=6$, $m=7$ (Abhayākaragupta’s (1084-1130) Kālacakrāvatāra systems as he supposes), $m=2$ is a generally known byed rtsis system, which has not been given in the computer tables. However, further examination of the two systems, (i.e. $m=3$ and $m=4$, especially $m=4$ ) (Phags pa’s system as he supposes) is required. Regarding this, see Jo Sokhyo (2016) pp. 203-4, note 432.
concerns is to reconcile Tibetan dates with Gregorian dates so that Tibetan historians can accurately deal with Tibetan dates they encounter in real Tibetan historical texts, some theory and principle, as well as some aspects of astronomical practice, etc., have been ignored. These criticisms and points have been depicted in my dissertation.


This article concisely conveys his insight and opinion on the nature of Tibetan astronomy. The detailed contents in the Untersuchungen zur tibetischen Kalenderrechnung have been briefly summarized in this work.

1. (p. 554): Existing research into and the significance of the Tibetan calendar in relation to Tibetan history are mentioned. Schuh argues that reconciling the Tibetan calendar with the Gregorian calendar is critical.

2.1. (pp. 554-5): Alexander Csoma de Kôrös (1784-1842) wrongly fixed the first year of the first rab byung cycle as 1026.25) This was corrected by Berthold Laufer (1874-1934) and Paul Pelliot (1878-1945) to 1027.26)

26) See Laufer (1913) pp. 569-96; Pelliot (1913) pp. 633-67. For a summary of the corrections, see Schuh (1973a) p. 3.
2.2. (p. 555): In spite of the corrections, the issue as to reconciling with the Gregorian calendar is still unsolved.

2.3. (p. 555): Different methods of year-, month-, and day-reckoning in the Tibetan calendar exist, which have been tackled by modern researchers.

2.4. ~ 2.5. (pp. 556-7): Statements pertaining to astronomy made by Luciano Petech, Tsepon W. D. Shakabpa (1907-1989), Claus Vogel, Josef Kolmaš, etc.27) are incorrect.

3.1. (p. 557): In the many different calendrical systems that have existed in Tibet, the only common ground is that they are all lunisolar.

3.2. (p. 557): Citing Erik Haarh’s (1929-1993) The Yar lung Dynasty, Schuh points out that a unified lunisolar calendar was used at least until the end of the Yar klung dynasty.

3.3. (pp. 557-8): The Kālacakra calendar was officially introduced by ’Phags pa (1235–1280) in the second half of the 13th century. Since then, calendar systems based upon the Kālacakratantra have been developed in Tibet.

4.1. (p. 558): Tibetan astronomy, which is based upon the first chapter of the Kālacakratantra, is of Indian origin.

4.2. (pp. 558-9): The Kālacakratantra could not have originated before 1026 in its present form but was based on a text from around 806.28) Some Kālacakra methods exploited by

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27) As a matter of fact, except for Claus Vogel, the others do not have knowledge on Tibetan astronomy and astrology. Of course, they are good Tibetologists. In the case of Claus Vogel, he has worked on Indian and Tibetan astronomy and Buddhism. Although he made minor errors in presenting details of Tibetan astronomy, it should be considered that he is more of an Indologist/Buddhist scholar than a Tibetologist.
Bsod nams rtse mo (1142–1182) and Grags pa rgyal mtshan (1147–1216) show that a complete assimilation to the *Kālacakra* system did not take place until 'Phags pa’s time.29)

4.3. (p. 559): The movement of the Sun and the Moon is as important in Tibetan astronomy as it is in Indian astronomy.

4.4. (pp. 559-60): Since the *Kālacakra* system was established in the 13th century in Tibet, Tibetan astronomy has not been combined with real observations and criticism. This is probably due to dogmatism of Tibetan Buddhism, as western astronomy was hindered by Christianity in the medieval period.

4.5. (p. 560): Two systems of calendrical calculations developed in Tibet in the context of the Indian *Kālacakra*. The *Mūlatantra* which contained the Indian *siddhānta* astronomy was lost, and only fragments of the system survived in a later commentary named the *Vimalaprabhā* from which the Tibetan *grub rtsis* stems. The other Indian system of calculations is the *karana* (T. *byed rtsis*) which comes from a later text named the *Laghutantra* (abbreviated *Kālacakratantra*). This is an inherent tension in the Tibetan calendrical systems.

5.1. (pp. 560-1): Due to differences in the values of the mean movement of the Sun and the mean synodic months between *siddhānta* and *karana* in the *Kālacakra* system, two different astronomical traditions, *grub rtsis* and *byed rtsis*, have developed in Tibet.30)

5.2. (p. 561): In the Tibetan system, 67 synodic months corre-

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28) See also Schuh (1973a) p. 20.
29) See also Schuh (1973a) p. 5.
30) See also note 23.
spond to 65 solar months, and thereby in the course of 65 solar years 24 synodic months are intercalary. In the *grub rtsis* system, length of a *khyim zhag* = length of a *tshes zhag* $\times (1 + \frac{2}{65})$; length of a *tshes zhag* = length of a *nyin zhag* $\times (1 - \frac{1}{64})$.  

5.3. (pp. 561-2): An introduction to Bu ston’s *byed rtsis* work *Dpal dus kyi 'khor lo'i rtsis kyi bstan bcos mkhas pa rnams dga’ bar byed pa* (1326) is given. A basic approach to the theory of the mean movement of the Sun and the Moon (later known as *zhag gsum rnam dbye*) is first identified in it.

5.4. (pp. 562-3): In the 15th century, remarkable achievements in Tibetan astronomy were made mainly by Mkhas grub Nor bzang rgya mtsho, Phug pa Lhun grub rgya mtsho, Mtshur phu 'Jam dbyangs don grub 'od zer (1424-1482), etc. Firstly, they further developed the theory of the *zhag gsum rnam dbye*. Secondly, Phug pa Lhun grub rgya mtsho proposed the change of the *zla bshol rtsis 'phro* (remainder for the calculation of leap months) for the beginning of the year 806 from 0 to 61. Thirdly, a simplified calculation (T. *mgyog rtsis*) began to be used in the 15th century. However, none of these movements were based upon real observations. Instead, Buddha’s religious authority was attributed. Another significant point in the 15th century is that the *grub rtsis* system of the

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31) See also Schuh (1973a) pp. 4-5.

32) See also note 21. Also, one *tshes zhag* = \( \frac{65}{67} khyim zhag \) = \( \frac{11135(nyin zhag gi cha)}{11312(nyin zhag gi cha)} nyin zhag. \)
Phug pa school was adopted by the Phag mo gru government.  

5.5. (pp. 563-4): Even if real observations were neglected, Tibetan astronomers were well aware that Kālacakra calculations did not function correctly for the occurrences of solstices and solar and lunar eclipses. As a result, attempts to improve astronomical systems were made.  

5.6. (pp. 564-5): Tibetan astronomy reaches its apogee in the period of Sde srīd Sangs rgyas rgya mtsho, who is a Phug pa scholar. Čaqr Dge bshes Blo bzang tshul khrims (1740-1810) maintains that Chinese calculations of solar and lunar eclipses are accurate. The Dga’ ldan rtsis gsar, which he adopts, is the last phase of the development of the Tibetan astronomy.  

My comments are as follows: He explains the nature and essence of Tibetan astronomy with a special emphasis on the innate discrepancy evolved from the Kālacakra literature. In addition, he takes political aspects of Tibetan astronomy into account. In contrast to the difficulty of the issues, this work is too terse. His seminal work Untersuchungen zur tibetischen Kalenderrechnung should be consulted for further information.  

(2008), pp. 205-42. [In English]

Schuh first gives a brief introduction to the three major scholars on the Tibetan astronomy, Winfried Petri (1914–2000), Dieter Schuh, and Yamaguchi Zuihō, complaining that their achievements have not been understood at all: “…there is an astonishing lack of attention to the results of the research work of Winfried Petri, Dieter Schuh, and Zuihō Yamaguchi”33)

33) As Schuh admits it in this article, Yamaguchi Zuihō rightly pointed out that Schuh’s intercalary month in the Phug system (New Phug system (m=1A) according to Schuh’s classification) is incorrect. See Yamaguchi Zuihō (1992), pp. 873–95. For an accurate intercalation of the v system, see recently published Yum pa (2016). In it, calendar dates based on following four Tibetan systems (plus one Chinese lunar calendar) are given: 1) Phug pa grub rtsis (the system based on Phug pa Lhun grub rgya mtsho’s Pad dkar zhal lung (1447) and ensuing Phug pa writings such as Phug lugs rtsis kyi legs bshad mkhas pa’i mgul rgyan baidur dkar po’i do shal dpyod ldan snying nor (simply Vaidūrya dkar po) (1685), Dharmaśrī’s (1654–1717/18) Rtsis kyi man ngag nyin mor byed pa’i snang ba (simply Nyin byed snang ba) (1681; rev. 1713), Phyag mdzod Gsung rab’s (active in early 19th c.) Bstan bcos bai dūr dkar po dang nyin byed snang ba’i dgongs don gsal barston pa rtsis gshi’i man ngag rigs ldan snying gi thig le (Simply Rigs ldan snying thig) (written year: unknown, epoch: 1827), etc. It corresponds to m 1A in Schuh’s notation. It uses bshol’ phro (= mda’ ro lhag ma) 48 and 49 for intercalation, 2) byed rtsis (the system which Yum pa supposes dates back to Rje btsun Grags pa rgyal mtshan’s Lnga sgra gza’ lnga nyi zla gza’ ’dzin gyi don kun ’dus pa’i me mkha’ rgya mtsho (1193). Yum pa claims that later byed rtsis works are basically the same with it in terms of rtsis’ phro. This makes a drastic difference from Schuh’s opinions which present several different byed rtsis systems (m 2 ~ m 7) in Untersuchungen zur tibetischen Kalenderrechnung. This system uses 63 and 64 as intercalation index, 3) Mtshur rtsis (the system based on Karma Nges legs bstan ’dzin’s (18th c.) Nyer mkho bum bzang (1732), Kong sprul Blo gros mtha’ yas’s (1813–1899) Rtsis kyi bstan bcos nyer mkho bum bzang las skar rtsis kyi lag len ’jug bder bsdebs pa legs
(p. 210). Then, he maintains that the lack of attention caused Saul Mullard, Shen Weirong (沈衛榮), and Per K. Sørensen to make errors in calendar calculations and in reading texts filled with astronomical terms (pp. 210-3).

Going to the heart of his argument, Schuh critically reviews the recent three publications on the Tibetan astronomy by Svante Janson, Nachum Dershowitz & Edward Reingold, and Edward Henning. His general assessment is as follows: “...none of [the three publications] has any professional, scholarly background in respect of the language, history, religion and culture of Tibet” (p. 213).

Svante Janson (2007) (pp. 213-35): “… a number of statements in Janson’s article demand further clarification” (pp. 213–4). “…one basic shortcoming of Janson’s article, [is] the lack of

*bshad kun ’dus* (simply *Legs bshad kun ’dus*) (epoch: 1852). It uses 65 and 66 as intercalation index), 4) *Dge ldan rtsis gsar* (the system based upon Sum pa mkhan po Ye shes dpal ’byor’s (1704–1788) *bu gzhung*, (i.e. *Rtsis kyi bstan ’chos kun gsal me long gi bu gzhung zla bsil rtsi sbyor dge ldan rtsis gsar*). Yum pa used 46 and 47 as intercalation index for the calendar of *Dge ldan rtsis gsar*. He personally told me that because the indices have not been specified in Sum pa Mkhan po’s *bu gzhung*, he referred to the *Dge ldan rtsis gsar* system which is currently being used in Mongolian People’s Republic. Regarding this, Svante Janson also put forth 46 and 47 as intercalation index used in the tradition of the *Dge ldan rtsis gsar*. See Janson (2014) pp. 42–3. 5) Chinese lunar calendar (the system presented by Chen Yuan (陳垣) (1880–1971) in Chen Yuan. (1926). *Ershisi shuorunbiao* 二十史朔閏表. Beijing: Beiping Beiping daxue yanjiusuo guoxuemeng 北平北京大學研究所國學門 and by Wang Kefu (王可夫) and Li Min (李民) in Wang & Li. (1996). *Zhonghua tongshi da lidian : Gongyuan qian 2674-gong yuan 2000 nian*. 中华通史大典：公元前2674~公元2000年. 3 vols. Chengdu: Sichuan minzu chubanshe 四川民族出版社.
precise definitions of terms and their strict usage” (p. 215). As a part of his criticism, Schuh gives expositions on various calculation methods of Tibetan days (tshes), months (zla), and years (lo). He is mainly devoted to explaining “the exact number of past lunar months” (tshes zla rnam par dag pa; zla dag) whose “basic relation is that the period of 67 lunar months and 65 solar months are equal” (p. 218), and twelve zenith points (T. sgang), which defines a particular month if the mean sun reaches one of the points during that month.

Nachum Dershowitz and Edward Reingold (2008) (pp. 235-8): “Dershowitz and Reingold started from a given Tibetan date of the later Calendar of the Phug pa school and constructed a computer program for the conversion of this date into the Julian or Gregorian calendar” (p. 236). However, according to Schuh, the conversion is inherently problematic because “historical source[s] will not give us any information on whether this day is a leap day or not” (p. 237).

Edward Henning (2007) (pp. 238-42): Schuh is very critical of Henning: Firstly, Henning lacks in understanding of Tibetan culture: “…he (Janson) basically follows the obscure terminology of Henning, who obviously has only a very limited knowledge of the structure of the Tibetan language” (p. 232). Secondly, he is not honest: “One of [the] strange features of this book is the pretention of the author to be unaware of everything published so far about Tibetan astronomy and Tibetan calendar” (p. 238). Thirdly, Henning’s calculations are
not correct in the book and his book does not make any contributions to Tibetan astronomy: “Apart from numerous mistakes, Henning’s book does not contain anything new” (p. 238).34) Taken together, “Henning’s publication is characterized by deficient scholarship, fundamental misunderstandings, lack of scholarly fidelity and lack of mathematical reliability” (p. 242).

He concludes his article by an ad hominem statement that “the basic problem for the high-flying English-speaking community is the fact that they believe that nothing exists if it is not written in the English language. Finally, this will take back science into the beginning of the 19th century. I personally recommend that such types of publications as Edward Henning’s book should be completely ignored” (p. 242).

**My comments** are as follows: Schuh’s criticism is that the three commonly lack in understanding of the Tibetan culture and language, which caused the misunderstanding of Tibetan astronomy. The second one (the monograph of Nachum Dershowitz and Edward Reingold) was written to provide a general understanding of various astronomical traditions and included a Tibetan section. Further, the authors do not specialize in Tibet. So, it would be prudent not to be too strict to-

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34) An exemplification given by Schuh to substantiate that Henning is incorrect is that Henning incorrectly presents an epoch date. However, given Henning’s joinder seen in Henning (2013), Schuh is mistaken and Henning is correct. The key issue in the debate is that mean sun (*nyi bar*), not true sun (*nyi dag*), is applied to the epoch. For further explanation, see Jo Sokhyo (2016) pp. 205-10.
wards them. In the case of Svante Janson, even if he does not have a great understanding of Tibetan culture, he, as a mathematician, presents some nice mathematical principles on which Tibetan astronomy is based. In the case of Henning, he has specialized in Tibetan Kālacakra astronomy for decades and has a mastery of the mathematics on which it is based. Moreover, his book is another monumental achievement in Tibetan astronomical research in the West, showing a possibility of the interpretation and translation of the arcane first chapter of the Kālacakratantra. Most of all, his understanding of the Kālacakratantra is coherently applied to different kinds of Indo-Tibetan astronomical systems in his book. Thus, I think that Schuh’s critique is excessive. From a different perspective of knowledge on Indo-Tibetan astronomy, this is a nice article to provide a general understanding of Schuh’s research into the Tibetan astronomy in spite of his *ad hominem* remarks and complaints.

**Conclusion**

Schuh’s best philology, coupled with expertise, has produced landmark achievements for Tibetan astronomical research. Especially, Schuh (1973a) is the milestone works in the field of

35) His understanding of Tibetan astronomy is well represented in his article “Tibetan Calendar Mathematics,” published online in 2014.
Tibetan *Kālacakra* astronomy. Confronting the field filled with technical vocabulary and rich and deep cultural and religious implications, he has bravely pioneered the field and paved the way for future studies. Lastly, I should mention one of his points that has been repeatedly emphasized throughout his works: he sustained political and secular—“scientific” in his terms—stances, and reflected political concerns. In the case of astronomy, he also showed the political construction of time by the research into the establishment of the Tibetan calendar.
Abbreviations

AZG: Archiv für zentralasiatische Geschichtsforschung
BEFEO: Le Bulletin de l’École Française d’Extrême-Orient
c.: century
D.: Derge (Sde dge)
ed./ eds.: edited by
JA: Journal Asiatique
Ōtani: Ōtani daigaku toshokan zō eiin pekin-ban chibetto daizōkyō sōmokuroku, sakuin.
大谷大学図書館藏影北京版西藏大藏經總目錄・索引. ed.
P.: Peking
rev.: revised
S.: Sanskrit
TBRC: Tibetan Buddhist Resource Center (Reorganized as Buddhist Digital Resource Center as of 2017)
TP: T’oung pao 通報
tr.: translated by
ZDMG: Zeitschrift der deutschen morgenländischen Gesellschaft
ZS: Zentralasiatische Studien des Seminars für Sprach- und Kulturwissenschaft Zentralasiens der Universität Bonn.

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2006a Sangs rgyas kyi bstan pa rin po che ji ltar gnas gyur dus kyi nges pa rjes su dran pa bskyed pa legs bshad sa bon tsam smos pa nyung ngu don gsal rin po che'i sgron me, in Kah thog rig 'dzin Tshe dbang nor bu'i bka' 'bum, vol. 2. Beijing: Krung go'i bod rig pa dpe skrun khang, 37-60.

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Abstract

The German scholar Dieter Schuh is one of the contemporary giants of Tibetan studies. His seminal and ground-breaking work *Untersuchungen zur Geschichte der tibetischen Kalenderrechnung*, published in 1973, has made a lasting contribution to the field of Tibetan astronomical and historical research, clarifying the essence and calculation bases of Indo-Tibetan astronomy in Tibet (*skar rtsis*). Further, he has pioneered such new fields in Tibetology as sino-tibetan astrology (*nag rtsis*), manuscripts and xylographs, historical documents, the diplomatic history between Tibet and Mongolia, law, demography, research into Western Tibet, etc. In this work, I attempt to show the integral components of his scholarship on Indo-Tibetan astronomy by means of presenting the structure and outline of his works.

Because I focus on showing the main ideas and contents according to his line of thinking in each work, readers may benefit from easily spotting parts they are interested in. Thereby, this work may serve as a guideline for further research into the details of each work. The amount I assign to each work may vary in accordance with the gravity and importance I subjectively assume.

Lastly, the aim of this work is simple: numerous quality non-English writings are not easily used simply because they were not written in English. The depth and breadth of the time-honored German tibetology based on high-level philology has been a great source of inspiration to Tibetan scholars in the world. As a part of bridging the gap between
English and non-English scholarship, this work, which introduces Dieter Schuh’s research into Indo-Tibetan astronomy, may be helpful to enrich and foster future research, being another source of inspiration.

**Keywords**: Dieter Schuh, *Kālacakratantra*, Indo-Tibetan astronomy, manuscripts and xylographs, a critical investigation.

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