

# Pancharatnam – Some reminiscences

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AFTER obtaining my Master's degree in Mathematics, I applied for the position of a research scholar at the Raman Research Institute (RRI) against an advertisement in *The Hindu*. The reply came swiftly within a week from C. V. Raman, the Nobel Laureate.

K. S. Viswanathan, Esq., B.A.,  
Big Street,  
Kulakad,  
Tinnevely District.

Dear Sir,

I am writing with reference to your application of the 27th September 1950 for one of the six research scholarships at this Institute.

It is my intention to award one of these scholarships to a competent mathematician who would be interested to take up research work in mathematical physics, so that in due course he could qualify himself for a position as a theoretical physicist. My own feeling is that your knowledge of both the pure and applied branches of mathematics should enable you to undertake such work with success.

Kindly let me know whether you would like to accept ~~the~~ the scholarship on this basis. If you wish to discuss this matter with me personally before reaching a decision, you can come down to Bangalore to talk it over as soon as you can. A single 3rd class fare for your journey to Bangalore and back will be paid to you by this Institute. I shall be in town till the ~~14th~~ instant.

Yours faithfully,



I met Professor Raman and I told him that I would like to do research in pure mathematics as I was not trained in physics; however, he was clear that he wanted a research scholar to work in theoretical problems of crystal physics, and if I would like to take up the scholarship, I should change my field. I thought about it one whole night and the next day I informed him that I would take up the fellowship and was prepared to study physics from the very basics as I was interested in a research career working with him. He asked me to join the Institute as early as possible. I was given an excess of a rupee or so as travelling allowance and I told him that I had returned the extra amount back to his office. He was very pleased with this.

The Institute had started functioning barely a year previously in an imposing stone building. The first person to join it was J. Padmanabhan, the talented technician in crystal grinding, polishing and optical work. All who have known him will remember his

scintillating jokes that enlivened the atmosphere around him. A. Jayaraman joined a little later. The research scholars at that time in RRI were S. Chandrasekhar, T. K. Srinivasan (a geologist), A. K. Ramdas and M. R. Bhat (later in Brookhaven National Laboratory, N.Y.), D. Krishnamurti (later Professor, Mysore University) and myself.

Pancharatnam joined about two years later. He was Raman's last research student and also the youngest. Optics was his favourite subject in the University, and it was no wonder that it turned out to be his field of research also. He was working on a variety of problems in optics, such as the applications of the Poincaré sphere, generalized theory of interference, coherence properties of light, etc. A series of papers on these subjects appeared in the *Proceedings of Indian Academy of Sciences* during the period 1953–1960. He collaborated with Raman in explaining the optical illusion of the mirage. I was happy to find that several papers based on his ideas on coherence, Poincaré sphere, etc., were presented by eminent scientists at the Raman Centenary Symposium on 'Waves and Symmetry' held in 1988.

The Raman Research Institute had rented a house as hostel for the research scholars at 15th Cross, Malleswaram, opposite to the Himamsu Sisu Vihar. The owner of the house was one Ramaswamy Iyer, a retired professor. All the research scholars lived in this building initially.

Pancharatnam had the habit of staying long in the laboratory both during day as well as night. His eating hours were therefore quite irregular. Later, RRI built a hostel inside the campus. The lunch hour generally was very interesting, full of arguments and discussions on scientific topics and other matters.

Raman arrived every day at the Institute at 8.30 am sharp and left at 6.30 pm in the evening and went for a long stroll in Cubbon Park. He told his visitors 'I am the first to come to the Institute and the last to leave'. (This was not completely true as Pancharatnam used to work late into the night.) Raman was a great horticulturist. The beautiful flowering trees, the rose garden, the green lawns and the fences with flowers of all colours at the Institute owe in no small measure to his imagination, planning, and aesthetic sense. To an admirer, he once said: 'After the age of sixty, one is supposed to become a Vanaprastha – to go to the forest and live there. On the other hand, I brought the forest around my residence.'

Whenever a student wanted to meet him to discuss anything he never made him wait, and the first thing he did was to ask the student to take a seat in the chair opposite his. However his general style of talking and discussing physics with students was while walking with them in the garden which he loved. All the research scholars obtained their doctorate degrees within four years, excepting T. K. Srinivasan and M. R. Bhat. The former left the Institute in the middle to join a Company, while the latter obtained his Ph D degree in the United States.

It is remarkable how well Raman's last students did later in science. In 1955, Chandrasekhar left the Institute for Cambridge to take up the coveted 1851 Exhibition Scholarship. After five years he returned to India to become the Professor and Head of the Department of Physics at the Mysore University. He rejoined RRI around 1971 and set up an excellent liquid crystals group. The discovery of discotic liquid crystals by him and his colleagues will rank as a very important contribution to Indian physics. He was elected a Fellow of the Royal Society in 1983. Ramdas left the Institute around 1957 to join the Purdue University, where he has been working ever since. For four decades, there has been a steady stream of publications from him and his students in semiconductor physics and laser Raman spectroscopy. A few months ago he was awarded the prestigious Newton Medal of the American Physical Society for outstanding contributions to the field of optical properties of solids. Jayaraman left the Institute to work in high pressure physics at the Institute of Geophysics UCLA. Later, he joined the Bell Telephone Laboratories. His publications in high pressure physics have earned him a place among the top leaders in this field. The change of phase of  $SmS$  discovered by him, through the application of pressure opened up the new and fertile field of valence fluctuations. About Pancharatnam's remarkable achievements I will not recount here. His *Collected Works* and this special issue of *Current Science* are evidence for them.

Pancharatnam was attracted by the Gandhian philosophy and the *Sarvodaya* movement, which at that time was preached by Acharya Vinoba Bhave through his *padayatra*. He actively participated in the social work programme of the *Sarvodaya* movement and it is said he contributed a good part of his salary to it. One of the Gandhian programmes is to clean the slum areas. Along with a few other workers he spent his weekends cleaning the slums in Guttahalli adjacent to Vyalikaval. In this process, he caught a serious infection, which shattered his health. For a few months, he was laid up with jaundice; probably the viral infection remained dormant in him even after his apparent recovery. Raman said quite often that his premature death was probably the result of this infection he acquired during the cleaning of the slums. Apart from the *Sarvodaya* movement, he had considerable interest in music; he

could sing well. He was also interested in philosophy. I remember having long philosophical conversations with him on Bhagavan Ramana Maharshi, and his teachings.

Pancharatnam used to work hard, spending long hours in the Laboratory but was very sparing in his words. Once Raman told us, 'I say, why don't both of you open your mouths and speak out. Look at me, my wife says that all the twenty four hours of the day I do nothing but talking and talking'.

After 1957, the hostel in the RRI was closed. Pancharatnam, still a bachelor stayed with his brother Ramaseshan and was also eating his meals there, while commuting to the Institute on his motorbike. Raman once remarked to him 'You have all the advantages of a married man, with none of the disadvantages'.

During 1955, Raman asked me to work out a theory of propagation of light in polycrystalline media and the Christiansen experiment. He suggested a model in which the material was assumed to be an assembly of a large number of cubical blocks, each block being a single crystallite. The three edges of the cube were assumed to be parallel to the three axial directions. For the Christiansen experiment a liquid is added to the cell with polycrystallites or another immiscible liquid. Using the standard statistical method, I derived expressions for the transmission coefficient as a function of the wavelength of light and, the three refractive indices of the birefringent crystallite (or those of the liquid in the case of the Christiansen experiment) and the probability that the crystallite has one of the three orientations. It happened that for the Christiansen experiment, the expression derived by me was the same as the one obtained by Raman earlier using different physical arguments. He was quite excited about it and two papers resulted. Pancharatnam argued with me about the mathematical techniques I used in this derivation. These two papers were quoted in the article on crystal optics by G. N. Ramchandran and S. Ramaseshan in *Handbuch der Physik*. I was told Pancharatnam contributed much to this article, although his name did not appear as one of the authors.

Around 1959, there were only three of us left in the Institute – Krishnamurti, Pancharatnam and myself; all three of us were Assistant Professors at RRI. Towards 1960, all three of us applied for the posts of Reader in Physics in the newly started Mysore University at Manasagangotri. The University selected S. Chandrasekhar who was in England as Professor of Physics, and Krishnamurti, Pancharatnam and myself as readers. I did not accept this appointment as I had simultaneously an offer of another job as scientist at NAL, Bangalore, which I preferred. Pancharatnam tried his best to persuade me to join the Mysore University and argued that scientists should work in Universities, help their development and provide a good training to the students. He was quite upset at my decision not to go to

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the Mysore University,' but this however in no way affected our friendship.

These appointments were challenged through a Writ Petition but they were upheld by the High Court. Within a year however Pancharatnam left Mysore University to join Oxford University on a post-doctoral fellowship.

During October 1965, I proceeded to Dublin, Ireland to take up a post-doctoral fellowship at the Dublin Institute for Advanced Studies. *En route*, my wife and I halted in England and stayed at Oxford with our friend R. Sankar of NAL. By this time, Pancharatnam was deeply immersed in his experimental work on lasers and optically pumped atoms at the Oxford University. We had lunch with him at his home. He took me to his laboratory at the Clarendon. It was a pleasure to see the sophisticated experimental arrangement on optical pumping he had set up and to hear him explain his work. Pancharatnam gave me a loan to meet my expenses for the first few months at Dublin, because at that time, the Government of India released a foreign exchange of *only three pounds sterling for each traveller*. The Dublin Institute, however, gave me a substantial advance on my salary with which I could repay the loan. I received several letters from Pancharatnam when I was at Dublin and I am still preserving a few of them.

During 1966-67, we spent one year at Princeton, where I was a Visiting Associate at the Plasma Physics Laboratory of the University. On our way back to India,

we went to Oxford to meet Pancharatnam. When I saw him, I was shocked to see his physical frame and the state of his health, and I could not help exclaiming 'I say, what is this; You look so worn out. You must take care of your health'.

A few months later, when R. Sankar who was at Oxford returned to NAL, I enquired of him about Pancharatnam. He said that Pancharatnam's health had deteriorated very much and that he had been hospitalized and kept in an intensive care unit. A few months later, while I was walking in the NAL campus towards the Material Sciences Block, I met Ramaseshan who said in a sad and shocked voice, 'I got news from England today that Pancharatnam passed away'.

Several years later, I visited the Mahatma Gandhi University at Kottayam to attend a meeting of the Board of Studies in Physics. I met the Vice-Chancellor Professor U. R. Anantha Murthy, who was earlier Professor of English at the Mysore University. He said that he became a close friend of Pancharatnam at Mysore and was all praise for his personal qualities. So many, who had come across him, felt so too. He was a brilliant physicist, whose work on optics has made definite impact on the subject. His contributions to physics are available in his *Collected Papers*. *As a person, he was a gem. It is tragic that such a fragrant flower was plucked at the prime of youth.*

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