

THE SOLAR ENERGY AS UNDERSTOOD FROM *SĀMBAPURĀṆA*

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Abstract

The ancient seers have observed nature closely and have recorded their observations in the Vedas and Purāṇas. Sun is the main source of light and energy to planet earth. The various aspects of Sun and its mode of worship has been dealt with in the Purāṇas. This paper brings to notice some of the aspects of sun which have been specifically termed to be the cause of energy and change in environmental conditions on earth and other planets. The *Sāmbapurāṇa* is the prime source of the information for this paper.

INTRODUCTION :

The Purāṇa literature is vast and in large numbers. The Purāṇas are grouped as Mahapurāṇas and the Upapurāṇas with eighteen principal ones in each classification. Based on the principal deity dealt with in the Purāṇas, they are further grouped as Saurapurāṇas dealing with Sun, Sāktapurāṇas - with the Goddess as the Supreme, Gāṇapatya - Lord Gaṇesa as the principal God, Śaiva - Śiva as the Highest Lord, Vaiṣṇava - Viṣṇu as the Supreme Deity and Kaumāra - Kumāra as the Supreme.

The Sun worship exists from the Vedic times. The yearly Saṅkrānti is celebrated in the month of Pauṣa throughout India when the Sun starts moving northwards from the tropic of Capricorn. The Sundays of the Śrāvaṇa month are dedicated to Sun-worship. The famous Sun temple at Konark also remains as a

place of the Saura worship. Some Purāṇas describe in detail the worship of Sun while a few deal briefly about it.

Today science has developed to such an extent that the solar energy is trapped and utilised for various purposes especially in generating electricity. Further it is discovered that there are many rays like the ultra violet ray which are harmful with direct exposure during intense summers but put to use effectively in medical field. Similarly the Vitamin D – indispensable for human health especially the bones, is available exclusively in the Sun's rays alone. These are the general facts known about the Sun's rays in recent times.

SUN IN THE *SĀMBAPURĀṆA*

The Purāṇas though dedicated to a particular cult as Śākta or Śaiva, deal with all the subjects. The description of Sun, its size, various rays, names of different months and seasons etc presented in Purāṇas reveal that the sages of ancient times have made a deep study of nature around them. Sun worship and description of Sun can be found in most Purāṇas in a few chapters. The Bhaviṣya, Agni, Garuḍa, Viṣṇudharmottara, Bhaviṣyottara, Kālikā, Mārkaṇḍeya and other Purāṇas have extracts on the various aspects of Saura cult. Of all the Purāṇas extant, the Sāmbapurāṇa is the only one that deals principally with the Saura worship. Thus the present paper culls out information about Sun and Solar energy from the *Sāmbapurāṇa*.

The *Sāmbapurāṇa*¹ records that the Supreme Lord Sūrya took the form of twelve Ādityas. The twelve Ādityas are Indra, Dhātā, Parjanya, Pūṣā, Tvaṣṭā, Aryamā, Bhaga, Vivasvān, Viṣṇu, Amśu, Varuṇa and Mitra:

ततः स च सहस्रांशुरव्यक्तः पुरुषः स्वयम् ।

कृत्वा द्वादशधात्मानमादित्यमुदपद्यत ॥

इन्द्रो धाताऽथ पर्जन्यः पूषा त्वष्टाऽर्यमा भगः ।

विवस्वान् विष्णुरंशश्च वरुणो मित्र एव च ॥

Of these twelve Ādityas, Indra is said to lead the Gods; Dhātā is the creator; Parjanya exists in the clouds and showers rain; Pūṣā exists in the food nourishing all the living beings; Tvaṣṭā presides over the plants and herbs; Aryamā is responsible for the movement of air; Bhaga exists in the bodies of living beings; Vivasvān assumes the form of digestive fire in living beings; Viṣṇu takes various forms to destroy the enemies of the gods; Amśa existing as the winds pleases all beings; Varuṇa enters the water as the life energy and Mitra as the sun, gives light and energy to the world.

THE RAYS NOURISHING THE STARS AND PLANETS :

*Sāmbapurāṇa*² states that there are seven important rays which nourish the planets and stars :

सुषुम्नः सूर्यरश्मिर्यः क्षीणं शशिनमेधते ।
 सम्यग्वासुस्तु यो रश्मिर्योनिः सोऽङ्गारकस्य तु ॥
 दक्षिणे विश्वकर्मा तु रश्मिराप्यायते बुधम् ।
 उदावसुस्तु यो रश्मिर्योनिः स तु बृहस्पतेः ॥
 विश्वव्यचाश्च यो रश्मिः शुक्रयोनिः स वै स्मृतः ।
 शनैश्चरं पुनश्चापि रश्मिराप्यायते सुराद् ॥
 हरिकेशस्तु यो रश्मिर्ज्ञेयो नक्षत्रयोगिनः ।

As gleaned from the verses cited above the different types of rays and the planets that they support are given in the table:

Rays	Planet/ Stars
Suṣumnā	The moon
Samyagvasu	<i>Lohita</i> (Mars)
Viśvakarmā	<i>Budha</i> (Mercury)
Udāvasu	<i>Bṛhaspati</i> (Jupiter)
Viśvavyacā	<i>Śukra</i> (Venus)
Surāt	<i>Śanaiścara</i> (Saturn)
Harikeśa	The stars

The distance of the planets from the sun varies and hence the intensity, angle and other aspects influence the ray's component ratio which is observed by our seers and hence termed particularly.

Different bodies of the Solar System receive light of an intensity inversely proportional to the square of their distance from Sun. The actual brightness of sunlight that would be observed at the surface depends also on the presence and composition of an atmosphere. For example, Venus's thick atmosphere reflects more than 60% of the solar light it receives. Sunlight on Mars would be more or less like daylight on Earth during a slightly overcast day, and, as can be seen in the pictures taken by the rovers, there is enough diffuse sky radiation that shadows would not seem particularly dark. Thus, it would give perceptions and "feel" very much like daylight on the Earth. The spectrum on the surface is slightly redder than that on Earth, due to scattering by reddish dust in the Martian atmosphere.

RAYS AND THEIR VARIED EFFECTS :

The *Sāmbapurāṇa*³ states that the rain causing rays are collectively called *Amṛtas*, which are four hundred in number with the following names– *Vandanās*, *Medhyās*, *Kātanās* and *Ketanās*. The rays that cause *hima* (snow) are yellow coloured, thirty in number and are called *Candras*. The rays that nourish the men through the food are *Auṣadhas*(herbs), which nourish the *Pitṛs*(manes) are *Svadhā* and gods are *Amṛta*(nectar):

तासां चतुःशतं नाड्यो वर्षन्तेऽचिन्त्यमूर्तयः ।
 वन्दनाश्चैव मेध्याश्च कातनाः केतनास्तथा ॥
 अमृता नामतः सर्वा रश्मयो वृष्टिसज्जनाः ।
 हिमावहास्तु त्रिंशद्वै ताभ्योऽन्या रश्मयः स्मृताः ॥
 चन्द्रास्ता नामतः सर्वाः पीताभास्तु गभस्तयः ।
 समं बिभ्रति ताः सर्वान् मनुष्यान् देवताः पितॄन् ।
 मनुष्यानोषधीभिस्तु स्वधया च पितॄनपि ॥
 अमृतेन सुरान् सर्वास्त्रयस्त्रिभिरतर्पयन् ।

The various rays of the sun and their numbers found in each season is also recorded in the *Purāṇa*⁴ : In the *vasanta* (spring) and *grīṣma* (summer) He shines with six rays; in the *śarad* (autumn) and *varṣā* (rainy seasons) He causes the rains with four of his rays; in *hemanta* (winter) and in *śīśira* (cold season) He emits the dew with only three of his rays:

वसन्ते चैव ग्रीष्मे च शतैः सः तपति विभुः ॥
 शरत्सु चैव वर्षासु चतुर्भिः संप्रवर्षति ।
 हेमन्ते शिशिरे चैव हिमोत्सर्गं त्रिभिः पुनः ॥

THE TWELVE SUNS IN-CHARGE OF EACH MONTH OF THE YEAR :

The twelve Ādityas shining in the twelve months and the number of their rays are recorded in the *Sāmbapurāṇa*⁵ :

उत्तिष्ठन्ति सदा ह्येते मासैर्द्वादशभिः क्रमात् ।
 विष्णुस्तपति चैत्रे तु वैशाखे चार्यमा तथा ॥
 विवस्वाञ्ज्येष्ठमासे तु आषाढे चांशुमान् स्मृतः ।
 पर्जन्यः श्रावणे मासे वरुणः प्रौष्ठसंज्ञके ॥
 इन्द्रोऽथाश्वयुजे मासे धाता तपति कार्तिके ।
 मार्गशीर्षे तथा मित्रः पौषे पूषा दिवाकरः ॥
 माघे भगस्तु विज्ञेयस्त्वष्टा तपति फाल्गुने ।

In accordance with the above details, the *Purāṇa*⁶ also adds the number of rays of the sun that reach the planet earth in each month of the year. Further it records that during the northern solstice the solar radiation increases and during the southern solstice it decreases; they vary in each month and season :

एतैर्द्वादशभिर्विष्णुरश्मीनां दीप्यते सदा ॥
 दीप्यते गौसहस्रेण शतैश्च त्रिभिर्यमा ।
 द्विसप्तकैर्विवस्वास्तु ह्यंशुमान् पञ्चकैस्त्रिभिः ॥
 विवस्वानिव पर्जन्यो वरुणश्चर्यमा यथा ।
 इन्द्रस्तु द्विगुणैः षड्भिधतैकादशभिः शतैः ॥

मित्रस्तु दशभिः सार्धं पूषा तु दशभिः शतैः ।
मित्रवच्च भगस्त्वष्टा सहस्रेण शतेन च ॥
उत्तरोपक्रमेऽर्कस्य वर्द्धन्ते रश्मयस्तथा ।
दक्षिणोपक्रमे तस्य ह्रसन्ते सूर्यरश्मयः ॥
एवं रश्मिसहस्रं तत् सूर्यलोकार्थसाधकम् ।
भिद्यते ऋतुमासाभ्यां सहस्रं बहुधा पुनः ॥

These records as given above are represented in the chart below :

Ādityas	Month	No. of Rays
Viṣṇu	Caitra	9,000
Aryamā	Vaiśākha	1300
Vivasvān	Jyeṣṭha	1400
Amśumān	Āṣāḍha	1500
Parjanya	Śravaṇa	1400
Varuṇa	Bhādra	1300
Indra	Āśvina	1200
Dhātā	Kārttika	1100
Mitra	Mārgaśirśa	5,000
Pūṣā	Pauṣa	1000
Bhaga	Māgha	5000
Tvaṣṭā	Phālguna	1100

From the above table it can be understood that the ancient seers were aware of the different types of rays of the sun and their numbers. In modern days, the pyranometer or the pyrhelimeter is used to measure the rays of the sun. But the instruments used by the ancient Indians are not mentioned in the *Purāṇas* or any other text.

In modern research it is understood that the total amount of energy received at ground level from the Sun at the zenith depends on the distance to the Sun and thus on the time of year. It is about 3.3% higher than average in January and 3.3% lower in July.

The *Sāmbapurāṇa*⁷ also describes the sun to have a particular colour in each season. It is further stated that these are the natural colours of the sun in each season. In such a natural course of the sun the land is said to be prosperous.

वसन्ते कपिशः सूर्यो ग्रीष्मे काञ्चनसन्निभः ।
 श्वेतो वर्षासु वर्णेन पाण्डुः शरदि भास्करः ॥
 हेमन्ते ताम्रवर्णस्तु शिशिरे लोहितो रविः ।
 इति वर्णाः समाख्याताः सूर्यस्य ऋतुसंभवाः ।
 ऋतुस्वभावजैवर्णैः सूर्यः क्षेमे सुभिक्षकृत् ॥

The colour of the sun in each season is represented in the table below :

Season	Colour
<i>Vasanta</i> (Spring)	<i>kapiśa</i> (Tawny)
<i>Griṣma</i> (Summer)	<i>kāñcana</i> (Golden hue)
<i>Varṣā</i> (Rainy)	<i>śveta</i> (White)
<i>śarad</i> (Autumn)	<i>pāṇḍu</i> (Pale-white)
<i>Hemanta</i> (Winter)	<i>tāmra</i> (Coppery red)
<i>śīsira</i> (Dew)	<i>lohita</i> (Reddish)

The *Bṛhatsamhitā*⁸ (XXX. 22) also records the particular colour of the sun's beam during the different seasons. It also declares that each colour at twilight is beneficial in its own season and harmful if it is contrary:

शिशिरादिषु वर्णाः शोण-पीत-सित-चित्र-पद्म-रुधिरनिभाः ।
 प्रकृतिभवाः सन्ध्यायां स्वतो शस्ता विकृतिरन्या ॥

The *Bṛhatsamhitā* also deals with its effects on the earth indicated by the change in the colour of the sun in various seasons.

MODERN RESEARCH :

The spectrum of surface illumination depends upon solar elevation due to atmospheric effects, with the blue spectral component dominating during twilight before and after sunrise and sunset, respectively, and red dominating during sunrise and sunset. These effects are apparent in natural light photography where the principal source of illumination is sunlight as mediated by the atmosphere.

Also it has been established that direct sunlight has a luminous efficacy of about 93 lumens per watt of radiant flux. This is higher than the efficacy (of source) of most artificial lighting (including fluorescent), which means using sunlight for illumination heats up a room less than using most forms of artificial lighting.

CONCLUSION :

From the information available in the *Purāṇas*, it is evident that the sages had keenly observed every aspect of the sun through a period of time and have recorded it. The rays causing change in seasons, nourishing the planets and stars, intensity of the rays, their colours in different seasons have been specifically named and dealt with in detail. These can be taken up for further research and can be re-established with experiments by a modern researcher.

End Notes :

1. *Sāmbapurāṇa*, IV.5-6; 8-22
2. *ibid*, VII. 62; 64-69
3. *ibid*, VII. 46-50
4. *ibid*, VII. 51-2
5. *ibid*, IX. 5-8
6. *ibid*, IX. 9-14
7. *ibid*, VIII. 12-13
8. *Bṛhatsamhitā*, XXX. 22
9. *ibid*, XXX.

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4. Hazra, R.C., *Studies in the Upapurāṇas*, Sanskrit College, Calcutta, 1958.
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All modern research data has been collected from <https://en.wikipedia.org/wiki/Sunlight>.
