

Raman, a scientific genius



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It is customary for the Nobel Committee to announce the Nobel Prizes in October every year. Yet, way back in 1930, C.V. Raman took ship tickets for himself and his wife for Stockholm as he was confident that his research would fetch him the Nobel Prize that year. To his pleasure, his hope proved fruitful.

Important discovery

On February 16, 1928, Raman's research student K.S. Krishnan came running in joy to him. He told Raman, "Two new sub-lines are vaguely found at lower wavelengths in the spectrum." Subsequently, over the next couple of days, Raman repeated the experiment. Two new emission lines were found faint. They used a spectrometer to study the scattering of light after passing a single wavelength of light through a liquid of pure glycerin. Additional emission lines were seen in green color very clearly on February 27. That is, only a small fraction of light's wavelength has changed as it reacts to the glycerol

molecule. News of this discovery was published in 'Statesman' on the leap day of February 29, 1928. It is in commemoration of this discovery that we celebrate February 28 as 'National Science Day' in India.

Raman lines

A phenomenon known as 'Raman Effect', for which the Nobel Prize was awarded, is a manifestation of the quantum effect. Light of a specific wavelength can be considered as a light particle with specific energy - photon. A molecule is always in a state of vibration. The electron in it keeps oscillating back and forth. When the photon gets scattered, striking the electron of a molecule in a vibrational state, the energy of the photon will be in three states. Its energy may increase, decrease, or stay at the same level.

Most of the scattered photons have the same energy level. Hence bright emission lines will be seen in the spectrometer. Some will be scattered with an increased energy and some with a decreased energy. These appear as two new faint lines. The nature of these two lines depends on the molecule that causes the scattering of light. That is, these extra lines look like fingerprints of the molecule. These are called 'Raman lines'.

It was with the help of the Raman spectrometer examining the Raman lines that Chandrayaan-1 detected the presence of water on the moon. Cancer cells can be identified using the Raman spectroscopy. Thus the Raman Effect has been in use in fields ranging from medicine to remote sensing.

Progressive thinker

On an occasion Raman and Gandhi met and discussed God and religion. When Gandhi said religions helped unite people overcoming wars and conflicts, Raman countered it, saying, "If God exists, we must look for Him in the universe. If He does not exist in this universe, there is no use seeking out Him. Hence some call me an

atheist. It is not religion, but the scientific spirit that can unite people.” Despite the differences of opinion, Raman had great regard and admiration for Gandhi’s sterling qualities of honesty, simplicity, and ability to unite people.

When Kamala Bhagvat, popularly known as Kamala Sohonie, sought to join the Indian Institute of Science as a research student in 1933, Raman, the then director of the institute, refused to admit her, believing as he did that women could not carry out research work properly. However, Kamala persisted and persevered in her intention and finally got admitted to the institute. Later three female students studied under the tutelage of Raman. Yet all the same, Raman clamped certain restrictions on the environment of learning such as prohibition on man-woman interactions and conversations. Of course, he could not free himself from conventional thoughts. But over the years he began to get disillusioned with superstitious rituals and ceremonies. When he was on his deathbed counting his last moments, his wife asked him to recite a prayer, chanting the name of God, Raman told her in a tone of conviction, “Believe only in the humanity of Mahatma Gandhi, Christ, Buddha, etc.” He had asked that his mortal remains be consigned to flames very simply without unnecessary ceremonies on the campus of his Raman Research Institute.

Concern for development of Indian science

As the colonial British government had felt that Indians were not intellectual enough to carry out research, there were no research institutes in the country at that time. So Raman was working at the University of Calcutta when he was actively engaged with his research that would earn him the Nobel Prize. However, he was able to carry out his research in the voluntary organization ‘Indian Association for Cultivation of Science’ founded by freedom-fighter Mahendralal Sarkar with the financial support of the people with the goal of enabling Indians to carry on science research.

All scientists of the day including Raman knew that the future of Indian science lay in the success of the Indian Freedom Struggle. Although Raman was not directly involved in anti-colonial politics like Meghnad Saha, Raman felt that he too could contribute to the struggle for the nation's freedom in a non-political way. Creating competent and skilled scientists is also part of the freedom movement, which would help immensely in the nation's growth, he believed.

After winning the Nobel Prize, Raman was appointed as the first Indian Director of the Indian Institute of Science, Bangalore in 1934. Making the most of the opportunity, he took the initiative to encourage the immigration of scientists from Germany to India to develop Indian science. Jewish scientists and left-leaning scientists were under great threat during Hitler's Nazi regime and so Raman wanted to take advantage of the situation, believing that the presence of leading German scientists in India would be a great boon to India's development. He invited Max Born, who would later become a leading figure in quantum physics, to come to India. Born came to India in 1935 and wanted to stay in Bangalore to undertake research. But it did not materialize unfortunately, following objections from some British members of the Governing Council of the institute.

Several German scientists including Born, Einstein and so on migrated to the U.S. and served as catalysts in the amazing development of science in that country.

If only they had been allowed to stay and do research in India, history would have been different from what it is now.

February 28 marks the National Science Day.

Translated by V. Mariappan.