Search for ancient Indian records of the sighting of supernovae

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The Crab Nebula is recognized today as a supernova remnant. Historical records from China show that the star explosion leading to the event was observed by the Chinese star gazers on 4 July 1054. There have also been indications from the rock carvings of the American Indians and records of a physician in the Middle East that they had witnessed this spectacular event. As the event would have been visible from the Indian subcontinent, efforts were made to search for written records available in India. This paper is an account of that search and its conclusions. Although some suggestive references were found, they are not definitive enough to be identified with the event. Some reasons are advanced for the apparent lack of written records.

What is common amongst the following: A Chinese Emperor of the Sung Dynasty, the Red Indian tribes on the American subcontinent, a learned physician from the Middle East, all belonging to the eleventh century and the astronomers of the twentieth century?

This may sound like a quiz question, whose cryptic answer is: *They were all witnesses to a spectacular cosmic event, which is still unfolding, an event that was first witnessed on the earth on 4 July 1054, but whose aftermath is being studied even today, and will continue to be investigated by astronomers in the years to come.*

(a) Let us begin with the Chinese, to whom we are indebted for maintaining records that date back nine and a half centuries.

In the *History of Sung Dynasty* by Ho Peng Yoke, published in 1962 the following event is described:

On a Chi-Chhou day in the fifth month of the year of Chi-Ho reign period, 'a guest star' appeared at the south-east of Tien-Kaun measuring several inches. After more than a year it faded away … .

What could this event be? How was it noticed? What was meant by a guest star?

For answers, we have to go back a millennium, to the then prevalent Chinese tradition in which the ruling emperor looked to the sky for any 'warnings' from the Almighty, just in case he happened to stray from the straight and narrow path of fairness and justice. Lest he had to pay a heavy penalty for inadvertently missing such a warning, the emperor made sure that a careful watch was kept on the heavens. It was the duty of the court astrologer to maintain a vigil and inform the emperor of anything unusual. It was in that context that the above event was noticed and duly recorded as stated above. And 4 July 1054 is the date, according to the modern calendar, corresponding to the Chinese record. The word 'guest star' indicates that the star did not exist in the sky prior to the event; more correctly, it had not been observed before. Similarly, after the event was 'over', the star disappeared from the heavens. The Chinese had the custom of describing such transient objects as guests in the sky. The sighting of this object was also recorded in Japan, where too the astrologers kept fairly meticulous records of the heavens.

Indeed, the star which had been previously too faint to be seen, became so bright initially, that it could be seen even in daylight for twenty-three days, while at night it was five times as bright as the planet Venus is in the early morning or late evening, for about six months. When it was at its brightest, one could read by its light at night.

The recorded direction of the object, points to Zeta Tauri in the constellation of the 'bull'. What do we see there today?

Figure 1 shows the photograph of that site where, of course, by naked eye we do not see anything. The photograph shows a remarkable cloud-like structure with several filaments sticking out. Because its shape reminded the astronomers who took the first photographs, of a crab, the object was given the name 'Crab Nebula'. Certainly, whatever is going on there now must be still pretty violent, judging by its highly disturbed appearance.

We will return to this remarkable picture later. We first look at another bit of evidence of its observation, coming from an altogether different part of the world.

(b) In 1955, William C. Miller published a leaflet under the auspices of the Astronomical Society of the Pacific, presenting evidence that the Pueblo Indians in North America had witnessed this event and recorded it not on paper,

Figure 1. Crab Nebula, the relic of the star that was seen to explode in 1054 AD, the date recorded by the Chinese astronomers corresponding to 4 July of that year. (Photograph by courtesy of Palomar Observatory, California Institute of Technology, USA.)

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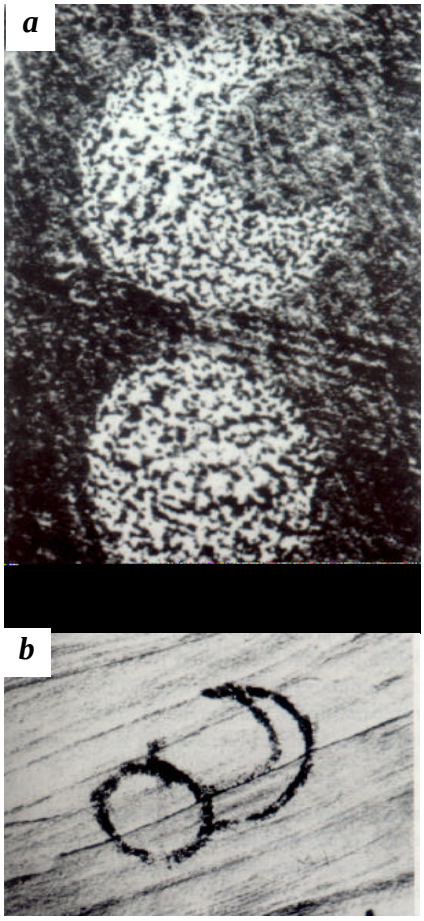

Figure 2. ***a***, Pictograph in the Navajo Canyan area in North America showing crescent moon along with a bright star-like object; ***b***, Petroglyph in the white Mesa region, which also indicates the same event. Both pictures are ascribed to Pueblo Indians of the eleventh century.

but through pictures on rock, pictures which have survived till today.

In Figure 2 *a* and *b*, we see two different types of pictures. In Figure 2 *a*, we see a pictograph, which is an image made on rock with paint or chalk (or, with a rock that writes like a chalk). This is found in the Navajo Canyan area. Figure 2 *b* is a petroglyph, that is an image chiselled on rock with a sharp implement. It is from the White Mesa region. In both the pictures, the crescent is the moon; but what is the round object near it? Also, why are the crescents facing opposite ways in the two pictures?

From old Chinese records, one notes that the moon was in a crescent shape when the object was first seen and was at its brightest. The guest star could have been near enough to the moon for its identification with the round object in these pictures. Moreover, these pictures were found in places from where the eastern horizon was clearly visible. Bearing in mind that such a sight would have been seen near the eastern horizon, one can attach significance to the locations of these pictures.

Could these pictures represent another more common sight known to observers, namely the occultation of Venus? Miller thinks not, because such occultations occur once in a few years and one would therefore have expected many more such pictures in the area. Rather, one may conclude that the tribes were not routinely interested in astronomy, but still were sufficiently impressed by this particularly rare event, to have immortalized it on rock.

As to the opposite orientations of the crescent, Miller feels that the artists may have drawn one figure by looking at the original over their shoulders and may have experienced, a left–right ambiguity. If one tries to draw a crescent moon with one's back to it while looking over one's shoulder, one may understand the likely confusion with regard to orientation.

(c) On 29 June 1978, in a letter to *Nature* (1978, **273**, 728–730), Kenneth Brecher from MIT in the United States and the couple, Elinor and Alfred Lieber from Jerusalem, Israel presented evidence that the same remarkable sight was seen and recorded in the Middle East by a Christian physician from Baghdad, named Ibn Butan. Although not a professional astronomer or astrologer, Ibn Butan, like his contemporary physicians, was interested in the possibility that diseases on the earth could be related to cosmic events. Ibn Butan's biography was recorded in a biographical encyclopaedia prepared by Ibn Abi Usaybia around 1242 AD, in which his report is reproduced. Some extracts, from that report, are illuminating.

… One of the well-known epidemics of our own time is that which occurred when the spectacular star appeared in Gemini in the year 446H. In the autumn of that year, fourteen thousand people were buried in the Church of Luke, after all the cemetries in Constantinople had been filled… As this spectacular star appeared in the sign of Gemini… it caused the epidemic to break out in Fustat when the Nile was low, at the time of its appearance in the year 445H(sic)… .

Here, the year is measured on the Islamic Hizri calendar, according to which the year 446H corresponds to the period 12 April 1054 to 1 April 1055 AD, that is encompassing the dates when the Chinese saw the guest star. Ibn Butan seems to imply that this event occurred in the summer and caused the epidemic in the following autumn, when the Nile was low. This places the event in the summer of 1054, which agrees with the more precise Chinese date of 4 July 1054 AD.

One additional point may be noted. The Crab Nebula is seen today in the constellation Taurus, whereas Ibn Butan refers to Gemini. If he were using the astrological convention, he would give the location with respect to the sun's location in the zodiac. If one takes into account the steady precession of the earth's rotation axis, the Crab Nebula would have appeared in Gemini about a thousand years ago.

We thus have three different sources of information about the sighting of a unique cosmic event, from China and Japan in East Asia, from the American continent in the western hemisphere, as well as from the Middle East in West Asia. Why no records from India or Europe? Why, with their long tradition of writing and preserving manuscripts, did Europeans fail to record this event? Here, astrophysicist Fred Hoyle and historian of science, George Sarton have independently argued that the religious beliefs in Europe of those days assumed that God had created the cosmos in perfection and as such no new phenomenon, like this one would have been considered credible enough to be documented. So the scholars in the monastries chose to ignore what they saw. Perhaps! But what about India?

In India, astronomy was flourishing in the golden era which had started with Aryabhata in the 5th Century and which was to continue till Bhaskara II in the 12th Century. Surely, such an event would have been witnessed by many at least in some part of the subcontinent, despite the July date falling in the monsoon season. And when something so unusual was seen, the astronomers and astrologers would have been consulted.

The explanation may be that there was not much written tradition in India at the time, the emphasis of scholarship being on reading the ancient texts, rather than creating new ones.

Nevertheless some attempts were felt to be necessary, to trace old records of the period which might contain at least oblique references to the event. A project was accordingly proposed for support by the Indian National Science Academy (INSA), under its programmes in the History of Science. This paper is the outcome of the investigations made under this project.

Before coming to those details, we summarize the modern interpretation of this strange event.

The Crab Supernova

Around 1731, an English physician and amateur astronomer named John Bevis found a bright nebula in the Taurus constellation. In 1758, Charles Messier began his famous catalogue of bright nebulous objects in the sky, with this bright object labelled *M*1. Figure 1 is a modern photograph of that remarkable object. With its direction matching that of the ancient Chinese records, and its physical environment consistent with the remnant of what that event was, astronomers are sure that the guest star did not actually go away, but is still around in the shape of its remnant, the Crab Nebula. The approximate distance of this nebula from us is 5000 light years, while the extent of the whole structure of Figure 1 is as large as 5 to 10 light years. (One light year is the distance travelled by light in one year, and is approximately ten million million kilometres.)

So, this is what remains today of the event that was witnessed by the Chinese, the Red Indians and the Middle Easterners, nine and a half centuries ago. The event is a catastrophic one, marking the break-up of a star. The star, in its evolutionary course, burns nuclear fuel in its interior. This process serves two purposes. Firstly, it provides the star with an energy reservoir on which to draw in order to continue shining. Secondly, and more importantly for the star's continued existence, it generates internal pressures which keep the star in a stable equilibrium against its inward force of gravity.

However, at some stage, the nuclear fuel gets fully depleted and the star can no longer keep itself in equilibrium. Its inner core collapses inwards (–implodes), while the outer part, the envelope, explodes outward, being disrupted by the shock wave generated by the inner implosion. A vast amount of energy and particles, including neutrinos are released, which is why the star, now called a supernova, outshines the entire galaxy (containing some hundred billion stars). No wonder, the Crab supernova was seen by the Chinese even during daytime.

Our Milky Way Galaxy is expected to have such stellar explosions three to four times in a century. After the Crab, two supernovae were seen in the Galaxy, one by the astronomer Tycho Brahe in 1574 and the other by Johannes Kepler in 1604. The reason why only three were seen in a millennium, is because light absorption prevents us from seeing explosions in most of the galactic disc. Nevertheless, astronomers do see and regularly record supernovae seen in other galaxies.

With these remarks, we now come to the project itself and the search strategies adopted.

Search strategies

After considerable brainstorming it was decided to proceed with the following search strategy. It addressed three questions:

(a) What kind of literature constitutes the material to be searched? Obviously astronomical literature had to be searched. However, it was realized at the same time that it was not correct to limit the area of search to astronomy alone. The reference we were looking for could as well appear in a literary work, an epic or a poem. It was also likely to be located in a work on history of India or of a region or of a ruling king. A possibility of the mention of a sudden appearance of a bright new star in the sky causing spread of a certain illness among people on the earth, could be located in a treatise on medicine or a commentary thereof. Moreover, speculations and flights of imagination arising from the sight of a strange shining body in the sky would not have been out of place in books of folk tales or books on miracles, portents and omens in the literature with Indian ethos.

The literature thus identified for the purpose of the present project was astronomical, literary, historical, medical, religious and cyclopaedic in character. This literature was available in three forms: printed books, manuscripts and inscriptions.

Apart from the primary sources available in the three forms mentioned above, secondary sources in the form of monographs, surveys and research articles dealing with relevant matter were also included in the search material.

The Jain and Buddhist literature which developed in Ardhamagadhi and Pali languages contemporaneously with Sanskrit, also was considered a potential source of information that was sought for.

(b) The 'when?' question concerned selection in the literature confined to a certain period. Since the event of the Crab supernova took place in 1054 AD, it was first decided to collect the literary sources existing around this period. However, later it was realized that the description of the event could appear also in the works belonging to the subsequent period, because many Indian authors took delight in imitating their forefathers by repeating, sometimes *ad verbatim*, what the latter had said. The span of the period of composition of the literature was therefore, extended from 11th to 15th Century.

(c) How should the search be carried out? Because of the vastness and the complex variety of the literature and its being scattered in the libraries throughout the country, the mission of collecting and sifting data began with Pune and fanned outwards.

Histories of Indian literature, bibliographies and proceedings of national and international conferences, festschrifts and commemoration volumes, indices of papers published in prominent Indological journals and other similar works were perused to collect primary material in the form of Sanskrit works and secondary material in the form of monographs and research articles.

For collecting material from manuscripts, the research team went through catalogues of manuscript libraries, both in Pune and outside. The *Catalogus Catalogorum* also was consulted for obtaining more information. The five-volume *Census of Exact Sciences in*

India, prepared by David Pingree, proved to be of immense use for the compilation of astronomical data. In spite of a long, exhaustive list of books and manuscripts prepared by the researchers, relatively few books and manuscripts were available to them.

These included the well-known works like the historical poem *Rājataraṅginī*, the *Vikramāṅkadevacaritam*, the folktale collection *Bṛhatkathāmañjarī*, the *Bhaviṣyapurāna*, the astronomical works like the *Bhadrabāhusaṁhitā* and the manuscripts of astronomy and astrology like *Sāntisāra*, *Camatkāracintāmaṇi* and *Nakṣatracintāmaṇi*. The bibliographical poem in *Prākṛta*, *Kumārapālacariyam*, was also studied.

At this juncture, it was decided to consult some eminent scholars on the future course of action, notably B. V. Subbarayappa, President, International Union of the History and Philosophy of Science at Bangalore and K. V. Sarma, the veteran Indologist at Chennai.

Among the works perused at Bangalore and Chennai were the books *Nārasaṁhitā*, *Yātrāprabandha* and manuscripts *Mukundavijayaprasasti* and *Jyotiṣaratnamālā*. About 50 books and manuscripts were perused at the Academy of Sanskrit Research at Melkote, and Oriental Research Institute at Mysore.

The idea of search through Kerala manuscripts was therefore given up as much work had already been done on the Kerala School on astronomy and the researches by eminent scholars were available in the form of publications.

The research group visited Rajasthan, Gujarat, Kolkata, Ahmedabad, Patna and Varanasi in this connection.

Results

Our searches have not led to anything definitive that can stand alongside the Chinese or Japanese notings of the Crab supernova, nor are they even broadly confirmatory as in the case of Ibn Butan's records. Our scholars, however, had been instructed to jot down any references that even remotely were suggestive of a supernova explosion. Having looked at over twenty such findings, we have shortlisted them to the following seven. Although one has to allow for poetic licence, the items ((5)–(7)) may have some relevance to the sighting of a star in daytime, which can be a supernova.

(1)

jvalitārkendunakṣatraṁ
nirviśeṣadinaksayam |
ahorātraṁ maya dṛṣṭaṁ
tad bhayāya bhaviṣyati ||

Mahābhārata, Bhīṣmaparvan, II.2

Vyāsa warns of Dhṛtarāṣṭra of undesirable consequences of the war. He says, 'I have seen the day and night with the sun, the moon and the constellations burning and the end of the day not differentiable. This will create horror'.

(2)

prāgandhakāro deśesmin
divase'pi vyajṛmbhata |
rūpikādivasāloka iti
yat paprathe janaḥ ||

Rājataraṅginī, VII,1346

The verse is from the story of Harṣa who, during his war expedition, uprooted the idol of a local deity, Parihāsakeśava. It describes the incidence as follows: 'Deep darkness spread all over the land even during the day. People say that each and every direction was illuminated even during the day when the idol was reinstated.'

This description probably comes closer to that of a total solar eclipse, than an exploding star. Nevertheless, we give it here since it talks of illumination (other than from the sun) during the day.

(This translation is based on the Hindi translation published by Pandit Pustakalay Kashi. However, the term 'rupika' is difficult to understand.)

(3)

saptame'hani kampaḥ syān
mahān anilasambhavaḥ
tārolkāpātavidāhair ādīptaṁ
lakṣayen nabhaḥ ||

Jyotiṣakalpataru (MS)

The manuscript describes a certain event as follows: 'On the seventh day, there would be tremor caused by the wind and one would notice the sky blazing and burning with the falling of meteors and stars.'

(4)

nakṣatracandrasūryāṇaṁ
maholkāpātanaṁ tathā |
divyolkāpātanaṁ tadvad
divā nakṣatradarśanam ||

Śāntisāra

The text describes heavenly events causing calamities on the earth. The list of such events includes the following: 'Falling of stars, the sun, the moon, similarly, falling of a giant meteor or a heavenly meteor as well as the sight of star during the day (are bad omens).'

(5)

grahaṇaksatratārāṇāṁ
darśanaṁ ca divāmbare |

Bṛhatsaṁhitā, Chapter 46

The text describes portents. One of them is sight of stars, heavenly bodies and constellations during the day (as a portent).

(6)

divyolkāpātanaṁ tadvad
divā nakṣatradarśanam |

Sarvādbhutaśānti - 36

The text enlists portents in the same way as above. Two of them are described as follows: 'Fall of a meteor during the day and sight of a star during the day (as portents).'

(7)

tesāṁ darpāpahārāya
prabodhārthaṁ ca gopate
tejorūpaṁ samudbhūtama-
ṣṭaśrṅgamanaupamam ||
alaksyaṁ pāpatamasā
mahadvyoma narādhipa
jv¯lamālāvṛta¯ vīra
bahurūpa ca bhāsate ||
śatayojanavīstīrnaṁ gatamūrdhvaṁ
bhramaṁ tathā
gomadhyato mahārāja
karṇikevāmbujasya vā ||

Bhaviṣyapurāṇa, Brāhmaparvan, Chapter 153, Verses 29–31

The text narrates the story of the sun god who, in order to destroy the pride

of all the gods, assumed the form of all-pervading brightness. This is described as follows: 'O king, to remove their pride and to awaken them, a bright form with eight horns arose in the sky. It was beyond description. The vast sky, which was covered with strings of flames and which appeared in multiple forms, was invisible for sinners. Like the central bud of lotus, a stream of brightness shooted from the middle of the earth and spread high up along a hundred yojanas rotating in the heaven.'

Conclusion

This, at the first instance, seems a disappointing end to a quest in history of science. One may try to rationalize the lack of any specific evidence with the oral tradition of transmission of knowledge on the subcontinent. Thus, the practice of writing down some fact or idea and preserving it for posterity, common in Europe and China, and also in the Middle East, was not so common in India. Also, the practice of debating at length, deep philosophical concepts in preference to experiments and observations, must have played a role. Even the written material, as mentioned before, cannot be authenticated *vis-à-vis* dates. For, in some cases, portions from earlier manuscripts are simply copied in later ones, presumably because the author felt that it would enhance the overall credibility of the entire text. In other cases, portions were added later, giving the impression that the later insertions belonged to the earlier period.

Nevertheless, we feel that the exercise was worth undertaking. It is by no means exhaustive; and some written notings of supernova sightings not found by us, may still be around in stone inscriptions or in Prākṛt languages, instead of in Sanskrit. A detailed list of material searched by us will be available with our report submitted to INSA. If any scholars in future wish to resume the quest, they may wish to know *what we have already looked at*, since this will enable them to concentrate their searches elsewhere. These references will be made available by the authors if required.

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