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Role of Benaras in the Studies of History of Science

A.K. Bag*

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The note highlights the activities of Kāśī Rājakīya Pradhān Samskṛta Pāṭhśālā (Benaras Sanskrit College) and BHU in the 19-20th centuries in India

Benaras has been a nerve centre of many religious & cultural activities for centuries, and propagating various subjects of social relevance including science. The Benaras Hindu University (BHU) has also been playing equally an important role in the understanding of science and technology from our modern and traditional perspectives. It is perhaps the only university which nurtured great national spirit through Pandit Madan Mohan Malviya, its first Vice-chancellor, himself a national leader elected three times as President of Indian National Congress invited great national leaders like Mahatma Gandhi, Rabindranath Tagore, Acharya P.C. Ray, Sir C.V. Raman and others at its initial phases to give guidance and shape to the curriculum of the university. It is the first university of its kind which understood the importance of national heritage in science and encouraged studies and researches in different areas of traditional Indian science and created space for them in the university curriculum along with modern science. Slowly it developed faculties of Indian Medicine, *Dravyaguṇa, Rasaúâstra, Kṛṣiśâstra*, Metals and Metallurgy, Indian history and archaeology, along with modern areas in science and technology. This exercise has produced a large number of stalwarts like Prof T. R. Anantaraman, P. Ramachandra Rao, R.Balasubramaniam (in Metal and Metallurgy), K.N.Udupa and P.V.Sharma, H.S.Singhvi (History of Indian Medicine), Lalanji Gopal (History of Indian Agriculture), R.S.Singh & Damodara Joshi(History of Indian Alchemy and Chemistry) and so on, whose works had been of great merit and internationally recognized. The University has been cultivating and nurturing an environment to assess our national heritage in science, and in a way is very close to our activities

*Editor, *IJHS*, Indian National Science Academy, New Delhi. email: akbag99@gmail.com

of the Commission in History of Science. This has helped us to reconstruct and reevaluate the Indian contribution in science, technology and culture in assessing the contributions of various traditions in the society on the basis of contemporary knowledge. Only in one area in which BHU is deficient is in the age -old traditional area of mathematics and astronomy (*jyotiṣa*), in which Benaras had excelled in the 19th century through Benaras Sanskrit School before the establishment of BHU. Benaras School produced several competent scholars in *jyotiṣa*, among which at least a few scholars were unique in their contributions.

Phalita-jyotiṣîs in Benaras: In the 19th century, the interest in *Phalita- jyotiṣa*, specially *Janma-kuṇḍalî* (astrological chart of birth time), *Muhûrta phala* (prognostication of good or bad moments in time etc) was quite popular in Benaras, though this was being given less importance as an academic subject. However, some *Phalita-jyotiṣa* exponents practishing in Kâúî (Benaras) were still very popular. Some of them were:

Babuâ Jyotiṣî (1756 AD)— A Maharashtrian brâhmin from Golagrâma belonging to the family of Kamalâkara 1616 AD settled in Benaras; became popular by his calculation of good time for the Kâúî Mahârâj who lived happily as Nyâyapâl by the British Government in India. Ali wazir of the Avadh king Mirza Ali, son of Asafadaullah, likewise consulted Babuâji to find the *muhûrta* (moment) to declare war against the British ruler Ceri Sâheb which also made him extremely popular. He trained large number of students who made names in and outside Benaras.

Paramasukha Upâdhyâya (1768 AD) — Son of Sītârâm of Itâvâ ; earned a great reputation as an astrologer and was presented a lakh of rupees for correctly predicting the right birth-time of Kâúîrâja Sri Viśvanâtha Simha. He also wrote a comm. *Bîjavṛttikalpalatâ*, on the *Bîjaganṭa* of Bhâskara II.

Bâlakṛṣṇa Jyotiṣî (b.1770 AD) — Son of Babuâ Jyotiṣî's brother Sevârâma, a great scholar of *Jyotiṣa-siddhânta* (see under Benaras Sanskrit School); Bâlakṛṣṇa was the principal pandit in the *sabhâ* of Kâúîrâja Udita Narayan.

Jayarâma Jyotiṣî (1795 AD)—Mahârâṣṭra Brâhman settled in Benaras; son of Babuâ Jyotiṣî, was trained by his father; his memory was very sharp and his colleagues used to envy him; his son Bhâu Úâstrî used to get monthly *vṛtti* from the Kâúîrâj for the reputation; Wilkinson used to send books from Sihore.

Benaras was well known for many such reputed Phalita Jyotiṣîs in the 17 and 18th centuries .

Kâúî Râj (Benaras) Sanskrit College: The Kâúî Râj family has been running *Sanskṛta Pâṭhúâlâ* for centuries*. Jonathan Duncan, a British Resident Agent/ Officer in Benaras** took interest and recognized it as the *Kâúî Râjakîya Pradhân Sanskṛta Pâṭhúâlâ* (Kâúi Râj Principal Study-centre) or Kâúi (Benaras) Sanskrit College on 28 October 1791 AD. It was modeled in the line of the Calcutta Madrassa (established in 1781). Poona Sanskrit College (1821), Calcutta Sanskrit College (1824), etc were established a few years later.

These Colleges were geared mainly to support British/European Agents/ Officers and the courses were so designed that it will be handled by a Head *Pundit* (or Rector) to be assisted by several professors, each is required to cater a few foundation students and prepare annually a lecture or teaching materials on the subject of his speciality for the use of his students. The major emphasis in the curriculum of *Jyotiṣa* was in the area of *Siddhâta-jyotiṣa* and *Karaṇa-granthas*. The Benaras College was served by great eminent peoples. A few among them are:

Lakṣîpati (b.1740 AD)— The first professor of *Jyotiṣa* was a brâhmin from the northern region of mountainous India, who had expertise in Sanskrit as well as Arabic languages. He was appointed by the British resident officer Duncan himself in 1791 AD for his expertise and scholarship in *pâṭîgaṇita, bîjagaṇita*, and *jyotiṣa-siddhânta*.He appears to have compiled *Samrâṭ-siddhânta*, *Ṣoḍaśayoga-vyâkhyâna,* etc from the Arabic originals.

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* History goes that Varanasi (so called Benares) was so reputed that even Jai Singh's forefathers used to send their children to Varanasi, as reported by French traveler, Jean Baptist Tavernier (1650). The College was originally in the same building, or close to it, and on the roof of which Sawai Jai Singh built this observatory about one century later. When Millitary Commander-in-chief of East India Company in Bengal, Robert Barkar's report came out on the Benares Observatory came out in the *Philosophical Transactions of the Royal Society of London* in 1777, it made a lot of hue and cry whether Indians could predict about solar and lunar eclipses. A large number of reports came out slowly on this observatory.

**Resident Agents/Officers for other Centres—Jonathan Duncan (Benaras), L. Wilkinson (Sihore), Hamilton (Indore), Captain Thomas Cadell (Alwar); many students were deputed from other centres like Agra, Jhansi, Hamirpur, Indore, Alwar, Sihore and other places to Kāsī̃ Rāj Sanskrit College.

Mathurânâtha Úukla (b.1750 AD) — A Mâlavîya brâhmin expert in Sanskrit & Persian languages; educated in Benaras and became professor of *Jyotiṣa* in 1813 AD ; wrote *Jyotiṣasiddhântasâra*, a practical astronomy (in 8 chaps) and a commentary, *Yantrarâjaṭîkâ* of Mahendra Sûri.

Kṛṣṇadeva (b.1775 AD) — Son of Lakṣmipati, became professor in 1820 AD; expert in *Jyotiṣa-gaṇita* and *Gola;*

Sevârâma Úarmâ (b.1795 AD)— Originally from Barelly, , educated in Benaras in *Jyotiṣa-siddhânta*, *Phalita-jyotiṣa* and *Karaṇa-grantha* and other works; appointed Professor of *Jyotiṣa* school in Sihore on the recommendation of L.Wilkinson of Sihore and the Rector of the Benaras school. He was the teacher of Bâpudeva Úâstrî and many others in Sihore. He had also served Indore and Nagpur Jyotiṣa schools, and returned to Benaras after the death of L. Wilkinson. His eldest son, Úrî Kṛṣṇa had taught in *Jyotiṣa* schools of Indore, Agra, Jhansi, Hamirpur, Lucknow and returned to Benaras as Deputy Inspector of Schools. Sevârâma's youngest son Sri Siddhesvar Śarmâ was also a great scholar of *Jyotiṣa* who had taught many students in his house.

Lajjâúankara Úarmâ (b.1804 AD)— A Gurjara brâhman, educated under Lakṣmipati, Dûrgâúaṅkara Pâṭhaka in Benaras, was appointed professor of the Benaras Jyotiṣa school after the death of Kṛṣṇadeva sometime in 1831 AD; an extremely polite teacher who was peaceful, kind, truthful, took the profession as a love of labour, became well known as a teacher.

Nandalal Úarmâ (1804 AD)— Second professor appointed to Kâúî Royal School in 1835 AD to help Lajjâúankara Úarmâ.

Devakṛṣṇa Úarmâ (b.1818 AD)— Son of Râmadhana Miúra, a Gauḍîya brâhman; studied under Lajjâúankara Úarmâ in Benaras; became well versed in *Jyotiṣasiddhânta* and taught many students of Mithila and other places; he was sent to Jammu school to teach *Jyotiṣa* by Walton, the principal of Kâúî Râj School, on the basis of a request from the king Sri Mahârâj Ranbir Simha of Kashmir. He stayed there for nine years and made a great name; settled in Benaras after his return.

Bâpudeva Úâstrî (alias Nṛsimhadeva Úâstrî, b.1819 AD)— A Mahârâṣṭrian Brâhman; appointed Professor of *Jyotiṣa* in Kâúî Râj Sanskrit College on the recommendation of Wilkinson sometime in 1842.

Sudhâkara Dvivedi (b.1821 AD) — Originally a student of Devakṛṣṇa Úarmâ, became professor at Kâúî Râj School sometime in 1851 AD.

Govindadeva Úâstrî (b.1834 AD)— A Mahârâṣṭrian brâhmin and son of Bâpudeva Úâstrî's brother, was trained under Bâpudeva, and was appointed third professor of *Gaṇitaúâstra* in Kâúî Râj College in 1859 AD.

Padmâkara Dvivedi (b.1831 AD ?)—Son of Sudhâkara, also became professor of Gaṇita-jyotiṣa in the Kâúî Râj School; compiled *Gaṇaka Tarañginî* of his father Sudhâkara, and *Gaṇita Kaumudî* of Nârâyaṇa Paṇdita (c.1356 AD) and processed for publication.

Among these experts I will refer only to two scholars in more detail, viz Bâpu Deva Úâstrî and Sudhâkara Dvivedî . Both were *Mahâmahopâdhyâya*, and the title was recognized as the highest degree in Sanskrit and considered equivalent to a professor or Ph.D holder of a university in prestige during Colonial time in India. Bâpudeva got the title in 1819 and Sudhâkara in 1887. Both served as professor of Mathematics and Astronomy (*jyotiṣa*) at the Kâúi (Benaras) Sanskrit College, before BHU was established in 1916 AD.

Bâpudeva Úâstrî (1819-1890): Bâpudeva was born in October 27, 1819 and originally from Belanesvar in Ratnagiri, Mahārāṣṭra and had his education in Nagpur, Pune and Sihore (Maharashtra), and studied *vyakta-avyakta gaṇitam*, *Lîlâvatî, Bîjagaṇita*; student of Pâṇḍurang, Dhuṇḍirâj and Sevârâma and made a good name in the field; later he came in contact of L. Wilkinson and was appointed Professor of Kâúî Râj Sanskrit College in *Jyotiṣa* on 15 Feb., 1842. He edited *Golaprakâúa* of Nîlâmbara Jhâ (1825 AD); assisted Fitz Edward in compiling and publishing *Sûryasiddhânta* with commentary *Gudhârthaprakâúikâ* of Ranganâtha in 1859, and also revised the manograpgh, *Siddhântaúiromaṇi* prepared by L. Wilkinson (1861) and completed the editions, *Bîjagaṇita* (2 parts, 1856), and *Lîlâvatî* (1850) of Bhâskara II (1150 AD).

Bâpudeva composed a number of works in Sanskrit viz., *Phalitavicâra* (1862), *Atulayantram* (1865), *Nûtanapancâṅganirmâṇam* (1875), *Pancâṅgapapâdanam* (1875) and others. His monograph in Sanskrit, *Kâúî Mânmandîra-Vedhâlaya-varṇanam* (Kâúî Mânmandir stone observatory, near Daúâúvamedha Ghât) is based on various accounts. Sastri reported that there were 10 observation instruments in 1861 of Kâúi Mânmandir which he described as follows.

Samrâṭ-yantra (Large and Small): Equinoctial sundial to indicate mainly the apparent solar time or local time of a place;

Digaṃúa- yantra: Two cylindrical walls engraved in degrees and minutes with a central pillar to measure the azimuth angle with the help of cross-wires stretched between the cardinal points;

Nâḍîvalaya-yantra: Two circular dials fixed at the equatorial plane with a iron rod pointing towards pole in order to measure time during the day and night;

Cakra-yantra : Circular scale for measuring hour angle and declination;

Dakṣiṇottaravitti-yantra I & II : Graduated quadrant or semi-circlular meridian dial for measuring meridian altitude or the zenith distance;

Krântivṛtta: Used for measuring declination (incomplete);

Palabhâ-yantra: Horizontal sundial; and

Agrâ-yantra: Circular dial with a rod at the centre to measure the amplitude or the angular distance from the east-west direction at horizon to a nearest degree?

Sharma, V.N has given an excellent account of the Varanasi Observatory.

Sudhâkara Dvivedi (1860-1910): Sudhâkara's family was originally from Gorakpur District of Uttarpradesh, later settled in Khajuri, a village adjacent to Varanasi. His father was a professional priest and astrologer. He wanted Sudhâkara to study *jyotiṣa* under Pandit Bâpudeva Úâstri, the then Head of the Department of *jyotiṣa*, but, however, completed his study under Pandit Devakrishna. Sudhâkara was extremely talented in mathematics, and even detected a few mistakes in the *Bîjagaṇita*, Part I, authored by Bâpudeva and received an award on the recommendation of Bâpudeva. After the retirement of Principal Griffith from Benaras Sanskrit College, G. Thibaut took over the charge. Thibaut, aftersome time, appointed Sudhâkara as head of *jyotiṣa* after the retirement of Bâpudeva in 1889. He obtained the title of *Mahâmahopadhyâya* in 1889 and was appointed a professor of astronomy and mathematics in the same year. He commented and published a large number of ancient and medieval texts . Some of his editions with commentaries on earlier texts are:

Yâjuṣa Jyotiṣa and *Ârca Jyotiṣa* (c.500 BC): *Yâjuṣa Jyotiṣa* with comm. of Somâkara-Sudhâkara and *Ârca Jyotiṣa* with *Sudhâkarabhâṣya*, Benares, 1908;

Bṛhatsaṃhitâ and *Pañcasiddhântikâ* of Varâhamihira (505 AD): *Bṛhatsaṃhitâ* (with comm of Bhaṭṭotpala) , 2 Vols, Benares, 1895-97;and *Pañcasiddhântikâ* (with a comm in Sanskrit, Eng tr by G Thibaut and Sudhâkara Dvivedī, Benares, 1930;

Brâhmasphuṭasiddhânta of Brahmagupta (c.628 AD): Text with a comm by Sudhâkara Dvivedī, Benares, 1902; Originally published in *Pandit*, 1901-02.

Śiṣyadhivṛddidatantra of Lalla (c.750 AD): Edited and published, 1886.

Sûryasiddhânta (c.8-9th century AD): Text with *Gûdhârthaprakâúikâ* comm. of Ranganâtha, ed by Fitz Edward Hall and Sudhākara Dvivedī, Calcutta, 1859, published in *Bibliotheca Indica*, no.25.

Mahâsiddhânta of Âryabhaṭa II (950 AD): Ed with comm., Benares, 1910, Originally published in Benares Sanskrit Series.

Triúati of Úrîdhara (c.991 AD): Ed by Sudhâkara, Nirnayasagar Press, 1899.

Karaṇaprakâúa of Brahmadeva Gaṇaka (c.1092 AD): Ed with comm. by Sudhâkara Dvivedî, Benares, 1899; Originally published in Chaukhamba Sanskrit Series.

Bhâsvatî of Úatânanda (1099 AD): Ed by Sudhâkara Dvivedi, 1883;

Bîjagaṇita and Karaṇakutûhala of Bhâskara II (1150 AD): *Bîjagaṇita* with comm. of Sudhâkara, pub by Muralîdhara Jhâ, Benares,1927; *Karaṇakutûhala*, ed with comm. *Vâsanâ* by Sudhâkara Dvivedī, Benares, 1991; Ed also *Siddhântaúiromaṇi* with Sudhâkara's own comm., Kâúi Sanskrit Series no.72, Benaras, 1929.

Grahalâghava of Gaṇeúa Daivajña (1507 AD): Ed with comm. of Mallâri, Viúvanâtha and Sudhâkara Dvivedî, Benares,1904;

Siddhântatattvaviveka of Kamalâkara(1616 AD): Ed with notes by Sudhâkara Dvivedī, Benares, 1895; and a few others.

A large number of original works were also written by him, e.g.

Gaṇaka Tarañginî (Biography of earlier astronomers), Benares, 1892, Originally published in *Pandit.*

Calarâúikalana (New methods of Differential and Integral Calculus, in15 chaps), 2 Vols, 1941-43, *Princes of Wales Saraswati Bhavan Texts*;

Dîrghavṛttalakṣaṇa (Treatise on the Properties of Ellipse), Second ed, 1943.

Other works are: *Bhûbhramaṇa, Rekhânirûpaṇa, Yantrarâja, Grahaṇa Châdakanirṇaya, Samîkaraṇa-mîmânsâ,* and a few others.

The range of activities of both Bâpudeva Úâstri and Sudhâkara Dvivedî is indeed praiseworthy. It is not easy to edit such a large number of serious astronomical texts from the old manuscripts in one's life time, together with knowledge of instruments and other original contributions. The knowledge of the technical subjects in *Jyotiṣa* ranged from 500 BC onwards dealing with subjects like calendar, epicyclic and eccentric models, solar and lunar eclipse, beside knowledge of trigonometry and various other parameters which need predicting of accurate positions of planets. Foreign experts: L. Wilkinson & G.Thibaut , who worked with them, had rated them as the finest scholars in Indian astronomy in the 19th century.

Both Bâpudeva Úâstrî and Sudhâkara Dvivedī tried their best to make an assessment of several centuries of knowledge before them. Their motivation and spirit are extremely important and their attempt to look through centuries of traditions in order to preserve and nurture the contributions in *Jyotiṣa* in the period and their impact on the society and culture are extremely lauding. Wilkinson and Thibaut's appreciation for them are apt and justifies their worth.

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