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Chandrasekhar - some reminiscences*

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1. Introduction

Friends,

I consider it a great honour that I have been asked to deliver the bicentennial lecture of your historic institute. For me the Indian Institute of Astrophysics has always been the home of Indian Optical Astronomy. It has been in the vanguard of building optical telescopes for India.

I first went to Kodaikanal when I was eight years old. The Kodaikanal solar telescope was the first telescope I had ever seen. I shall never forget the excitement I felt. Nor the thrill I got when I saw for the first time sunspots projected on a screen. I have visited Kodaikanal several times later. The old clocks of IIA at Kodaikanal have to be seen to be believed. The renovated Evershed hall - commemorating a great discovery is beautiful. The 2.3 metre telescope at Kavalur is a magnificent achievement. I now understand that the entire institute is united in pursuing the goal of setting up a two metre telescope and possibly a much larger one in Hanle or Ladhak which may prove to be one of the best telescope sites in the world. I wish you all luck. All this warms my heart. For I was closely associated with your Institute when it was formally formed; when it moved to Bangalore; and when the money for the Kavalur telescope, the dream of Vainu Bappu, was sanctioned. I feel quite embarassed by the way I have been introduced by Prof. Cowsik, today, and more so with that what is written in the brochure. He must have done much archaeological digging about me and my science.

Sometime ago Prof. Cowsik requested me to give this bicentennial lecture. He said, "It will be befitting if you talk about Prof. S. Chandrasekhar this year. He was an Honorary Fellow of this Institute". I too felt that Chandrasekhar would be an appropriate topic - as he

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was associated with an Optical Astronomical Laboratory - Yerkes for almost 25 years. Cowsik requested me so earnestly that I could not say NO.

This reminds me of a cartoon in New Yorker. There is a middle aged lady surrounded by children of differing ages and of various nationalities, Japanese, Indian, Arab, Caucasian, African and so on. The legend says - "she worked for the foreign service. Her problem was she could not say NO".

I now regret having accepted this invitation. I was wondering what I should talk about - Chandrasekhar's science - How can anyone cover it in one hour even if one were competent to do so. There is Rajaram Nityananda's talk at IPA Madras entitled "The six faces of Subrahmanyan Chandrasekhar" punning on the belief that God Subrahmanya is a six - faced god. For comparatively popular accounts of Chandrasekhar's science, read the forthcoming special issue (May 10th) of "Current Science"; for technical accounts read the forthcoming issue of Academy's Journal of Astrophysics and Astronomy.

Should I talk about the great human being he was? Wali has done this in 325 pages. Then there are these wonderful articles by Abhay Ashtekar, G. Srinivasan and others again in "Current Science" - which I presume you have read - if not you must. I must be pardoned for mentioning "Current Science" again and again. For this has been my obsession for the last 6 or 7 years. Sometime ago I heard Radhakrishnan telling someone - "I have known Ramaseshan for almost 60 years - we always discussed every subject under the sun - Optics and Astronomy, Physics and Aerodynamics, Cars and Gadgets, Planes and Glidets, Materials and devices etc. etc., we have had a great deal of fun together. But now I find it a little difficult to talk to him. For instance if I tell him I saw a very pretty girl - so strikingly beautiful that it may even make his heart flutter". Ramaseshan replies : "That is very nice - can you write it up for "Current Science".

I can therefore talk to you only about my personal interactions with Chandrasekhar. That is why I gave the present title to this talk. Here again I have a problem. Since he first left India in 1930 I have met him many times and after each meeting I have come back exhilarated. I have four files of letters we have exchanged. And providence has showered on me an unexpected gift - We became very good friends.

> "I should not be writing this letter" he wrote "if I were not sure of your long standing friendship".

Even today this appears to me to be unbelievable. You can therefore understand my reluctance to wash linen in public even if they are not dirty. I fear also I may commit the cardinal error of making myself a central player. For what is Chandrasekhar's stature and where am I?

I have taken seven or eight incidents from my large collection which may possibly interest you and have written this essay. Three things I have to say. The incidents I relate are essentially correct. But memory can be deceptive. When I use the active voice, the words

might not be the exact ones spoken at that time. Finally I lace the stories with my comments- which you may ignore if you like.

2. The last conversation and his death

My last conversation with him was in July 1995. I called him up from Canada on my way to Montreal. We talked of many things for a long time. He said he had finally received the printed copy of his book on Newton's Principia - "I like the cover. It is magnificent". He had worked on this book for almost 5 years. "My work is finished" he said. Did he see the figure of the Grim Reaper close by. On hearing that I was not going to Chicago due to reasons of my health he asked almost in a wailing voice "Sivaraj (that is me) aren't you coming to see me". That question still haunts me - for within two months he was dead.

I was quite ill, when in the early morning of August 22 I got a telephone call telling me that he was no more - it was a few hours after his death on 21st in Chicago. I was calm - I phoned a few friends in USA. It appears he had slight pain in the chest on the 19th morning. As it was on the right side he and Lalitha were not too worried. In fact so unworried that they even discussed. I am told, what they should do on the occasion on their 60th wedding anniversary which was to come a year later in September 1996. He phoned his sister who was in USA that he was preparing a series of lectures to be given at various Universities. He therefore requested her to postpone her visit to Chicago by a week - He obviously died in harness.

On 21st morning after breakfast he drove to the University Clinic to get himself checked. Doctors told him that he was having a massive heart attack and were horrified that he had driven to the clinic himself. His car was not parked in the regular parking area but in the emergency one. One guesses that he had the heart attack during the drive. They phoned Lalitha. She came and was with him for 10 minutes. He was heard to tell her "I think it is the time for you to start making the preparations we had planned". He died sometime later. It is almost certain he did not suffer much. He had stipulated that there should be no memorial service or meeting. He was to be cremated and no one was to be present and the ashes should be brought to Lalitha. As Plato says of his master the great Socrates, I quote :

> "Such was the end of a man who I think was the wisest and the justest and the best man I have ever known".

I was calm and collected. I told myself he was almost 85, he had become a legend in his time and was the greatest astrophysicist of this century. He had chosen perceptively fields which were seemingly unfashionable which later were to blaze new trails. He had produced 50 or more remarkable students who were dotted all round the world. He had written essays on science, literature and the arts which were masterpieces. He had said to me - My work is finished and it seemed to me as though he had arranged with Providence for his passing away.

When I was invited to Montreal to speak at the memorial meeting for Dorothy Hodgkin (who also considered me a friend) - Kausalya, my wife, said that on no account must I break down and cry before a western audience.

Today she told me : you have a good Indian audience, familiar with Kannada, Tamil and Hindi films you could therefore break down and cry, if you wish!

3. Polarisaiton of the sunlit sky

I met him first when he came to Calcutta to bid goodbye to my mother on the eve of his going to England in 1930. I was then less than seven. Again in Calcutta when I was 12 years old. I heard his lecture at the Indian Association for the Cultivation of Science. He wore the traditional cylindrical dhothi and a coat which was to become his standard dress whenever he was in India. I still remember him mentioning a mnemonic used for classification of stars. O BE A FINE GIRL AND KISS ME RIGHT NOW SALLY.

15 years later in 1951 when he came to Bangalore he was received at the airport by C.V. Raman. He came to lunch at our little house at the Indian Institute of Science, I was recently married. He was full of laughter, made fun of us, quipped with Kausalya and discussed with her sari fashions.

I think it was then that he told us of his experiences in Russia in the Thirties. He was shocked when he had to share a compartment with one or few women for an overnight journey. In telling this story I shall assume that there was only one. They carefully evolved a method of undressing before going to bed - to their respective beds. Question "Was she the usual fat Russian". Answer "No she was alright". "So you did peep". Answer "No it is not necessary to peep to know that a woman has a fine figure". I have heard later another version of this story.

He told us how he had met a large number of brilliant astronomers and physicists. All of them were later sent to Siberia, purged or executed. Landau and Ambartsumian were the exceptions - thanks to the heroic intervention of Peter Kapitza.

The next day he gave a lecture "On the polarisation of the sunlit sky". It was perhaps the best scientific lecture I have ever heard. It was the pinnacle of his monumental work on Radiative Transfer. He told us how he got interested in this problem - the problem of the atmosphere of a star. The need to treat the coupling by photons of the different layers with varying properties. He told us how the principle of invariance was evolved - following the work of the Armenian Astrophysicist Ambartsumian I referred to earlier (in Russia from his first name in the passport he was often taken for an Armenian as it had the same ending - Subrahmanyan - Ambartsumian) - He developed "invariant embedding" This he applied to explain the polarisation of skylight - the radiative transfer in a finite slab of air which scatters the sunlight in the sky. He went back to the great Masters, he discovered Stokes', paper in the late 1870's from which he obtained the Stokes parameters for the description of polarised light. He formulated integral equations which were so complex that even very good mathematicians

would have abandoned them. To quote Rajaram Nityananda "He talked to these equations personally and intimately till they gave up their secrets". It is a saga that has to be heard or read to be believed. At the end of the lecture Raman who was in the audience commented "Rayleigh formulated the theory of light scattering to explain the blue of the sky in 1871. For eighty years the problem of the experimentally observed complex polarisation of skylight has defied the efforts of the great masters. Today we have had a most extraordinary exposition - We have heard how the problem was solved by the combination of physical intuition and powerful mathematical analysis. Then he asked : "Professor Chandrasekhar can you tell us how long it took you to work out the results which you have published in the four page paper in Nature?". Chandrasekhar after some thought answered "More than two and a half years". That issue of Nature (1951) had not reached Bangalore then. But Chandrasekhar, as was his habit, had sent a reprint or preprint by airmail to Raman.

One realised that if one had some previous knowledge of the subject (as I had on polarisation of light and the Stokes parameters etc.,) one can get much more from an outstanding lecture by one like Chandrasekhar. But the awful disadvantage is that such a lecture exposes ones inadequacy unforgivingly.

I jump 35 years - as this relates to another Indian who was also an expert in the same field. Chandrasekhar once wrote to me :

> "Stimulated by the handsome references to Pancharatnam by Michael Berry, my colleagues and I are interested in the Collected Works of Pancharatnam, I should like to buy a copy".

I sent him a complimentary copy of the Collected Works. As the High Priest of Polarisation Optics of this century I asked him whether he would be inclined to write for the Pancharatnam issue of "Current Science".

> He wrote - "I am too far away from this subject - It is almost 45 years since I even thought of the Polarisation of Light. Further I may not have anything worthwhile to say. However I always congratulate myself that when I read Pancharatnam's classic paper long ago I did recognise its merits".

Time does not permit me to talk to you about my meeting him in Yerkes in 1954; his accounts of his collaboration with Enrico Fermi, Fermi's death which had occured just a few weeks earlier (He told me the well known story of the elephant which all of you must have heard). How he decided and took the US citizenship in 1953 (without consulting his father). "Now Lalitha has been appointed as the peace maker" and he told me of her efforts to appease the old man. I remarked "You coward". He told stories of his and Raman's encounter with colour prejudice in USA, his introducing me to Otto Struve - whom Blaauw described as the man who knew all of astrophysics – and many many other stories. I shall never forget this meeting.

4. Einstein's view of God

I mentioned that he and I had exchanged many letters. I give an example which illustrates how meticulous he was in answering questions asked of him, the effort he takes to make his listeners understand, his consideration and his strong views.

"I am writing this letter, however, with respect to two questions you asked of me at the airport prior to our leaving Bangalore a week ago".

First, with regard to Einsteins different views of God : in 1919 when he said I would be sorry for the Lord" and his later statement in the late twenties "God does not play dice".

Chandrasekhar was always uncomfortable when the word God was mentioned. The letter contains a few typed pages and has some equations. His argument is that the same metric (using the post Newtonian approximation) gives the precession of the perihelion of mercury to be 43 seconds of arc per century and the deflection of light grazing the Sun to be 1.75 seconds. A theory which is consistent with one crucial test if it fails in another - then one would be justified in being sorry for "the Lord". "Ignoring the word "Lord" I do not think anyone would disagree with what Einstein intended to say".

"Your second question really concerns the spin of the photon. That the photon must be associated with an angular momentum s = 1 which is as old as Einsteins concept of the Photon (remember the weight 2 in Planck's formula)". Then a long discussion follows on Bohr's correspondence principle, Rubinovicz' derivation, the demonstration of the spin of the electron by the Mottdouble scattering experiments and the need for explicity demonstrating the spin of the photon etc., etc. He ends the letter by saying

> "I hope you will not consider me too impertinent, if I quoted Eddington in this context. In the off chance that posterity may find wisdom in our words is no reason for making meaningless noises".

In another context he wrote "Einstein's judgement on the uncertainty principle is one of personal conviction only. It is not any reasoned scientific argument. His later official judgement on the quantum theory does not invalidate his own personal conviction of the truth of general relativity.

5. Wali's Biography and Raman

He asked me once what I thought of Wal's biography. "It is a remarkable biography. It reads like a novel". "Do I detect a slight understone of disapproval" he asked. "Yes I do not like those parts where by implication it is derogatory to you". "Derogatory to ME" - the Me became a high monotone - reminding me of his uncle. I think he could not believe, that Wali, his Votary, could have said anything derogatory to him.

"When Raman offered you a position at the Indian Institute of Science - you wrote to him a very fine courteous and what I consider to be an honest letter; that you were flattered, you were not sure whether you would fit into an experimental group and finally you were afraid that the media attack against Raman would increase if you, his nephew, were appointed. And this may affect your performance as a scientist. Therefore you were, with great regret, not accepting his offer". "Wali on the other hand, has written it in such a way that one gets an impression that you were really responding to your father's request to stay away from Raman. This implies the letter was a false one - that you were dissimulating. I have now known you for a long time. I cannot imagine you dissimulating or playing the hypocrite.

Chandrasekhar was silent for some time and said with a smile,

> "I did not write the biography it was Wali who did".

Chandrasekhar was always reluctant to talk about Raman. I once cornered him and made him speak on this topic.

In your letter when Lalitha and you presented Ramanujan's bust you say :

> "as a companion to the bust of Raman so that the bust of the greatest physicist of India could be along with that of the greatest mathematical genius of our times who happened to be an Indian".

"Do you really think Raman was the greatest physicist of India"?

"Of course I have no doubt on that score - and you yourself have sometime ago given me a certificate that I do not dissimulate"

People in India remember him for the discovery of the Raman Effect which won him the Nobel Prize. One discovery advances science, but it cannot be a criterion to judge the quality of a physicist. Raman's work on acoustics is first rate - his work on the violin is considered a classic even today. Acousticians wonder how he could have done these beautiful experiments and theories in those days. In optics he was a Master, in the class of Rayleigh and Michelson. It is a great pity his "Lectures in Physical Optics" which I used for giving an advanced course in Optics is not so widely known.

His Nobel Prize, in my view, retarded his science - probably it was because the effect it had on his psychology, I may be wrong. Even so his later work on Brillouin Scattering and crystal transformations are again world class. One feels sorry he committed major errors in his latter life - and he became aggressive too. Unfortunately this is what many remember him by - not the excellent physics he did earlier. I consider him to be a brilliant classical physicist who made a spectacular experimental discovery of a quantum mechanical phenomenon. It has influenced physiics, chemistry and even technology as he predicted in his Nobel Lecture.

Most of the other Indian physicists of repute, of those days, had practically no outstanding students. On an invitation from CSIR I had the opportunity of visiting a large number of laboratories and scientific institutions of India. I realised Raman's contribution to the growth of Indian Science and Technology, after India's independence, was also in the form of students. Many of them had established very competent research schools - many had headed and built laboratories. They must have imbibed from him the spirit of science for they, in turn, produced excellent students.

"How do you rate Raman by world standards".

"As an experimental physicist"

"Yes"

"For that we have to compare him with men like Rutherford and Fermi - the answer is obvious".

"If that is the yardstick you use would not all experimenters of the world except perhaps those like Michael Faraday fall by the wayside".

After some thought he remarked : "Yes, that is probably true".

6. He enters general relativity

The following story was told to me by Chandrasekhar himself. He wanted to go to Warsaw to the Conference on General Relativity which was to be attended by the established figures in the field like Dick Feynman, Leopold Infield, Paul Dirac and the younger ones like Roger Penrose and Ted Newman. The National Science Foundation wanted to support his travel. He did not fit into the standard categories they had.

Q1	Are you Chairing a Session?	NO
Q2	Are you giving an invited talk?	NO
Q3	Are you making a presentation?	NO
Q4	Are you an expert?	NO

I want to be there as I am seriously thinking of entering the field of General Relativity. They found an appropriate excuse to give him travel funds.

A friend of mine was visiting Chandrashekar. They were walking down the corridor. Suddenly he saw someone coming at the end of the corridor. He was a young man, wearing dirty torn jeans. Chandrashekar was of course immaculately dressed - in his charcoal grey suit - handsome as ever. He straightened up his tie, went forward at a fast pace, greeted the young man, shook his hands talked to him for sometime, opened the door of the car and the young

man got in and drove off. Chandrashekar came back and joined my friend who asked "Who is that Hippie?"

"He is Geroch."

"Who is Geroch?" "He is one amongst the most outstanding relativists of today - he is in his twenties. I have invited him to lecture in Chicago this summer. I am attending his course. It takes me the entire weekend to work out and understand some of the equations he puts on the black board - to be ready for his monday lecture. When I am stuck. I ring him up, even if it is late at night, to bail me out."

At 60 he was humble enough to learn relativity from youths, at 70 he held his head high amongst the brilliant young relativisits. At 80 he was respected by all for his unparalleled contributions to General Relativity.

It was about this time that Chandrashekar told me

> "The trouble with Einstein was that he did not believe sufficiently in the General theory of relativity."

I honestly felt that he was going gaga. Many years later after he wrote his monumental treatise on Black Holes I told him of the fears I had. He laughed loudly in his characteristic way.

It was later when Abhay Ashtekar wrote the following that I understood what Chandrashekar meant.

If Einstein had believed in his general relativity sufficiently and deeply enough, he would have worked out the consequences of the non-linear aspects of the theory in the strong field regime. Chandrashekar believed that Einstein was the only person who could have done this at that time. The General Relativity would have entered the mainstream of physics four decades earlier.

Chandrashekar told me that many authors had not considered the gravitation radiation reaction in General Relativity. When all my old problems were reexamined very unexpected results turned up. For example I was able to show that all rotating stars are unstable due to radiation reaction.

Abhay Ashtekar says:

> "Chandrashekar more than anyone else played a decisive role in bring the beautiful creation of Einstein to its natural home - Astrophysics" and

> "His intuitive feeling that the radiation reaction in general relativity is important is one of the deepest insights in relativistic astrophysics".

7. Music, Literature and the arts

Chandrashekar's appreciation of Music, Literature and the Arts was staggering. He mastered each of these fields in his own way. He heard each of the symphonies of Beethoven and the Operas of Wagner many times. His attachment to western music was both intellectual and emotional.

Often he read out to us pieces from poetry and prose which he liked. His readings from T.S. Elliot were delightful. When he read passages from Virginia Woolf in his sing song voice you felt you even understood this rather difficult author. But I think it was Shakespeare that he loved best. He must have read every play of Shakespeare many times. He could lecture on any play better than any Oxford don - especially Hamlet and Tempest. I think Shakespeare gave a sort of direction to his life. He often told me that reading Tempest helped him in the attitude he had in doing research. I can easily imagine Chandrashekar to be Prospero of the Tempest. If I now allow my imagination to roam: Like Prospero he was -

> Far away in a distant land - nursing a grievance and - biding his time for vengeance.

Then he was - Drawn deep into books - Succumbing to his overwhelming thirst for knowledge - and in splendid isolation - taking long years of preparation - and long years to perfect his art.

He discovered to his amazement -

> the more he pursued his science (Shakespeare calls it the enchanted arts), the more single minded he became in its pursuit. Thus finally it cleansed him as it did Prospero.

When the time did come a transformation had already taken place and like Prospero he had become free. His grievance was gone and he had no desire for vengeance. However, I think what finally liberated him and his soul was his complete surrender to his god - whom he called "The unmatched and unmatchable Newton".

It would be impossible for me to convey to you the thrill and excitement of the exposition he gave us on Newton's Principia on one of our visits to Chicago. Almost true to his chosen title - Newton's Principia for the Common Reader - he lectured to Kausalya the Common Woman. I felt that he was really constructing the sentences that he was to write in the introduction two years later. We cherish a photograph of Kausalya and Chandrasekhar which I took. He is holding Cajoris 2nd Edition of the Principia which he had bought for Eight Thousand Dollars.

Once when we were in his drawing room Kausalya asked "Is that a Monet?", "Yes - only a print - I cannot afford an original". He told us that a chance remark by Roger Penrose that his excursions into General Relativity reminded him of the series paintings of Monet - triggered him off. It is the same Monet - whose Sunrise - an impression" started the impressionist movement. He studied everything written about Monet and by Monet. He collected excellent prints of all his paintings - especially the Series Paintings of Haystacks, Poplars and Mornings on the river Seine. His world pictures of these paintings were such that he could make us see things we would not have seen otherwise.

> "I feel I am exploring the landscape of the mathematics of General Relativity as Monet explored his Haystacks which took new forms in the changing colour of light during the day and during different seasons".

He showed us how in Monet's Poplars and their reflections were vertical lines while the tops of the other trees appeared a near horizontal lines forming a wavy and beautiful grid - such exquisitely wavy grids, according to him, inspired newer trends in geometric painting like those of MONDRIAN. "The parallel in physics is", he said, "just as the quantum theory of scattering of gravitational waves by stars led to a deeper understanding of the theories of scattering themselves".

We sat there with our mouths open. It was an entrancing half hour. We can remember almost every word he spoke. Did we understand whatever he said. We do not know. His enthusiasm, his sparkling eyes, the cadence of his voice remained with us for a long long time.

8. Basilis Xanthapoulos

My visits to USA were never for more than 10 to 12 days. A day in Chicago was a must. I phoned him once. He said, "I am flying over to meet Roger Penrose this evening. Can you come after three days". I went on the specified date. He received me at O'Hare airport. I again felt greatly privileged.

He was at that time probably working on black holes and cosmic strings.

> "Whenever I come across a stumbling block I go and meet Roger Penrose. We spend an hour together early in the morning when I present him with my problem. We have 4 to 5 hours of discussion after lunch, then dinner, when we talk of other things - and I fly back. In no case has he not cleared up my doubts in physics or mathematics. An amazing man".

Chandrasekhar always followed where his mathermatical and aesthetic instincts led him. During this period he collaborated with Basilis Xanthapoulos in Crete and Valeria Ferrari in Rome. He visited them often - but never for more than four or five days. It was with them that he discovered the underlying similarity between the mathematical theory of black holes and

of colliding gravitational waves. We at the Raman Research Institute had the privilege of listening to his latest work which had not yet appeared in print. On every occasion during his formal or informal lectures, he mentioned with gratitude and affection Basilis Xanthapoulos and Valeria Ferrari.

So when I read the horrible story that while lecturing at his University, in Crete, Xanthapoulos was murdered by terrorists, I wrote to Chandrasekhar a condolence letter. He was touched and he wrote : "My association with Basilis was the most enduring personal relationship I have had in all my 60 years in Science". He also sent the Foreword Basilis had written to Volume 6 of his collected works.

When we met him next time and I referred to Xanthapouls' death, we could see in his eyes the agony that I saw in my father's when he lost his much loved son. I realised then more than ever that those like Basilis Xanthapoulos and Valeria Ferrari were truly his Children - Children that he and Lalitha never had.

9. Return to India

The following episode extended over four or five meetings in Bangalore, Chicago and Cambridge. I will try to give a connected account.

One day I asked him - you say in an essay you wrote about 30 years ago :

> "I have been a foreigner all these years except for a brief vacation for eight weeks when I was in India. By foreigner I mean that I have never been allowed to feel otherwise. Yet people from other countries migrate to distant lands, build homes on new soils, adopt and are adopted by their neighbours. But why is it not so for me, an Indian.

I then asked "has that feeling changed now?"

"Unfortunately no, I thought it would when we become citizens of USA in 1953. But even today I feel at home only in India. I think it is a great pity - why do you ask"?

> "I always poke my nose into other people's business. If you feel I offend you, stop me. Have you ever thought what will happen to you if Lalitha dies - and what will happen to Lalitha if you die. For I feel the US can become a very very lonely place".

(I remember he and Lalitha most graciously visiting the great physical chemist Mulliken. They took me with them. Mulliken was suffering from Alzheimers disease. There was literally no one with him and Lalitha had to make the tea for all of us).

"Have you a solution?"

"Yes, I have". Why don't you come back to India. Bangalore would probably be the best place. You can be at the Raman Institute. People always say RRI means Raman's Relatives Institute. He said "some of his relatives who were at RRI have been very able scientists - of world renown". I said, "please do not interrupt me at this stage" and I continued. It would be nice if his most distinguished Relative can also be at RRI. You can stay with your brother who is in Bangalore. But it may be better for you and Lalitha to be in a cottage maintained by RRI or its Trust. It will provide you with help, transport etc., You can invite any of your collaborators to Bangalore. Now and then, if you so desire, you can give courses of lectures. I can assure you very bright young people, and they are in plenty in India, will swarm around you. You can select the best of them to work with you. You would also be fulfilling Radhakrishnan's dream of having a Gravitation and General Relativity Group.

He said "I have also been thinking about this problem", and always the gentleman, he said "It is most gracious of you to have thought of me and to have invited me. The offer is very attractive. I shall surely think about it".

I informed Radhakrishnan that there were chances - even though slim - of his accepting our offer. So a part of the new building was redesigned - special permission was obtained to put a lift - for Chandrasekhar - had had his share of heart attacks and heart surgery.

He told me later he had given some careful thought - "The only other place I could have considered was Oxford, because Roger Penrose is there.. But there are some difficult conditions. Firstly *I would not like to give up my US citizenship - for it was the US that gave me conditions that made my work possible - conditions which I could not have got anywhere else.* Secondly, I am not a rich man. I would get a pension. We need money to travel to conferences, to meet my colleagues and my collaborators. I am told that the Indian tax laws are formidable.

I knew nothing about tax laws. I consulted the best people - the private and Government experts, I met persons at the highest levels. I was assured that Chandrasekhar could retain his US citizenship, even if he lives in India. They also assured me that they would take steps to see that he was exempted from paying tax during his life time. Even an annual grant could be given to RRI for the sole purpose for the maintenance of Lalitha and him and for his research, travel, etc., I conveyed all this to him. At that time he had finished his work on Black Holes and had started his work on the collision of gravitational waves.

In 1983 he was awarded the Nobel Prize. I wrote him a congratulatory letter - also saying that my children were ecstatic, RRI and indeed the whole country were thrilled about it. A month later in January 1984 he phoned me saying that he would be accepting my invitation to give the inaugural address at the Golden Jubilee of the Indian Academy of Sciences - and that he was preparing an essay specially for the occasion. I was greatly excited.

He also conveyed the sad news that after getting the Nobel Prize it would be ungracious and appear ungrateful if he leaves the United States. Again a perfect Gentleman! He went on to thank me for all I had done and apologized that all my efforts came to naught.

10. Conclusion

In conclusion I say :

"There were two faces of Chandrasekhar, the stern aloof, and difficult to approach person and the kindly charming laughing human being dispensing jokes and anecdotes".

"He had an inexhaustible supply of anecdotes - from his own association with scientists and from the history of science. He never repeated the same story to the same individual - For he had a phenomenal memory".

"Each time you talked to him he opened up a new door for you and you saw a new vista - a new surprise".

I was always flattered that he listened so intensely to one such as me. When I look back I shudder to think that I lived when he lived, that I knew him and he befriended me. For me this was the proof of the theory of Karma. I must have done something good long long ago.

About his science he said once "I work on my own for my personal satisfaction generally outside the scientific mainstream". It always became the mainstream a few years later. His earliest work led to the concept of the neutron stars and black holes. His survey of Brownian motion started new fields, many not at all related to astronomy. His concept of Dynamical Friction has become as much a part of the astrophysics vocabulary as the Chandrasekhar limit. With his work on Radiative Transfer, began a brand new field in mathematics called invariant embedding. His ellipsoidal figures of equilibrium have become important to fast rotating pulsars. One can go on and on.

His prescience in taking up any problem makes one gasp.

Believers would say - "he was touched by the hand of God - a touch that remained with him till he died". This of course would have made him very uncomfortable.

But there is a simpler explanation - for him doing science was like breathing. He did what he could not help doing - As the poet said.

"As in yonder valley the myrtle breathes its fragrance into space"