An Exclusive Interview with Prof. Jayant Vishnu Narlikar

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Prof. Narlikar delivering a talk at Tezpur University

***Jayant Vishnu Narlikar**, is an eminent Indian cosmologist and is a shining example of people following the road less traveled. Prof. Narlikar was the founder director of IUCAA (Inter University Center for Astronomy and Astrophysics) at Pune, and is now an Emeritus Professor at IUCAA. Apart from doing pioneering work in the field of cosmology, Prof. Narlikar has been also associated with various science and mathematics popularization and outreach activities. He has been awarded many prestigious prizes and in particular is the recipient of Padma Vibhushan, the second highest civilian award in India. He along with his wife, Dr. Mangala Narlikar visited Tezpur University in September 2013 at the invitation of the Students' Science Council of the university to deliver a public lecture. Prof. Narlikar kindly agreed for an interview with Gonit Sora at our request. Below is the slightly edited transcript of that interview.*

[Prof. Narlikar was interviewed by Manjil P. Saikia, Salik Miskat Borbora, Sashi Kant Choubey, Priyanka Sarmah, Madhurrya P. Talukdar and Parama Dutta. The pictures were clicked by Sunit Manjil Hazarika and the interview was typed from the audio tape by Sirat Sandil. We are also grateful to Dr. Bhim Prasad Sarmah for helping us constantly in this endeavor and also for arranging the interview.]

Gonit Sora (GS): What inspired you to go into your field of research, that is astronomy, astrophysics and cosmology?

Prof. J. V. Narlikar (JVN): I went to Cambridge to do higher mathematics, that was my first goal and appearing in the university exams in mathematics. You are given a menu of various branches of mathematics, pure as well as applied. So I found that applied aspects, especially application to astronomy were very interesting. And the speakers on both courses, that is the lecturers were also very good. At that time, I also read a book by Fred Hoyle called 'Frontiers of Astronomy', which gave a very readable account for a layman for what was happening in astronomy. So, all these factors made me go into the research field of astronomy. Because one is required to choose which branch of mathematics one takes as research field. In Cambridge, astronomy is treated as a branch of mathematics. So I choose that.

GS: Sir, you left for Cambridge at a very young age. What was the education scenario in India at that time?

JVN: I left for Cambridge when I was 19, after I had done my B.Sc (Bachelor of Science) from Benaras University. And the system in those days was that if you want to do higher studies you either went to England or America, because Europe was of course interesting and advanced but language problem comes. In England and America you do not face that and since my father has been to Cambridge so I was keen to follow him and when I applied, I managed to get scholarship and so on, to go there. In the end, as you asked what was the scenario for higher studies, so the choice before me was to go to Cambridge for mathematical tripos, which the examination is called, or to go to US or join some undergraduate course

what they called MS or masters and then go to PhD. But I was not attracted at that time by any American University.

Cambridge was my goal, so once I got admission and scholarship, I decided to go there and the normal course is for 2-3 years in undergraduate mathematics. If you want to do research then you add 1 more year, so that meant 4 years of UG when you go for PhD and my problem was that my scholarship was for 3 years. So the question was how to manage. So my father suggested to do 2 exams at the end of third year. So, first part of tripos in first year, second part in second year and second and third part in third year. So I thought that was a bit of high pressure. Then my supervisor in Cambridge suggested that since I had come with a B.Sc, I had almost done what was done in Part I of maths, so why don't I take Part I and half of Part II in first year.

I thought that was a softer option and finished the two parts in one year and the remaining in the remaining years. I could manage in a 3 year course and at the end of that my performance was good enough for me to get scholarship from him and then I also got Fred Hoyle, he was there to take me as a student, that is how I started my research career. I went there after my B.Sc at 19, I did my Masters in 3 years, by age 22 and PhD in another 3 years, by 25 years of age.

GS: You mentioned that you had some very good teachers and lecturers at Cambridge. How did they motivate and inspire you?

JVN: In Cambridge, the system is that cover the syllabus very fast in covering the course so 24 lectures course in Cambridge would be equivalent to what you would do here in a whole year. Here you tend to go slowly. So you need to do self effort to fill in the gaps left by the lecturer and also somebody senior enough to tell you what your difficulties are.

In Cambridge, they have a system of tutorials, so every undergraduate student has one or two tutorials per week, so one hour per week, say in pure maths and applied maths. So I had some very good tutors to help me with my portions. This happened simultaneously with my compressed examinations (4 examinations in 3 years). So when I did two examinations I needed four tutorials, two for each subject.

The Cambridge system bears to that and my lecturers were very good, three were astronomy lecturers, but there were also famous lecturers, like Dirac, who lectured on quantum mechanics and the was one of the pioneers making the rules, so he followed his own book when he came to describe the Fermi-Dirac statistics, one of the two statistics in quantum mechanics. He told us one day how he would go about teaching the course. He went through the course work and said, this is called Bose statistics and this is called Fermi statistics, He dropped Einstein from Bose-Einstein and himself from the other. We had a course on number theory. Harold Davenport was a very good pure mathematician and lecturer, he lectured, then there was complex variables by Cassels.

So these were people who were leaders in their field in Cambridge and they lectured. And what impressed me the most was that all these big names never said that they were busy in their research and did not want to be burdened with lectures. They took their part in the lectures actively. In India I had come across many institutions where scientists do research but do not want to teach saying that it interferes with their research. But that is not the fact, it actually helps.

GS: At Cambridge you were a contemporary of Prof. Stephen Hawking. How was your association with him then and how is it now?

JVN: I don't have much contact with him now. I knew him at a time when he was a normal healthy person. I remember during our summer vacation at Greenwich observatory, we were not doing much research, it was the beginning of research. He was still an undergraduate, one year behind me, but at Oxford. He joined Cambridge after graduating from Oxford. At the end of the five or six week course all the students had organized a table-tennis tournament. In the final I was playing Hawking. I beat him, but he was very normal, that's the point I am trying to make.

He could play table-tennis and reach the finals, not that the standard was very good but he could do that. He used to go for long walks on the weekends. When he joined Cambridge, some of us noticed that he spoke in a slurred way, he could not pronounce the words correctly. Most of us thought that by speaking like that he was putting on air like fashionable people and speaking in Oxford accent and being sophisticated.

But later on we learnt that it was due to the advancement of his disease. He later began using a walking stick and afterwards a wheel chair.

In 1964 a senior colleague who knew the family of Hawking told me that according to his medical prognosis he had only two years to live. I was quite shocked because although he looked fragile he didn't look as if he would be dead. But as you have seen he is still around. The prognosis was wrong. But he was extremely weak and dilapidated physically. At that time he got married and his wife looked after him extremely well and got married to him despite knowing that he would not live very long and that he needed much looking after. All this happened while we were at Cambridge. We used to have discussions some times on academic things but our fields were different.

GS: You are one of the strongest proponents of the steady state theory. What convinced you of its validity and what is its present status?

JVN: In 1963, when I completed my PhD, it was mostly on the steady-state theory using mathematical formulations to describe creation of matter. People always argued that you cannot have matter coming out of nothing, what would happen to the law of conservation of matter. It is a normal criticism of the steady-state theory. One could answer it either in one sentence by saying what is the big-bang theory where the entire universe came out of nothing, so you are violating the law of conservation of matter and energy in a big way. But that would be to point out the weakness of the other theories and not answering your own theory.

So it was better to think of formulations which could explain the creation of matter without violating the law of conservation of matter. So that was my work in PhD and post-PhD. For that we used what is called as negative energy, which at that time was considered unrealistic. There was a good example of negative energy, mainly Newtonian gravity. Newtonian gravity is a negative energy system because gravitational potential energy is negative and we i.e, Fred Hoyle and me, worked out a fairly consistent method of describing this whole thing. Today what people call phantom fields, an idea which is catching up with people trying to explain some problems of the big-bang, these phantom fields are what we had proposed way back in the 1960's.

It has only come under a new name and some people working with phantom fields are now realizing that this is what we had said.

GS: You have been actively involved in science communication and science popularization activities at different levels and in different languages. What are the major challenges in trying to communicate and popularize science to the people and what advice would give to present and future communicators of science?

JVN: What I find is that in our society at all levels not only uneducated but educated as well are dominated by superstitions of various kinds. The superstitions of the educated are only more sophisticated than those of the uneducated. So one needs to introduce real knowledge in place of superstitious beliefs. You need to explain to people believing in superstitious ideas that the ideas are not correct and this can be verified experimentally. When doing science popularization you have to express some facts of the real universe or the real world to the person who is not willing to believe in it and if you express it in a very pedantic way or say to the person that you are a fool, you should not believe this then it is not good because then he will believe in his superstitions even more. So you have to persuade him to think for himself, you don't tell him what to believe but you ask him to try this experiment and see what is the reality. So that way you may be able to convince the person.

Science popularization involves information about science explaining the things and their implications in detail, or any beliefs the reader might have and also tell them about the newer discoveries so as to enlarge the persons horizons.

Prof. Narlikar with the members of Gonit Sora

GS: According to you what roles should institutions of higher education like our university or IUCAA play to help the common man develop an opinion of science?

JVN: That would be what I would call public outreach, for each of the higher education institutions, whether IUCAA or IIT or any other university. When we formulated IUCAA's modus operandi, we put in one clause that it should be involved in public outreach. At that time many scientists noted that IUCAA was the only institution that has made that bond. Others had not done so. This situation has changed a little in the past 25 years. More institutions are now appreciating the need of public outreach, but a lot needs to be done.

GS: In today's India which is crippling in economic and domestic crisis, the number of students studying basic sciences has also decreased gradually. So how does it impact society?

JVN: In western society, there is a problem similar to India that the income of a research scientist is less than that of a management person. But perhaps the facilities and the infrastructure being much advanced in the western universities, they are able to attract and retain the people. In our case this can happen but not to the extent we would like. A corrective measure to some extent has been taken by the establishment of the Indian Institutes of Science Education and Research (IISERs). They are doing for pure sciences what IIT's do for applied sciences. Since they are attracting good talent it may happen that you will have more input in research in the next ten years.

GS: After the privatization of education in India, there has been a mushrooming growth of private educations offering degrees for various levels. How has that had an impact on the society? It has been seen that the quality of education is not as high as expected. What are your views on this?

JVN: I sometimes get worried by this sudden expansion of this education sector. The watch-dogs of educational quality are probably asleep because the lack of good quality institutions, although there may be a hundred institutions suddenly produced, but how many of them are of good quality, whose presence is respectable against the overall expected standard of world class institutions. A very few are found, maybe three or four out of over a hundred. Also one hears about many scandals involving medical and engineering colleges, which are not well equipped, lacking in instruments and teaching power and where quality is completely ignored. I feel that one needs to put some kind of brake on this sort of phenomena. Make sure that whatever has been created should be of good quality.

GS: It has been noticed that although the government is focusing more on higher education and great importance is given to it, comparatively more number of students are enrolled in the school system. Do you not see an imbalance in this?

JVN: Certainly school education in general needs lot more designing. Private schools where people pay a lot of money to get good quality education are different. In government schools you find overcrowded classrooms, over-worked teachers with not enough time to complete the whole syllabus. This system is not going to help in inspiring the students for education. In fact my wife was involved with some schools in Maharashtra, she knows how scandalous the entire situation is.

GS: There is a perception in the common man that theoretical physics and mathematics have little to do with the real world. So what are your views on this?

JVN: Who thinks so? Somebody may think so but I will let them think. If student doing the courses think so then I would be worried.

GS: How would you change the perception of a common man who is not studying science?

JVN: This is another aspect of science popularization. One has to tell the common man that science has its uses and it can be presented in a way that its effectiveness is brought out clearly. Simply telling them about science is not good. Some kind of packaging needs to be done.

GS: At a young age most of us had an extreme fascination with cosmology and astrophysics. But that has gradually faded with higher education. Is there some problem with the education system that doesn’t allow us to study what we want?

JVN: I may agree with you in the sense that when I became a student of Sir Fred Hoyle, cosmology was a subject most people wanted to work on, but today if some students asked me if they should work on cosmology I would not be very encouraging. The reason being this particular aspect of cosmology, that is theory has become more like a religious dogma. If you believe it it you prosper, if you do not believe in it the chances of your success are very low. This should not happen, there should be a possibility of, what I would call ‘the freedom of speech’ or ‘freedom of action’. People who do not like where the present cosmology is going should have a podium or a stage to voice their difficulties. In the 60’s this was

possible but it's not possible now. It can be rectified by allowing more freedom of speech.

GS: How important is mathematics in physics? Both theory and experiment.

JVN: I think it is very important. I often get letters from semi-cracks, describing their theories and explaining why it is better than Newton or Einstein. At times they send it to the president or prime minister, who forward it to the department of science and technology. They further forward it to scientists like us for comment. My reply usually is that I cannot understand the argument unless it is backed by mathematics and is in relevant physical language. If you say that you do not understand then the person cannot argue with you but if you say that the person concerned is wrong then they get all worked up.

GS: How important has the role of family been for you? Your father was an academician, your wife is an academician.

JVN: I grew up in a academic atmosphere and my father and mother in different ways were instrumental in inculcating academic values in me. My daughters are also PhD in different fields, not necessarily cosmology. I didn't influence their choice of subject. There is always an academic ambiance at our house, which comes through either arguments or in taking logical decisions. It comes through more naturally when you have an academic background. Otherwise your statements would be without any logic or even laced with superstitions. In our family superstitions are non-existent, to the extent that they are relevant to any of present day to day life.

Prof. Narlikar answering a question

GS: Were there any role models that you looked up to in your student days?

JVN: My father as a mathematics teacher and researcher and Fred Hoyle as my guide and science popularizer. He was always independent-minded, he did not care what the majority said, but if he would be in the wrong he would accept it. I like that kind of attitude.

GS: Are there any interesting anecdotes of your student days which you would like to share with us?

JVN: I have written my autobiography in Marathi which was published last year, but it has not yet been published in English. There are a lot of anecdotes in the autobiography. Once when I was appearing for my mathematics examination, in twelfth standard I completed the given paper comprising of six questions in only an hour out of the given three. On completion I sat waiting in the examination room as we were not allowed to leave the room before a given time period. During this time an invigilator on seeing me came up to me and said,"think a little more, you might be able to solve the paper".

During another examination the question paper read, 'do any six questions, all questions carry equal marks'. But I attempted more than six questions and wrote for the examiner, "examine any six questions, all questions carry equal marks".

In the Cambridge mathematical tripods, they said, 'do six questions. Complete questions carry proportionately more marks than and equal number of fragments. Till you attempt half of the questions you wont get full credit'. Upon declaration of result I found that I had scored 110 out of hundred in one

paper, 140 in another and likewise in all the rest. I was confused. So my tutor explained to me that although they write ‘do six questions’, you can attempt as many as you want. They award you marks for whatever questions you answer correctly and the ranks are on basis of the score.

GS: Apart from science what are your hobbies?

JVN: I like reading humorous books. P.G Wodehouse is my favorite English author and Pula Deshpande and Simi Joshi are my favorite authors in Marathi. Apart from that I used to play tennis early in the morning. But upon retirement on not having anyone to play with I stopped.

[At this point, Dr. Mangala Narlikar, wife of Prof. Narlikar remarked that he used to play very good badminton in his youth days.]

GS: In an interview of you, you said that you have not taken part in any inaugural function in the past thirty years. Why is that so?

JVN: There was a time when I took part in inaugural functions. In 1968 on returning from Cambridge, I was asked by the head of the physics department at the Pune University to inaugurate a telescope which he had installed there. I complied and whatever passed on there was reported in the newspapers. One newspaper editorial read as such, ‘to ask Narlikar to inaugurate a telescope is a waste of his time’. Although the comment was very general, yet I took it as a action point for me. Since then I have not inaugurated anything. And I calculated the hours I saved. A typical inaugural function involves five or six people sharing a dais, and all saying the same thing but in different tones and languages and this is followed by the trivial act of pulling or cutting something. And that’s it. No one bothers to ask about what happened later on to the inaugurated enterprise. So I saved two to three hours per inaugural function and all other formal functions.

GS: What would be your advice to students like us who wish to pursue a career in research?

JVN: Whatever you decide to do or want to do, put all your effort into it. Do not do it half-heartedly.

GS: How has this visit to Assam been?

JVN: This is my fourth or fifth visit to Assam and first to Tezpur, although its my wife’s first visit to Assam. I have always enjoyed being in Assam.

Gonit Sora thanks Prof. Narlikar for giving us his valuable time and agreeing for this interview. We wish him a healthy and prosperous life ahead, full of joy, physics and more mathematics.
