



On the occasion of 90th Anniversary of Discovery of Raman Effect

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C V Raman : The Aesthete Physicist

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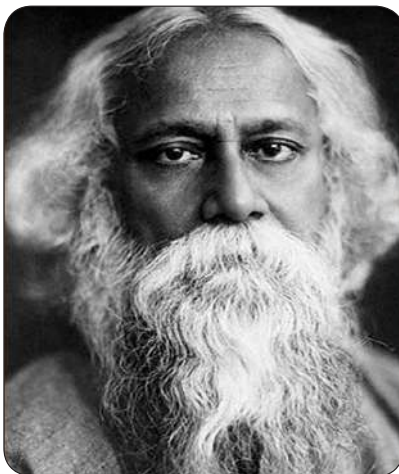
Chandrasekhara Venkata Raman—the living legend of science of 20th century—breathed science until he breathed his last in 1970. The other distinguished name that comes to my mind while writing about Raman is that of Gurudev Rabindra Nath Tagore whose heart beat for artistic pursuits all his life till his death in 1941. Although Tagore was born in 1861, 26 years earlier than Raman's birth in 1888, both of them lived into the 20th century when India was struggling against foreign domination and their world-astounding achievements buoyed and rejuvenated imperially suppressed India. The coveted honour, two Nobel Prizes, these representatives of Indian mind brought home infused fresh vitality and vigour into down-hearted Indian people fighting the battle for freedom. The international honour was conferred upon Tagore (Fig 1) in 1913, and then when in 1930 the second honour came, the whole of India watched on Raman (Fig 2) with bated breath, the wonder at Raman's achievement gave place to belief in prowess of Indian mind and Raman emerged as an internationally known physicist immediately after the discovery of the wonderful phenomena in the study of scattering of light. The honour deservedly bestowed upon Raman brought India in forefront of the commune of nations that prided upon their scientific achievements. The life story of this legend of science reads rather like fiction than real.

To Raman scientific research was not a career, but he so much enjoyed experimenting that his joy would turn into a passion like a poet's pouring out his heart into his work out of sheer joy of creativity. The pursuit was a single minded devotion, the means of realization of the ever evolving faculties of mind, the unfoldment of the urges of the soul, as an indispensable life activity as breathing. Raman's zest for scientific discovery tantamounted to, put it poetically, the Tennysonian spirit of inquiry for whom the known world is "an arch where through, gleams the untravelled world whose margin fades for ever and ever." Raman himself recounts how the ideals of selfless service to a great cause, the spirit of self-abnegation in the pursuit of a cause, the belief in invincible power of human endeavour remained for him the motivating force on the ideals of Gautam Buddha. In the words of Prof Raman :

the belief in the value of Human Spirit and the virtue of Human Endeavour and Achievement. When I read Edwin Arnold's classic, The Light of Asia, I was moved by the story of the Buddha's renunciation, of his search for truth, and of his final enlightenment. It showed one that the capacity for renunciation on the pursuit of exalted aims is the very essence of human greatness' [1].

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Rabindranath Tagore (7 May 1861 – 7 August 1941; Nobel Prize in Literature : 1913)



C V Raman (7 November 1888 – 21 November 1970; Nobel Prize for Physics : 1930)



K S Krishnan (4 December 1898 – 14 June 1961)(Co-Worker of C V Raman)

Imbued with the eye of the artist, probing ever the things beyond their surface and gifted with imaginative faculty of a poet, the beauty of nature captivated his heart and mind and he enjoyed being lost in the glories nature presents to man in her cycle of the sunrise and sunset and heart rupturing sights of clouds. His love of nature, verging on a poet's minute observation of her varied moods, comes akin to the versatile genius Leonardo Da Vinci's advocacy of the belief in immense faculties of Nature. Da Vinci—a painter, a sculptor, a thinker and a scientist, all rolled into one—speaks of power of Nature. “Kindly nature sees to it that you may find something to learn everywhere in the world.” Raman spoke of the wonders Nature presents to man :

The face of nature as presented to us is infinitely varied; but to those who love her, it is ever beautiful and interesting. The blue of the sky, the glories of sunrise and sunset, the ever shifting panorama of clouds, the varied colours of the forest and fields and the star sprinkled sky at night—these and many other scenes pass before our eyes on the never ending drama of light and colour which nature presents for our benefit [Ref 1].

The words quoted above show Raman's immense love of nature, afford a glimpse into the emotional side of his personality and are a fair index of the poetic felicity of expression he commanded. They call up to mind the following lines of William Wordsworth.

A lover of the meadows and the woods,
And mountains; and of all that we behold
From this green earth; of all the mighty world.

It is well said that a legend of science that Raman was, his personality as a physicist and visionary awestruck all who came in contact with him. The mystery behind his success still defies explanation. Nevertheless, it may be presumed, thanks to his profound appreciation combined with analytical faculty of glories of nature, his wonderful visual powers seem the primary reason behind the wonderful discovery he made. Raman, too, admits in one of his lectures how the acute understanding and minute observation of nature refines the vision of a scientist:

The man of science observes what nature offers with the eye of understanding, but her beauties are not lost on him for that reason. More truly it can be said that understanding refines our vision and heightens our appreciation of what is striking and beautiful [Ref 1].

Since Raman would often be spiritually and emotionally elevated while observing nature, he always felt lost amidst her charms. This so happened when he was aboard a ship on his first voyage to Europe in 1921. The incredible beauty of the Mediterranean bewitched him. It is worth remembering here that Lord Rayleigh attributed the blue colour of the sea to the reflection of the sky in the water. “He quenched the sky's reflection with a nicols prism at the Brewster angle and found that the blue colour far from being impoverished by the suppression of the sky reflection was wonderfully improved thereby” [Ref 1]. Raman on the strength of the above experiment disapproved the view held by Lord Rayleigh and wrote the famous monograph molecular diffraction of light in 1922. He found the plausible reason of the blue of sea water and demonstrated how the blue is due to molecular scattering and further explained the phenomena quantitatively that Smoluoehowski-Einstein fluctuations were its principal cause. In the monograph noted above “Raman says that if scattering of light is considered as a collision of light quantum with a molecule many concepts derived from the classical wave theory may be violated” [Ref 1].

It took Raman and the team of his talented students six years of persistent labour to discover these violations. The miracle discovery was reached on 28 February 1928. “It was shown that the light quantum and the molecule do exchange energy which manifests itself as a change in the colour of scattered light. (Sometimes the light quantum gave a part of its energy to the molecule to excite it and the quantum was scattered with diminished energy and at other times it was scattered with greater energy by acquiring some from the vibrating or rotating molecule) [Ref 1].

In the note of this **length** it is not possible to detail all scientific exploits of the man whose life's delight was the promotion, advancement and persuasion of research. Nor is it easy to recount the contribution the greatest Indian scientist made in his life time. The following observation simply hints at the wonderful work he did all his life. "On his formal retirement from IISc Bangalore, India; he established the Raman Research Institute in 1948. He trained scores of students, published scientific papers and monographs, founded the Indian Academy of Science in 1934, and carried on his personal research right upto his death in 1970 [Ref 1].

Nothing adverse at any phase in his life right from childhood could let down the fiery passion for academic pursuits the greatest physicist possessed. The blossom of genius bloomed at an obscure village Thiruvanaikkural near Thiruchirapalli in Tamilnadu in South India. Although born of poor parents, his father R Chandrasekhara was a teacher in local school and his mother Paravathi Ammal a simple housewife, the humble situation of the family could not impede him from scaling high academic heights that child Chandrasekhara Venkata Raman aimed. Still a lad of eleven, he completes matriculation and finishes 12th Standard at the age of thirteen. Before he joins Presidency College, Madras, he has read the popular lectures of Tyndall Farady and Von Helmholtz. The boy who has performed so splendidly well in studies joins the Presidency College shabbily dressed. Donning a dhoti in South Indian style, having walked to college bare footed, physically lean and thin, Raman looks an odd boy in his class. The professors soon find the boy superbly intelligent and free him from attending the routine class lectures. The time so saved is put to better use by his visiting libraries and keeping abreast with the latest research. "He works on acoustics and optics and published original papers in the The Philosophical Magazine and Nature. He corresponds with Lord Rayleigh who was then the President of the Royal Society" [Ref 1]. Around 1906, when he is still eighteen he passes the M.A. examination and he has won gold medals in Physics and English in graduation. Perturbed over how to earn a living he has to sit for the Financial Civil Service Examination and earns first position among the successful candidates. As an Assistant Account General, he does fairly well. Posted in Calcutta, he pursues his research before and after the office hours at the laboratory run by Indian Association for Cultivation of Science, Calcutta, India.

In 1919, he delves deep into research, guiding research students. He attends the Universities' Congress held in Oxford in 1921. From 1921 to 1928, Raman assisted by a team of superbly talented scientists, carries on his research and discovers the scattering of light, called Raman effect and wins laurels from the scientists all over the world and was awarded the Nobel Prize in 1930.

In 1933 Raman leaves Calcutta to become the Director of Indian Institute of Science, Bangalore, India. Raman's appointment to Directorship synchronised with the fleeing from Germany of the scientists under the tyranny of Hitler. Concerned over the lot of his fellow brethren and moved by the nobility of purpose so as to tap their talent for the benefit of the country, he offered the German scientists to settle in Bangalore. Max Born was appointed to an exalted Chair which he created at the Institute. His spirits of freedom were curbed and tamed out of the envy and demeaning politics having crept into the portals of academics. On the charge of wilfulness in inviting German scientists, and on other flimsy grounds he was forced to resign from the Directorship of the Institute and was retained as a Professor.

On retirement from the Indian Institute of Science he thought of a novel venture to build an institute for himself where he could enjoy *science*. With his hard earned life savings gone in a "south sea bubble investment," he collected money from public, and could see his vision of starting the institute come true. Adamant not to receive any largesse from the government, he started chemical units with the little saving he had on him so as to sustain the institute and the institute bloomed into a great research centre. No lure of power or office could ever corrupt the firm mind of this seer of science. He is said to have been offered the high office of Vice-Presidentship of India. The offer was declined saying "what shall I do with it."

The nominal support he was getting from the Government was refused as he prized his independence over any other consideration. When the offer was renewed through two ministers who visited the institute, he conveyed his feelings in clear terms: “Why do you want to despoil the only an oasis of freedom in the country” [Ref 1].

He had a strong wall made around the institute and had a signboard, with entrance prohibited for visitors written over it, installed. Thus he became embittered towards the government. The reason why he distanced away so from the government may reasonably be grasped. He saw his cherished vision of creating science movement thereby the promotion of indigenous talent through rigorous training under our scientists, come to nought, and what tormented his sensitive soul most was the fact how the bright young boys were being trained abroad at enormous cost! Raman felt his mission of life had been defeated as none in the country learnt from his personal example. The values he held close to his bosom were negated on purpose and he squarely blamed the establishment for the malaise. “My life, he once creid, ‘has been an utter failure.’ “I thought I would try to build science in this country. But all we have is a legion of camp followers of the West” [Ref 1].

It was in this phase that he broke off his connections with the West by resigning from the Royal Society of London.

Not free from the egotism more often than not a characteristic of gifted geniuses, Raman was an emotional personality. When angry he could rage as violently as a tiger and would weep like a child when overwhelmed with pity and compassion. Those who knew him from near still remember how he was swept away by emotions during one of the “Academy lectures when pictures were shown of children of our land suffering from nutritional ailments. He wept like a child. He had an incredible sense of humour and he could keep us roaring with laughter in just describing what could have been common place incident” [Ref 1].

Raman loved the common place matters not only in life, but also in nature. It would not be in oversimplification to state that his investigative imagination was set to working after he could probe the phenomena with mind’s eye with sensuous involvement. To sum up, the colossal figure in few words: “To Raman, scientific activity was the fulfilment of an inner need. His approach to science was one of passion, curiosity and simplicity. It was an attempt to understand. To him science was based on independent thought, combined with hard work. Science was personal endeavour, an aesthetic pursuit and above all a joyous experience” [Ref 1].

Reference

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Dr. G L Gautam, born in 1959 at a small village called Jatoi in Mathura District of U.P., India is currently Associate Professor and Head in the Department of English, at Lajpat Rai College Sahibabad, Ghaziabad. He was honoured with the title of a sincere and dedicated teacher by National Assessment and Accreditation Council. He publishes poetry both in Hindi and English. He has translated Hindi poetry of reputed poets into English. He has written a book on Mulk Raj Anand and has done a project on Raja Rao. He chaired an academic session at Lucknow University and presented a paper at Venice in Italy in 2008. His style of delivering the text of his research paper was appreciated at Oviedo University in Spain in 2017. Recently he has joined AJP as Language Editor.

