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BOOK REVIEW

Gaṇitagannaḍi: An astronomical text of 1604 CE in Kannada by Śankaranārāyaṇa Joisaru of Śṛngeri, translation with mathematical analysis by B.S. Shylaja and Seetahrama Javagal [Navaratnakara Publications Pvt. Ltd., First published 2021, Second Print: 2021, iv + 220, price: ₹ 350/ (India) US $ 25 (abroad)]

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It is very heartening that Dr. B.S. Shylaja and Sri Seetharama Javagal have published a translation and mathematical analysis of *Gaṇitagannaḍi: An astronomical text of 1604 CE in Kannada by Śankaranārāyaṇa Joisaru of Śṛngeri.* This is a commentary in Kannada on *Vārṣiktantra* of Viddaṇacārya. It is well-known fact that a number of manuscripts of ancient Indian astronomical texts have been still lying in the libraries of several parts of India waiting for the light of the day. These two scholars have taken a lot of trouble in publishing this commentary which was in manuscript form. They made available the translation of this ancient astronomical work with mathematical analysis. This published work has also included the original text *Vārṣiktantra* of Viddaṇacārya, which has been computed basing on *Sūryasiddhānta*. In *siddhānta* texts, the astronomical computations are based on *kalpa* or *yugas* involving large numbers. Hence, *karaṇa* texts have been designed to lighten the work of calculations and produce quick and more accurate results. A contemporary date of the sunrise where the conjunction of the Sun and the Moon is chosen as the epoch and the longitudes of other planets are determined for this moment and computation is made with this epoch as the basis in these *karaṇa* texts. Thus, it becomes easy for *paṅcāṅga* makers to prepare *paṅcāṅgas*. This *Vārṣiktantra* is one amongst them.

The division of the chapters and order of contents in this work are similar to that of other *karaṇa* texts. The publishers have made an insightful presentation of the texts of ancient Indian astronomy in the preface. They have provided graphical descriptions wherever necessary.

In the first chapter named *dhruvādhikāra*, the author explains the method to compute the mean positions of the planets at the beginning of the desired year from *kalyādi*. The mean positions of the planets at the beginning of desired year are called *dhruvakās* (Because the mean positions of all the planets at the beginning of *kaliyuga* have been already recorded in the earlier ancient *Siddhāntic* texts.) At the end, the author gives the *bīja* corrections to these *dhruvakās* of the planets. In the first chapter in the English translation, it is mentioned that in *Grahalāghava* of Gaṇeśa Daivajña a cycle of 4016 years has been adopted. In fact, he has taken a cycle of 11 years (4016 days). I think this is a typographical error. This error has been repeated at the end of the chapter (p. 54).

While commenting on the 5th verse, where the computation of *Savana dhruva* has been explained, the Kannada commentator narrates the procedure to get the number of elapsed years at the beginning of the desired year from *kalyādi*. But this method was not mentioned by the original author Viddaṇacārya in the text. Viddaṇa explains simple method that the elapsed number of *śaka* years added to 3179 gives the number of elapsed years at the beginning of the desired year from *kalyādi*. As *śalivahana śaka* begins when 3179 *kali* years elapsed. Here the commentator's method is as follows,

नतिः शरघ्ना पापोना प्रभवाद्यब्दसंयुता शकाब्दाः
60 × 25 = 1500 − 11 = 1489 (the number of *śaka* years elapsed)
śaka years + 3179 = Number of years elapsed from *kali*.

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This formula does not work at present. But of course, it worked well during the commentator's time. Later in the chapter the commentator explains the method to compute *ahargaṇa* at the midnight of the desired day, position of the planets and the *deśāntara* correction of the planets.

In the second chapter *grahasphuṭādhikara*, the method to get true positions of the planets has been explained. In the case of the Sun and the Moon only *mandaphala* correction is to be applied whereas for other planets *śīghraphala* correction is to be made to get their true positions.

In the English translation of 19th verse a small error has been found. This verse as well as the Kannada commentary explains the correction that is to be given to the Moon to get at the time of rising of the true Sun. This is called *bhujāntara* correction. This is to be applied to all the planets including the Sun. The *bhujāphala* (Equation of centre) of the Sun is to be divided by 27. The result obtained is negative or positive to the Moon. If the *bhujāphala* is positive to the Sun, then it is to be added to the Moon otherwise subtracted from the Moon. But in the English translation it is mentioned that the R sine of the Sun converted into *liptā* (minutes) should be divided by 27. I think the word "उष्णांशुदोर्ज्याफलम्" confused the translators. In the next verse, the method of *bhujāntara* correction to all the planets has also been explained.

The third chapter named *chāyādhayāya* is very important part of any ancient astronomical text. This is also called as *tṛpraśnādhikāra* in other ancient texts. The basic elements which are required for the observation of the planets are generally explained in this chapter. The computation of *krānti* (declination) of the planets, method of getting the shadow at any desired time, finding the rising times of the *rāśis* at the equator (*lanka*) and at the other places have also been narrated in this chapter. The rising times of the *rāśis* are needed to compute the *lagna*. For all practical purposes, this *lagna* plays an important role in ancient Indian astronomy.

In the fourth chapter *grahaṇādhikāra* author explains the computation of the lunar and solar eclipses. Publishers of this work have made mathematical and graphical descriptions in detail for the benefit of readers. However, there is an error in the Kannada commentary of the 2nd verse of *sūryagrahaṇa*. In this verse, the method of computing the *nati* (parallax in latitude) has been explained.

तज्ज्या नतज्याऽथ तदीयकोटिज्याप्ता हरः स्यात् खखाष्टकृतिभ्यः

The *koṭijya* of *natajya* (the cosine of zenith distance) is to be divided by 3600. The quotient obtained here is *hara* (divider). This is the meaning of the text, but the Kannada commentator explains the verse differently. According to him, 3600 is to be divided by the cosine of zenith distance to get *hara*. Here, I think this is not the error made by the commentator, but it is by the writer. In ancient times, there were expert writers who used to write down the text. Authors used to dictate the texts and the writers used to write the same. The writers need not be scholars or subject experts. Lack of concentration in writing or not listening to the text properly were the reasons for such errors. Apart from this, there were several other factors for committing such errors by the writers. The editing and publishing ancient texts is a challenging task for scholars.

The fifth chapter named *parilekhana* explains graphical description of the eclipses of the Sun and the Moon. All the required parameters are to be converted into *aṅgulas* to draw the graphical descriptions. The subject is similar to that of other astronomical texts.

Determination of *vyatipāta* and *vaidhṛti* is the subject matter of the sixth chapter *patadhyāya*. This is considered a very difficult one in ancient astronomy. In support of this, there is a statement like this. Even a profound scholar like *Lalla* who was well versed in all the branches of *jyotiṣa* too gets confused in determining the *pātas*. The duration of these *pātas* was considered very inauspicious. A lot of mathematical calculations are required to find this. It is well defined in this chapter.

The computation of the times of heliacal rising and setting of the planets has been described in the seventh chapter called *udayāstamaya*. The conjunction of the planets has been explained in brief. The eighth and the last chapter named *śṛngonnati* deals with the computation of elevation of the Moon's cusps.

I congratulate the publishers of this valuable text for taking so much pain to bring this text before the lovers of ancient Indian astronomy.