Sir Chandrashekhara Venkata Raman (C.V.Raman)

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- Raman was an **Indian physicist** who carried out ground-breaking work in the field of light scattering.
- He was **born on 7th November 1888** in Trichinopoly, Tamil Nadu.
- Because of his father's interest, he appeared for the **Financial Civil Services (FCS) examination** and topped it.
- In 1907, he went to Calcutta and joined as Assistant Accountant General.
- Meanwhile he **conducted research** at the Indian Association for the Cultivation of Sciences on the **areas of vibrations and acoustics.**
- He got an opportunity to join the **University of Calcutta in 1917, as the first Palit Professor of Physics.**
- He held the position of **permanent visiting professor at BHU.**
- On **28 February 1928, Raman led an experiment with K. S. Krishnan, on the scattering of light,** when he discovered what is called the Raman effect.
- It gave further **proof of the quantum nature of light.**

- The field of Raman spectroscopy came to be based on this phenomenon and **Ernest Rutherford referred to it in his presidential address** to the Royal Society in 1929.
- Raman was **president of the 16th session of the Indian Science Congress in 1929.**
- He won the **1930 Nobel Prize in Physics** "for his work on the scattering of light and for the discovery of the Raman effect".
- He was the **first Asian and first non-white to receive any Nobel Prize in the sciences.**

- In 1933, Venkatraman became the **first Indian director of the Indian Institute of Science (IISc).**
- In 1943, he started a company called Travancore Chemical and Manufacturing Co. Ltd. (now known as TCM Limited) which manufactured potassium chlorate for the match industry.
- In 1947, he was appointed as the **first National Professor** by the new government of Independent India.
- Raman retired from the IISC in 1948 and **established the Raman Research Institute in Bangalore in 1949.**
- He served as its director and remained active there until his death in 1970.

His works

Raman Effect: Raman conducted research about **light scattering in gases, liquids and solids.** He and his team used **monochromatic light** – sunlight that had been filtered to leave only a single color – and found that a variety of different liquids indeed changed the color of the light. They **first observed this in April 1923, but very weakly.**

When **light meets particles that are smaller than the light's wavelength, the light spreads in different directions**. This occurs when photons encounter molecules in a gas. In **1928** C.V.Raman discovered that a **small portion of the scattered light acquires other wavelengths than that of the original light.**

This is **because some of the incoming photons' energy can be transferred to a molecule, giving it a higher level of energy**. His team experimented to find a particularly strong color change in light scattered by glycerol. They observed the effect in gases, crystals and glass. In Raman's work the **light scattered by liquids was polarized, which ruled out the possibility of fluorescence.**

This phenomenon which came to be known as the **Raman effect – a**

color change accompanied by polarization, had never been seen before. The inelastic scattering was a very strong confirmation of quantum theory.

(A) Blue light approaches a molecule, and then (B) Lower energy green light leaves the molecule.

This is **inelastic scattering,** i.e. the light has given some of its energy to the molecule, causing it to vibrate more strongly. Only **about 1 in ten million photons undergoes inelastic scattering.**

Raman Spectroscopy (1929): Raman showed that the **energy of photons scattered inelastically serves as a 'fingerprint' for the substance the light is scattered from**. Raman spectroscopy is now commonly used in chemical laboratories all over the world to identify substances. It is also **used in medicine to investigate living cells and tissues, even detecting cancers** without causing harm. Laser light rather than sunlight is used as the source of photons.

Work on acoustics: Raman **worked on the acoustics of musical instruments.** He worked out the theory of transverse vibration of bowed strings, on the basis of superposition of velocities. He was also the **first to investigate the harmonic nature of the sound of Indian drums** such as the tabla and mridangam. He also investigated the **propagation of sound in whispering galleries.**

Raman-Nath theory: Raman and his student, Nagendra Nath, provided the correct **theoretical explanation for the acousto-optic effect** (light scattering by sound waves), in a series of articles. **Modulators, and switching systems** based on this effect have enabled optical communication components based on laser systems.

Other investigations carried out by Raman were experimental

and theoretical studies on the diffraction of light by acoustic waves of ultrasonic and hypersonic frequencies (published b/n 1934–1942) and those on the effects produced by X-rays on infrared vibrations in crystals exposed to ordinary light.

Honours:

- India celebrates **National Science Day** on 28 February of every year to commemorate the discovery of the Raman effect in 1928.
- He was elected a **Fellow of the Royal Society in 1924.**
- He was **knighted in 1929** for his discovery of the Raman Effect, becoming Sir Chandrasekhara Venkata Raman.
- In 1930 he won the **Nobel Prize** in Physics.
- In 1941 he was awarded the **Franklin Medal.**
- In **1954 he was awarded the Bharat Ratna.**
- He was awarded the **Lenin Peace Prize** in 1957.
- **He resigned from the Fellowship of the Royal Society in 1968 f**or unrecorded reasons, the **only Indian FRS ever to do so.**
- The American Chemical Society and the Indian Association for the Cultivation of Science in 1998 recognised Raman’s discovery as an **International Historic Chemical Landmark.**
- **Postal stamps** featuring Raman were issued in 1971 and 2009.