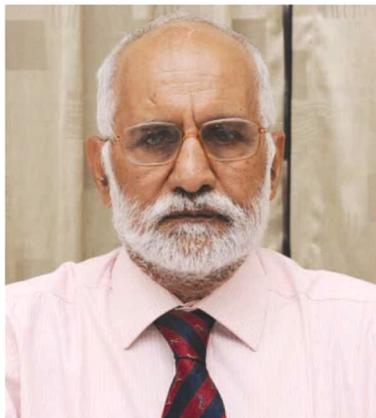


Hari Om Vats



Hari Om Vats, Honorary Professor, Astronomy and Astrophysics Division, Physical Research Laboratory (PRL), Ahmedabad was awarded the Indira Gandhi Prize for Popularization of Science for the year 2014. He has worked on experimental and theoretical aspects of scintillation phenomena. His current research interests are solar rotation, solar wind and solar activity. He has given 400 popular lectures based on topics of current interest, including astronomical events like solar eclipse, transits, and meteor showers. Vats delivered a lecture, 'Visitors of the Solar System' on 10 May 2014 at the Jawaharlal Nehru Planetarium, Bangalore. *Current Science* interviewed him after his lecture. The following are excerpts from the interview.

Congratulations on winning the Indira Gandhi Prize for Popularization of Science. Can you briefly explain how important are awards to scientists?

Thank you very much. An award gives recognition for the work that a scientist does for the society. This award is for popularizing science, which means, explain the complex phenomenon in science in a very simple and understandable language. Since my field is space science and astronomy, I mostly speak about space science and astronomy to the students in simple language, giving the examples that are easy and may be present in our day-to-day life. This makes them understand and appreciate space science and astronomy. As this award is in recognition of the work done in popularizing science, one feels good. These awards encourage scientists to interact

more with the students and teachers and contribute more to the society for the development of science. All awards are basically created by the Government of India to motivate scientists to do more work in their field of interest. Awards to scientist are definitely very important.

Can science be popularized in India?

Yes. A great deal is being done by various institutions and scientists to go and talk to school and college students by giving lectures, showing movies or PowerPoint presentations. This way a lot of work is being done to popularize science in India. Most of the science institutions celebrate National Science Day. Our institution, PRL, has been celebrating it for more than four decades. Every year, as a part of National Science Day, PRL conducts examination at 11 centres in Gujarat. In each centre, the principals of nearby schools are asked to send five bright students of 11th standard from their school. Every year 1500 students participate from all over Gujarat. Of these top 150 students are selected and they are given topics of common interest in physics, chemistry, mathematics and biology. They are asked to prepare posters with their own hand and bring them to PRL; these are evaluated by scientists. We also give them prizes. We make them do simple experiments, so that they learn and enjoy science. On the same day some scientists deliver lectures. At the end of the lectures, students are given a questionnaire based on the lectures and they are made to answer them. After evaluating their answers, that are on the basis of tests, experiments, quiz and personal interview, meritorious students are selected and given 'Aruna Lal Scholarships' and prizes. There are various activities for accompanying parents and teachers. This is about PRL, I am sure all other leading institutions in India also do activities to spread science and encourage students to pursue career in science.

What are your efforts in popularizing science in India?

Over several years, I have been participating in various INSPIRE programmes of the DST, where the organizers invite

me and I deliver popular science lectures, mostly on space science and astronomy. Wherever I deliver a lecture, I call students on the stage and make them do simple experiments. Then, I ask questions to the students as to why such a thing happened. Students become curious and find these methods very interesting. I later explain the principle behind those experiments. I also urge them to discuss these simple experiments in their community, school or wherever they go, so that others learn and become knowledgeable. I also write popular articles in Hindi and English. In the recent past, one major activity that I undertook for popularization of science is that there are eight space science comic books, which were originally written in Japanese. Japanese scientists who were associated with NASA translated these books to English. They were uploaded on space science website (http://www.yorku.ca/scostep/?page_id=366). They had mentioned in the website that those who are interested in translating these books to any other language are welcome to take the blanks and create similar books in their own language. I approached them with the offer that I would like to translate these books from Hindi. I translated all the eight books from English to Hindi (Figure 1). These were published by the Department of Space and were sent to some school and college libraries, and to some scientists. The Hindi version of these comics is there on the same website. In fact, these books are available in Japanese, English, Spanish, French, Korean, Hindi and many more languages. While translating, I too learnt some interesting facts about space science. All the eight comics cover a wide range of topics in space science. I would like to request the readers of *Current Science* to take interest in translating these comics in their own language.

What are the initiatives taken by Government of India in popularizing science in India?

The Government of India encourages scientists by giving various awards. DST's INSPIRE programme is in the direction of making science popular among students. All the institutions have public

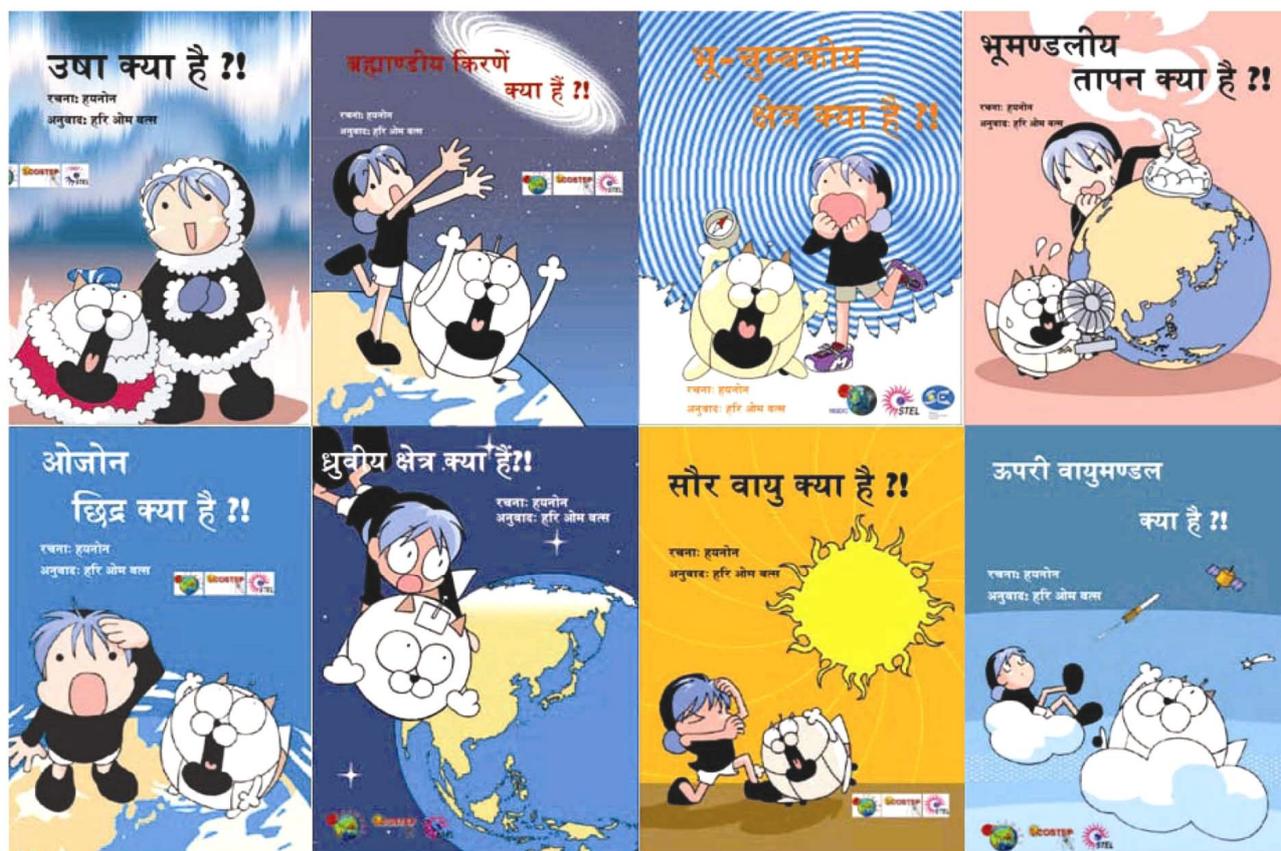


Figure 1. Space science comics in Hindi.

outreach programmes, through which they arrange popular lectures, exhibitions, conferences, symposiums and so on. Such programmes act as a bridge between common man and scientists. Celebrating National Science Day is also a good initiative. There are a lot of schemes that the Government of India has for science popularization. As our country is very large with a huge population, it will take time to popularize science more than it is today. More effort has to be made by the government, institutions and by scientists to popularize science in areas where we have little information on scientific work in simple ways.

How did you become interested in astronomy and astrophysics?

I come from a village background. We did not have electricity during my childhood. We used to spend time outside and watch the sky. I was not much aware of astronomical objects, but I had seen shooting stars, comets, constellations and so on. During dark nights, the sky used

to be very attractive. My father had a little knowledge about them, although he had no education in science and astronomy. He probably learnt it through astrology and he used to tell us reasonably correct time by looking at the night sky. He is my inspiration. In my school and college days, my teachers encouraged me to do experiments and learn physics. My elder brother who was a physics teacher wrote a book *Physics Made Easy* for high-school students, when I was in the eighth standard I read this book and understood several things which were not taught in our class. His way of explaining science in simple language impressed me and enhanced my interest in physics. He also taught me physics in junior college. His lucid lectures and teaching style made him my mentor for life. He is no more, but his teachings still inspire me. After my Master's in physics in 1970, I joined PRL to pursue space physics and earned my doctoral degree. While doing this, I always interacted with students and teachers of various schools, colleges and universities. In 2011, I officially retired from PRL as a professor,

but I am still associated with it as honorary professor. I take care of the UN-sponsored course on Space and Atmospheric Science (SAS) at PRL as Course Director. This work provides an even larger scope, as we take students from the Asia-Pacific region, thus spreading space science to these countries as well. All the work that I have done in the past and am doing now seems to me as my hobby. The urge to talk about space phenomena and activities has been growing in me ever since I started to learn about them. All these things have been like a positive feedback loop and gradually growing and developing interest in space science and astronomy. I always had a desire to contribute to society. Wherever I go, even on personal visits, I visit schools and talk to students and teachers about facts of science and also do small experiments.

Who are the visitors to the solar system and what is their significance?

Our solar system has regular members like the Sun, eight planets, several dwarf planets, asteroids and so on. These are

visible at regular intervals of time from our Earth. We can precisely predict their position. There are other objects which we see only once in a while; many of them were not predictable, though they have now become almost predictable. They are the visitors to the system. For example, the comets which come and go. Today we believe that most comets begin as aperiodic and some of them turn into periodic. There are numerous comets. Some come only once and may never return. Many of them strike objects of the solar system like Sun, Earth, Moon, Jupiter, etc. and perish. Most of the shooting stars that we see in the night sky are the fragments of comets which keep the same orbit after fragmentation. These are part of the family of visitors to our solar system. When the Earth goes close to those orbits, some of the fragments of comets get attracted by the Earth and these objects start orbiting the Earth and gradually come down. When they reach a height of 100 km from the ground, the atmosphere is fairly dense there. The air friction makes these fragments very hot; and they start burning and shine like stars. We see them falling and hence we call them as shooting stars. Actually they are not stars, they are meteors. Most of them get burnt in the atmosphere and their ashes fall on the Earth, including oceans. Some remain unburnt, they fall eventually on the Earth. These are called meteorites. Today, researchers have good reasons to believe that comets perhaps brought essential materials to the Earth which are required for creating life. Thus comets are in a sense creators of life on

Earth. It is believed that when the Earth formed, it had no atmosphere, no water; it was a dry and deserted object in the solar system. Over millions of years, comets seem to have brought water, air, carbon and several other elements to Earth. This led to creation of oceans, clouds and life on Earth.

There are evidences that once Earth was densely populated by giant creatures called dinosaurs. Earth had dense forest and vegetation which fed all the creatures, until a huge comet collided with the Earth. This great collision created a dense and thick cloud of dust all around the Earth. The cloud did not allow solar radiation to reach the Earth's surface and led to large-scale extinction of most of the dinosaurs and several other forms of life on Earth. Thus, impact by giant comet/meteorite was responsible for mass extinction on Earth. Therefore, comets can be considered as both creator as well as destroyer of life on Earth. It is now more or less certain that contribution of comets is much larger than what was known earlier.

How do you foresee the future of astronomy and astrophysics in India?

In India, when I did my Master's, we had very few observatories and smaller telescopes. In fact, I had not seen a telescope till my Master's. I saw the first optical telescope 5–6 years after joining PRL. I got an opportunity to work on a telescope for almost 20 years in the later part of my research career. The observations were mostly manual. The recording was

on films and chart papers. We now have more observatories with telescopes and the latest kind of back-end instruments. The observations can be made automatically. The computer controls and records all the observations. We are able to get observations from far and remote observatories. The telescope size is growing; thereby, we are able to investigate more distant and fainter objects of the celestial sphere. Many of our astronomers have very active collaboration worldwide. So, astronomic studies have grown and will grow faster in the country. However, we need to work for a better future of people in the remote areas and villages of India.

Your suggestions to students who wish to pursue a career in science

I do not suggest to them to pursue science or space science and astronomy. I suggest to them to pursue the fields of their own interest. I also suggest them not to be biased towards the market value of various fields, although it matters. Earnings they get by doing engineering or commerce is more; if they go for basic science it might be less. But there are many benefits, adventures and things to be explored in science, especially space science and astronomy. Anything that one does, it should be his/her own choice. Work with devotion should be the motto.

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