

# CANOPY OF THE HEAVENS

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## NOTE

BANPUR village described in this book is imagined to be in the heart of India, somewhere between Nagpur and Hyderabad, at altitude of 180 North. Children residing at this latitude would, see constellations like Aldeberan, Gemini, Regulus, etc., just overhead. The Pole-Star would be 180 above the horizon in the North. The maps in the book will make this clear.

For children North of this latitude, the whole canopy of the heavens shown in the maps would be proportionately shifted to the South. For children South of this latitude, 180 N, the canopy in the maps would be shifted proportionately to the North.

For example, children near Srinagar in Kashmir would see the Pole Star about 340 above the northern horizon and would observe constellations like Andromeda, the northern part of Regulus, etc., over their heads; Sirius, Canopus, Corvus, etc. would appear more to the South.

Similarly, children at Kanya Kumari in the South would observe the Pole Star at about  $8^0$  above the horizon. And over their heads they would see the head of the Orion, Betelgeuse, the southern part of Gemini, etc. The constellations in the extreme South would also appear a little higher.

All the constellations described in this book would, however, be visible from

all parts of India.

It should be noted that the two maps in this book and the one in the second part of this book issued separately, are set for particular days and times. But, if we observe the heavens on other days or during other months, or at other times the positions of the constellations would be either to the East or the West according to the period of the year and the time of the night. The constellations rise four minutes earlier every day and rise at the same time on the opening night of each solar year.

I acknowledge my thanks to Professor It R. Gunjekar for the guidance he gave me during my discussions with him on the subject.

- **BABURAO P. SAVE**

## **ASSEMBLY NO. 1 -- NOVEMBER EVENING**

LOOKING UP at the starry heavens on a clear night, you may have wondered at the beauty of the whole pattern of twinkling silvery stars. On some nights you might have observed a few bright and coloured stars. Some stars always have the same group around them, year in and year out. If you recognise a few of them, you may even enjoy a feeling of friendship with them. Often, you may have seen the moon occupy the place of honour and beauty in the sky, and then the whole pattern of the sky presents a different picture of glory.

You may have gazed at this canopy of the heavens trying to locate a Sputnik pointed out to you by a friend, and then various ideas about the stars, the planets, their distances, their movements, must have filled your mind with wonder and curiosity.

Now, like you, there were two children, Chandrakant and Shobha by name. They stayed with their Uncle Sadashivrao in Banpur, a prosperous village in the

heart of India, and away from the big cities. Their uncle was the science teacher in the school where Chandrakant and Shobha studied.

The High School was really a monument to the efforts of the villagers, a good two-storied building with a terrace and large play-grounds. Even more wonderful was the enthusiastic team of teachers and the efficient administration. Those in charge had furnished the school with many useful teaching aids. Chandrakant's uncle, the science teacher, was very eager to see that all his pupils developed their powers of observation by performing experiments in as well as outside school. He was very fond of taking the children out on scientific excursions. And now, he had decided to initiate the particular group under him into the mysteries of the sky at night.

As a matter of fact, the situation of the High School was ideal for sky-watching. The High School was situated at the extreme end of the village, on the eastern side. The part of the building on which the terrace was constructed was very high. So, from this terrace, the horizon could be clearly seen on all the four sides. No tall buildings, trees or bright lights stood in the way.

Many city dwellers do not really know how magnificent are the starry heavens in a village on a dark night. In the city the sky is always blurred by the glare of lights.

Now the science teacher had asked all the children in the group to assemble on the terrace of the school on 9 November, at 8 p.m. which would be the 11<sup>th</sup> day after the full moon. So the moon would rise very late and it would be completely dark when they began their study of the stars.

A few days earlier, Uncle Sadashivrao had distributed to the pupils a cyclostyled map of the main groups of stars known as constellations so that they could become familiar with the stars they would observe in the sky that night.

The school peons, Singh and Gopal, were also present to help the children and the teacher.

When it was nearing 8 p.m. that night, the children began arriving. Dilip, who was the leader, and Bharati, deputy leader, came along with Abhijit, Rohini and many others. Then came the teacher himself, Mr. Sadashivrao, accompanied by Chandrakant, Shobha and others.

Now they were all assembled on the terrace. The teacher was standing with his face to the West while the children were standing in three rows in front of him, thus facing the East. The teacher instructed the peons to switch off all lights and also shut the door leading to the terrace so that the terrace and the surroundings were in complete darkness.

Now the teacher asked all the pupils to sit down and listen to him. The teacher said, "Now, children, above your heads you see the shining stars. Some, as you can see, are in groups, while others are just single stars, but outstandingly bright. We shall now try to acquaint ourselves with a few of them. I shall begin first with the most outstanding stars in the most prominent groups. You may now look at your maps with the help of torches." Referring to the map of the stars, he continued, "But I hope you remember the correct method of reading this map. The North and South are where they should be but, as you must have observed, the East and the West have changed places, because we do not use this map like the usual geographical maps. We have to lie down on our backs, faces upwards, with our heads to the North and our feet to the South. Then, when we hold up the map above our faces and look at the sky, the canopy of the heavens, the East on the map will coincide with the real East and the West with the real West. Then we'll be able to locate the constellations in the sky according to the map.

"Now look at the constellation just over your heads. Do you see a small, shiny, twinkling group of stars, a little to the East, there?"

"Yes, and I can even count the stars in the group. There are six of them, aren't there?" cried Sudhir, excitedly.

"Well, actually Sudhir, there are seven stars in the group. But the seventh can

only be seen with the help of a telescope. In Indian astronomy this constellation is called KRITTIKA. In Western astronomy they call it THE PLEIADES Or THE SEVEN SISTERS," Said the teacher.

"And why are they called sisters?" asked Sudhir.

"They are so called from Greek mythology according to which these seven sisters were the daughters of King Atlas," explained the teacher. "They were transformed into a group of stars and the seventh sister is the 'last' sister hiding in shame because she is supposed to have fallen in love with a human being!"

"Really ! How funny !" exclaimed Hameeda.

"In Indian mythology there is an interesting story about Krittika. Kartikeya was supposed to be the commander who fought on behalf of the Devas and defeated the Danavas. It is said that in his childhood Kartikeya was brought up by six sisters and these six sisters have been immortalised in this constellation."

"AS YOU can see, it's a small, compact group of stars," continued the teacher, "and so it easily attracts the attention of those who gaze at the sky,."

"Look at that bright, beautiful star, somewhat reddish yellow," exclaimed Shobha.

"Where is it ?" asked Udaya.

"It's a little to the right of the Seven Sisters," said Shobha.

"Yes, that is ROHINI," explained the teacher. And some of the children cried out to their class-mate, Rohini, "Hey Rohini, that is your Star !"

They had a hearty laugh. "Well, well," smiled the teacher, "that may be Rohini's star but in the Western system it's called ALDEBERON. Near it we see some less bright stars and they form the shape of the letter V. Actually, ROHINI is one of the

stars in that V. Further to the East of ROHINI, we observe a few prominent stars gradually rising above the horizon. They are a part of the constellation MRIGA or ORION as they call it in the western system.

"Now turn your attention to the North. You will observe another group of stars. This group is like a broken M or W. It is now slightly turned to the West. We know it as SHARMISHTHA or CASSIOPEIA. You will be interested to know that CASSIOPEIA is also called THE LADY OF THE CHAIR. This broken M or W is supposed to look like a lady sitting on a chair. After a few hours' time, it will set in the West. Now, let's look again at CASSIOPEIA (SHARWSHTHA) and PLEIADES( KRITTIKA) Tight over our heads. Between them there are two other groups of stars PERSEUS (or YAYATI) and ANDROMEDA (Or DEVAYANI.)

"Sir, our history teacher told us a story about King Yayati and his two wives, Sharmishtha and Devayani," said Shirish.

"Yes, the very same three have been immortalised by the Indian astronomers in these three constellations," said the teacher. "There is an equally fascinating story about Perseus and Andromeda. It is said that Cassiopeia was the wife of the then King of Ethiopia. She had a daughter named Andromeda. Cassiopeia was very beautiful. But as she was very vain and proud of her beauty, Neptune, the god of the sea, sent a monster to attack the coast of Ethiopia. The King of Ethiopia was asked to sacrifice Andromeda in order to save his kingdom. But Andromeda was saved by the brave Perseus. All the three have been immortalised in different constellations."

"But which is YAYATI and which DEVAYANI?" asked Chandrakant pointing at the sky.

"Well," replied the teacher, ;'if you look to the East of these two groups, you will see a very brilliant star, that's BRAHMA HRIDAYA or CAPELLA. The group near CAPELLA is PERSEUS or YAYATI and the one near CASSIOPEIA ( SHARMISHTHA) is ANDROMEDA (DEVAYANI)."

"A little to the West of CASSIOPEIA (SHARMISHTHA)," continued the teacher, "there are two more bright constellations. The nearer one is HANSA or the SWAN or CYGNUS which is a big group of five stars."

"It looks very much like a cross," observed Joseph thoughtfully

"Indeed, it does ! Sometimes, it is referred to as the NORTHERN CROSS. Indian astronomers imagined that it had a shape like that of a flying swan, with its head towards the North Pole Star."

"O I see, that's why we call it HANSA,)" Said Dilip.

"Now look further to the West," said the teacher. "That's a group of stars (or a constellation as we call it) named ABHIJIT or VEGA, which is a little brighter than the SWAN.)"

Suddenly, at this juncture, a very brilliant light went across the sky for a short distance. "Look there !" shouted Bharati. "A shooting star ! Some great man must have died !"

"Nonsense! Shooting stars have nothing to do with the death of any man, great or small, and, as a matter of fact, they're not stars at all. They are meteors. We shall discuss meteors some other time," said the teacher. "Now, look again at this brilliant star up there, BRAHMA HRIDAYA. DO you remember where it was when you last saw it ? Down there ! But, do you see ? Now it has come up fairly high. To its East is AGNI or URAS. NOW, let's do some map- drawing. Open your maps, children."

"But it's dark, we'll need light," said Hameeda.

"Yes, of course," replied the teacher. He asked the peons to switch on the lights.

"Now," he continued, "if you are ready I want you to locate URAS Or AGNI,

and CAPELLA or BRAHMA HRIDAYA On your maps. Have you done that ?"

"Yes ! Both of them !" the children shouted.

"Now draw a line, joining the positions of these two stars on the map. Having done that, draw roughly the perpendicular bisector of this line." The teacher paused a while and then said, "Now produce this bisector towards the North and you will find that it will pass through a star. Doesn't it, Ashok ?" he went up to Ashok and asked him.

"Yes sir, it does pass through a star. Why, it's the POLE STAR, isn't it ?" asked Ashok.

"That's right," said the teacher and asked the peons to switch off lights once again.

"Now, let's have a second look at PLEIADES (KRITTIKA). A little towards the west of this group is a rectangle of fairly bright stars, four stars in the four corners of the rectangle."

"They are really bright and prominent," said Abhijit, "but, sir, I see only three of them."

"That's because the fourth is not as bright as the other three are. Look carefully again, and you'll see the fourth star too," said the teacher.

"I think he is still preoccupied with ABHIJIT in the sky, and so he can't see the last star," said Shobha smiling. "Sir, what's the name of this constellation ?" she asked. "In Western astronomy, it's PEGASUS. In Indian astronomy it is known as BHADRAPADA. In Greek mythology, Pegasus was a very famous horse with wings ! One day the king of the gods sent an insect to sting him. On being stung, Pegasus threw his master off the saddle and flew up into the sky and he has stayed there ever since.



"Lastly, between PEGASUS (BHADRAPADA) and PLEIADES (KRITTIKA) are two small groups of faint stars known as ARIES (ASHVINI and BHARANI ).

"We have observed just a few of the constellations in the sky. Actually there are as many as twenty-seven of them in the path of the sun and the moon according to our Indian system. The sun and the moon pass through these twenty-seven constellations during their journeys through the sky; the sun once in a year and the moon once in a month. We may say that there is a girdle or belt of these twenty-seven constellations round the earth in the sky, the canopy of the heavens. The sun and the moon pass through them at different times, and sometimes together. To the north and south of this girdle or belt of constellations we have other groups of stars such as those we have seen tonight, namely, VEGA (ABHUIT), CYGNUS ( HANSA), CASSIOPEIA ( SHARMISHTHA), ANDROMEDA( DEVAYANI), PERSEUS (YAYATI ), CAPELLA (BRAHMA HRIDAYA) and URAS (AGNI)."

The teacher paused and the children took this opportunity to ask several questions.

"Sir," asked Sudhir, "right over our heads there is a big white belt. Is that what they call the Milky Way ?"

"Yes, that's the famous Milky Way spread from North to South. It also encircles the other side of our earth. Of course we can't see that part of it."

"Sir, how is it that you did not show us, any Planet tonight ?" asked Sirish.

"Thank you Sirish, for reminding me about the Planets," said the teacher. "The Planets which we can see with the unaided eye are MERCURY, VENUS, MARS, JUPITER and SATURN. At the moment, except for SATURN they will be seen only from the other side of the earth, so we shall have to observe them some other time. But I didn't point out SATURN to you as it is rather faint these days. Anyway, let's try to find it now. Look just a little to the South of PEGASUS ( BHADRAPADA). There is a faint, shining body there. But it does not twinkle like the stars. It has a steady light. Can you see it ? That is SATURN."

"You must remember that the positions of the Planets are constantly changing. We won't be seeing SATURN in this position after a few months. On the other hand, the positions of the stars and the constellations will remain almost the same for thousands of years."

It was now late and the teacher wanted to send the children home. But before doing so, he told them some important and interesting things about the POLE STAR. "If you take the POLE STAR as the centre," he said, 'you'll find a chain of six faint stars near it." He asked the children to locate the POLE STAR again and look for this chain of six stars in the North-Eastern direction but very near it.

"You will observe," he continued, "that the last four of these six form a kite and the rest, only two stars, form a cord. It seems as if the cord is attached to the NORTH POLE STAR. These six stars together with the POLE STAR, making seven in all, give us the constellation known as the SMALL BEAR. There is yet another similar constellation known as the GREAT BEAR. It will come up on the horizon much later tonight, so we shall observe it some other time. The SMALL BEAR is called in India LAGHU RIKSHA, meaning small bear. It is also called DHRUVA MATSYA. DHRUVA is the POLE STAR, and MATSYA means fish; so DHRUVA MATSYA means fish attached to the NORTH POLE STAR.

"This SMALL BEAR goes round the POLE STAR in an anti-clockwise direction. We see it now in the North-East direction. It will slowly go round anti-clockwise and it will come back tomorrow to nearly the same position after twenty-four hours."

Just then, some children saw a Sputnik in the sky and they shouted out to the teacher and to the others to look up at it. It was like a fairly bright planet and was going across the sky from North-West to South-East. This made all the children curious and they began to tell one another what they knew about Sputniks. The teacher revised the names of the constellations they had observed that night and concluded:

"You should study the night sky as often as possible with the help of the map I have given you. We will also have to do some more star gazing early one morning to observe a few other constellations. I hope this small introduction will help you to observe the stars and constellations off and on. In fact, astronomy is an excellent hobby; for, apart from gaining knowledge, you will be inspired by the majesty of nature as revealed by this sparkling dome--the canopy of the heavens !"

## **ASSEMBLY NO. 2 -- NOVEMBER MORNING**

ABOUT A week later, on 16 November, this time early in the morning, at 5 a. m. the same group of children with their teacher, Mr. Sadashivrao, assembled on the school terrace, once again armed with star maps their master had prepared for them. Dilip, Sirish, Hameeda and Rohini were the first to arrive. The others followed. Most of them had put on woollen clothes. Good heavens ! Sujit had wrapped himself up in a blanket! Abhay and Vinu had put on woollen caps. The last to arrive were the teacher with his nephew, Chandrakant, and his niece, Shobha.

Now all the children were sitting in three rows, facing the East, and the teacher stood before them. They had all come in well before 5 O'clock. How punctual children are on such occasions !

The teacher began the lesson: "Well children, we have gathered together to observe some of the constellations that can be studied only early in the morning. When we gathered here last week, it was early night, and so we were not able to observe some of the stars which rise very late in the night. If we had continued our observation for the whole night last time itself, we would have certainly seen a few more constellations. New stars would have gradually come up on the horizon and then risen high overhead and we could have observed them. But even then, some would have been left out. Unless we observe the sky three to four times on different suitable occasions, we cannot observe all the main stars or constellations

or even all the planets."

"Which constellations and stars are we going to observe this morning, sir?" asked Hameeda eagerly.

"You will soon know," replied the teacher, smiling. He then asked the children to have a look at the map in their hands, and said, "As we look up, our attention is first caught by the brilliant group of stars known as ORION (MRIGA). It is nearly at the zenith and is tilted a little to the West. In the sky there are other shining constellations too. But ORION (MRIGA) beats them all in its brilliance and expanse. Now look to the north. The GREAT BEAR has come up fully. What a huge area it covers! To begin with ORION (MRIGA), you will observe that to its west are familiar constellations, viz. ALDEBERON (ROHINI), PLEIADES (KRITTIKA), etc. which we saw last time.

"MRIGA, as you perhaps know, means deer. The most prominent thing we observe in MRICA are the three bright stars in the centre which are in a line. And all around, in the four corners of the rectangle this constellation forms, you see four bright stars. Notice, there's that other line of three less bright stars within the rectangle. It represents the tail. The four stars in the four corners are supposed to be the four feet of the deer. The three stars in front represent its head. The three bright stars in a line in the centre form the arrow shot at the mriga."

Then followed much discussion between the teacher and the children.

**SUJIT** : Sir, I don't see any deer up there. Why then is it called mriga?

**TEACHER** : That is a good question, Sujit. Man has been looking at these constellations for thousands of years and has given vent to his imagination. After studying the outlines formed by the constellations he imagined them to be like those of some animals and other living things. Why, he even made up some stories about these constellations. Does this answer your question ?

**DILIP** : When you talk of the arrow, there must be a hunter. Where is he?

**TEACHER :** The hunter who shot that arrow at the mriga is certainly up there, somewhere in the sky. Which star, do you think, represents the hunter? What do you think, children?

**SHIRISH:** Is it that most brilliant star very near ORION?

**TEACHER:** A clever reply indeed! Yes, you have guessed correctly. That most brilliant star there is the hunter. We call it SIRIUS in Western astronomy, but VYADHA in some Indian languages for, *vyadha* means hunter. The less prominent stars near VYADHA are his hounds, and hounds, as you know, are the dogs used for hunting. In fact there are two groups of stars that have been imagined to be the hunter's hounds. In Western astronomy the larger group is called CANIS MAJOR, and the other is called the CANIS MINOR. Actually, these are not very large constellations but each has one very bright star in it. The bright star in CANIS MAJOR is SIRIUS or VYADHA the hunter in Indian astronomy. Scientists believe that it is the brightest star in the sky though not the hottest or the largest. It played a very important role in Egypt in the past. When, every year, after setting in the west, it reappeared on the horizon in the east for the first time, the Egyptian priests knew that the waters of the Nile would soon rise and irrigate its vast banks. This coincidence had been observed by generation after generation of Egyptian priests. Naturally, therefore, the star assumed great importance for the Egyptian farmer. "It is interesting to observe," the teacher continued, "how differently the Western and Indian systems viewed the constellations. We in India call this constellation, MRIGA, i.e. the deer, and VYADHA, the hunter, is just one star. But in Western astronomy, the whole constellation itself is known as the HUNTER or ORION, after a Greek mythological figure. As the story goes, Orion, the hunter, boasted that no animal could kill him. Finally, however, a scorpion stung him and the hunter died. Out of sympathy for Orion, the goddess Diana, herself a huntress, persuaded the god Jupiter to place the dead hunter in the sky, so that he would always be remembered."

"I think," the teacher went on, "it's about time you looked at another bright star known as CANOPUS. It is near VYADHA and to its South. CANOPUS is called

AGASTYA in Indian astronomy."

"Sir, wasn't there once a great sage Agastya who drank up the whole ocean ?" asked Sudhir.

"Yes, indeed, Sudhir, there was. It has been said that he went South of the Vindhya Mountains and never returned. Our astronomers have immortalised this sage Agastya in this star.

"But children, let's come back to ORION or MRIGA for a moment. Do you see the two stars on the northern side which form part of the constellation of MRIGA ? One of them, I mean the one on the eastern side, has a little reddish tinge. That reddish star is called BETELGEUSE in the West and KAKSHI in India, and, children, you will be interested to know that *kakshi* in Sanskrit means 'of angry eyes'."

"And I suppose it is red with anger," said Rohini.

"Now children, let's turn our attention to the North and observe the SAPTARSHI or the GREAT BEAR, fully risen above the horizon. The four bright stars dot the four corners of a big rectangle. The rectangle forms an imaginary kite and the remaining three bright stars hang like the tail of this kite. It's interesting to note that each of the seven stars represents a great ris

Rishi (sage) of the past. The seven sages are : Kratu, Pulaha, Pulastya, Atri, Angirasa, Vashishtha and Marichi. All of them were great rishis belonging to the Vedic Age. There are a great many stories associated with their names. It is from one of these stories that the theory has grown that the Aryan nomads who came to India had their original abode in the region of the North Pole. The story has it that the wanderings of the Aryans were destined to end only after seven sages agreed to come together and perform a yagna, a sort of sacrificial offering to Agni, the God of Fire. Six sages had come together and Vashishtha aspired to be the seventh. But a woman sage, Arundhati, also wanted this honour. Now Vashishtha was in love with Arundhati and wanted to marry her. So keen was Arundhati's desire to be the

seventh sage that she declined Vashishtha's offer in spite of the fact that she too loved him. Ultimately, she relented and married him, and both were accepted for the coveted seventh position. Now the yagna was performed by the 'seven' sages, the seventh 'sage' being the Vashishtha-Arundhati couple. Thus the wanderings of the Aryans came to an end, and they finally settled in the Sapta Sindhu--the land of the seven rivers.

"Vashishtha and Arundhati are, to this day, considered to be the symbol of an ideal couple. That is why we point out to a newly wed couple the stars in the SAPTARSHI which stand for Vashishtha and Arundhati.

"Now children, if you join the topmost two stars of the SAPTARSHI by an imaginary line, it would go through the NORTH POLE STAR.)"

"Isn't this another method for locating the Pole Star ?" said Girish.

"Yes, indeed," said the teacher. "The other day we saw CAPELLA and URAS. This morning you see them there a little to the West. The astronomers tell us that the perpendicular bisector of the line joining the positions of CAPELLA and URAS will, approximately pass through the Pole Star. If we produce this perpendicular bisector southward it would reach the tail of MRIGA. Thus ORION gives us one more method of locating the Pole Star."

"Which is the best of all these methods ?" asked Dilip.

"The GREAT BEAR method is perhaps the best. But, unfortunately, we do not see the GREAT BEAR every night," said Mr. Sadashivrao.

"Now let us observe the other main constellations. After ORION come the groups of GEMINI 01. MITHUNA which in Indian astronomy is split in two constellations, ARDRA and PUNARVASU.

"After MRIGA, ARDRA and PUNARVASU, come the constellations PUSHYA and ASHLESHA. Note that both PUSHYA and ASHLESHA are

grouped under the constellation CANCER, the name of the group in the European system. PUSHYA is just a Small group of faint stars, a little away from PUNARVASU Or GEMINI. To the unaided eye, five or six stars may be visible in PUSHYA. After PUSHYA to the East and a little to the South comes ASHLESHA. This also is a small group of rather faint stars.

"Now comes a prominent group belonging to the LEO constellation. First we have REGULUS or MAGHA in Indian languages. MAGHA is like a scythe or sickle in form. Some astronomers combine this group with other stars around it and imagine the shape outlined by this combination resembles a lion. So it is LEO or SINHA, i.e. lion, in both the systems.

"In the outline of LEO there are two groups of stars known as falgunas. One of them, called PURVA FALGUNI is known as THETA LEO in Western astronomy, while the other known as the UTTARA FALGUNI is called DENEbola in the West.

"Then we have a brilliant picture of the constellation CORVUS, and the stars SPICA and ARCTURUS or HASTA, CHITRA and SVATI respectively in the Indian system. These are recognised very easily. Now mark CORVUS or HASTA which is to the East and South of DENEbola. It is a group of five stars, resembling four fingers and the thumb. How similar it is to the palm ! Indeed, HASTA (palm) is the correct name for it.

"A little north of CORVUS is the brilliant SPICA or CHITRA, and then a little further to the North we observe ARCTURUS or SVATI, which is the most brilliant in colour in this region. SVATI has a beautiful tinge of yellow-orange and thus it is of great attraction. These three constellations more or less form a line from South to North, but they do not rise all together.

"Now, children, we have completed the list of constellations which could be observed before sunrise during this part of the year. Now let's revise. Let's see," he asked Dilip, "which constellations did we see today, rather this morning?"



The children named ORION Or MRIGA, ARDRA, GEMINI Or PUNARVASU, PUSHYA, ASHLESHA, REGULUS Or MAGHA, DENEbola Or the two FALGUNAS (PURVA and UTTARA ).

"And now, sir," said Dilip, "we would like to ask a few questions, if we may."

"Yes, of course, Dilip, the more questions you all ask the better." SHOBHA: Well, sir, there are ever so many other stars on all sides of the constellations we studied this morning. What are these other stars ?"

**TEACHER:** I'll tell you. To the south of HASTA Or CORVUS YOU can see many bright stars. They form the constellation called NARATURANGA in India and CENTAURUS in Western astronomy. In that same group we have our nearest friend, outside the solar system, ALPHA CENTAURI.

**ROHINI:** Sir, near MAGHA or REGULUS there is a very bright heavenly body. I think it must be a planet as it's not twinkling.

**TEACHER:** Yes, I have been wanting to tell you about that but I forgot. Thank you for pointing it out, Rohini. It is GURU or JUPITER. And next to the planet SHUKRA or VENUS it is the most brilliant of all the planets. VENUS also will soon rise. But as I told you last time, the times when the planets rise keep changing. Both GURU( JUPITER) and SHUKRA (VENUS) are brighter than VYADHA

(SIRIUS ). Also, there's another planet here, namely MARS. Do you see a reddish heavenly body near the CANCER group, that is, to the south of PUSHYA and ASHLESHA? That's MANGALA or MARS, which is rather small and faint on account of its great distance from us. When it comes nearer, its red colour is very clearly seen. We will not be able to see the other planets today. If you remember, we saw SHANI or SATURN last time. BUDHA Or MERCURY is very near the sun and so it can be seen only on a few days either in the evening or in the morning, depending on its distance from the sun. Suddenly, the trailing lights of two shooting stars went across the sky.

"Sir, what about your promise to tell us something more about shooting stars?" asked Chandrakant.

"Yes, I remember the promise. But first you must know that between our earth and the sun are SHUKRA or VENUS and BUDHA or MERCURY. Beyond the earth are MANGALA or MARS and GURU or JUPITER. NOW, between MARS and our EARTH there are millions and millions of METEORS, which also go round the sun. These meteors are really stones of various sizes, from those of the size of a mere grain of sand to those weighing kilos and even tonnes. Now these meteors in their path round the sun sometimes come so close to the earth that they are influenced and pulled down by the earth's gravity to fall towards the earth. These meteors rush through our earth's atmosphere at tremendous speeds of about 45 kilometres a second. Owing to friction with the earth's atmosphere, the meteors get burnt and give out bright light.

"What we see as the bright trailing streak is the glowing vapour of the burnt meteor. These trails are 75 to 120 kilometres above the ground. Only the very rare large boulders can even reach the ground in the form of meteorites. Then again, these meteorites are only very small pieces of the whole meteors which are much larger."

"Sir, what do these meteoric stones contain?" asked Pradeep. "Well, mostly they contain iron, besides some other elements in smaller quantities. Anyway, most of them are wholly burnt up during the process of falling to the earth's surface. And what do you think remains after a meteor is burnt up?" asked the teacher.

"Why, ash, of course !" Abhijit shot back.

"Yes, indeed, the ash remains. Most of the ash is so light that it floats as dust in the atmosphere.

"Now soon it will be sunrise, and time for us to go home. But before we do that let's have a last look at the constellations that we observed this morning."

They began with ASHVINI Or ARIES, which was about to set in the West. They came up to MRIGA or ORION. They located SHARMISHTHA or CASSIOPEIA. BRAHMAHRIDAYA Or CAPELLA, the most brilliant star in that region could be easily located. Between these two were the groups of DEVAYANI Or ANDROMEDA and YAYATI Or PERSEUS. LAGHU RIKSHA or the SMALL BEAR had changed its position in its anti-clockwise path. On 9 November they had seen this constellation at about 9-30p.m. Now it was past 6 a.m. on 16 November. Thus between 9-30 p.m. and 6 a.m. each night, the SMALL BEAR appears to move through about  $120^{\circ}$ . The Morning Assembly concluded as the teacher said, "There are still a few constellations which we could not observe in our first two sessions. For example, we have not been able to observe the GREAT SCORPION and its neighbouring stars. Perhaps we will locate them during another assembly."

Soon it was dawn and the children dispersed.

## MAIN CONSTELLATIONS

The twenty-seven constellations through which the sun appears to pass during the course of the year, and the moon every month

### Main Constellations seen in the North

Dhruva--Pole Star

Dhruva Matsya--Small Bear

Laghu Riksha

Sharmishtha-Cassiopeia

Devayani --Andromeda

Yayati--Perseus

Brahma Hridaya--Capella

Agni--Uras ( in Auriga )

Sarathi—Auriga ( in Auriga)

Saptarshi--Great Bear

1. Ashvini--Aries

2. Bharani--41--Aries

3. Krittika--Pleiades

4. Rohini--Aldeberon

5. Mriga--Orion

6. Ardra--Gamma Gemini

7. Punarvasu--Gemini (Castor & Polux to the South )

8. Pushya--Cancer

9. Ashlesha--Zeta Hydra

10. Magha--Regulus

11. Purva Falguni--Theta Leo

12. Uttara Falguni--Denebola

13. Hasta--Corvus

14. Chitra—Spica
15. Svati--Arcturus
16. Vishakha--Libra
17. Anuradha--Delta Scorpio
18. Jyeshtha--Anterese
19. Mool--Lambda Scorpio
20. Purvashadhn--Lamda Sagittarius
21. Uttarashadha--Pi Sagittarius
22. Shravan--Altair
23. Dhanishtha--Delphis
24. Shatataraka—Lambda Aquarius
25. Purva Bhadrapada—Alpha Pegasus
26. Uttara Bhadrapada—Gamma Pegasus
27. Revati-- Zeta Pisces

### Main Constellations seen in the South

Yamuna Eridanus

Vyadha--Sirius—Canis Major

Agastya -Canopus

Nowka—Argonavis

Patanga--Swastik—Trishanku – False Cross

Naraturanga-Centauris

Mitra--Alpha Centauri

Bhujanga--Draco

Shauri--Hercules

Abhijit--Vega

Vrishaparva-·Cepheus

Hans—Cygnus

Jatayu—Phoenix

Timingal--Cetus

## PLANETS

Budha--Mercury

Shukra--Venus

Prithvi--Earth

Mangala--Mars

Jatayu--Photi

Timingal--Cel

Laghu Graha--Asteroids, minor planets

Guru--Jupiter

Shani--Saturn

Uranus, Neptune, Pluto