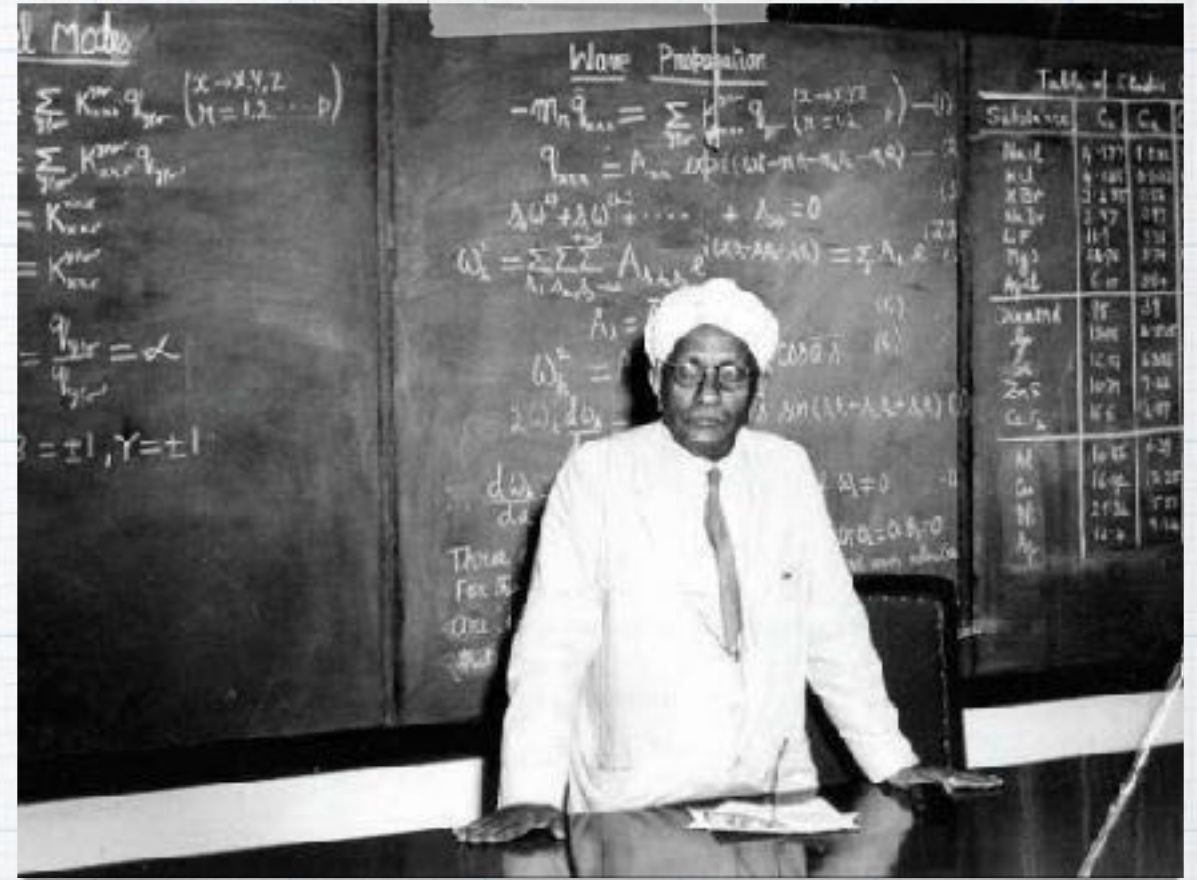
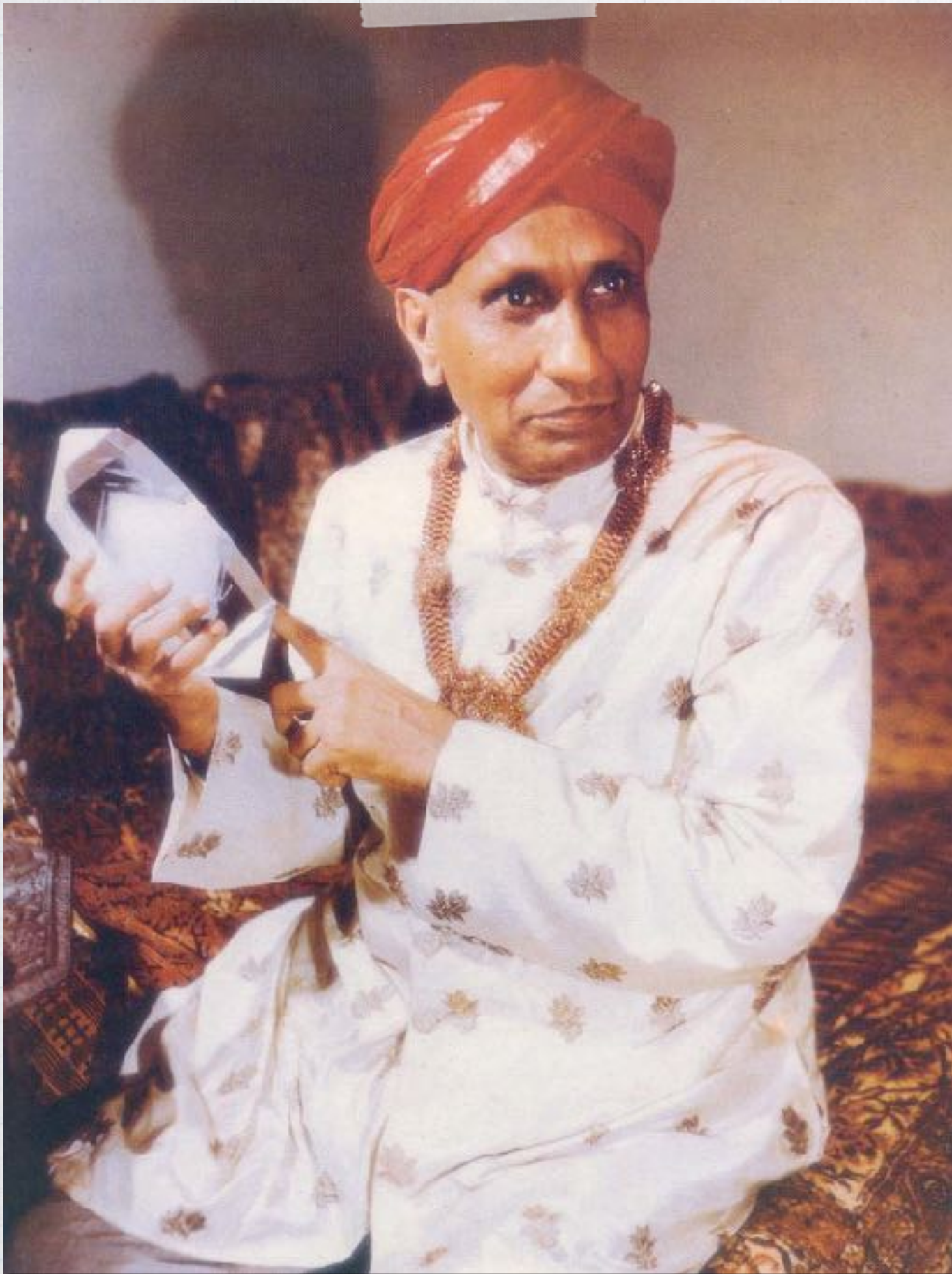


Prof. C.V. Raman



Professor Chandrasekhara Venkata Raman has been a great Acharya.

He created new knowledge, imparted knowledge to others, and nurtured young minds

several scientific fields — optics, X-rays, ultra-sonics, human vision, etc.

Professor Raraan is truly one of the most important
Builders of Modern India.

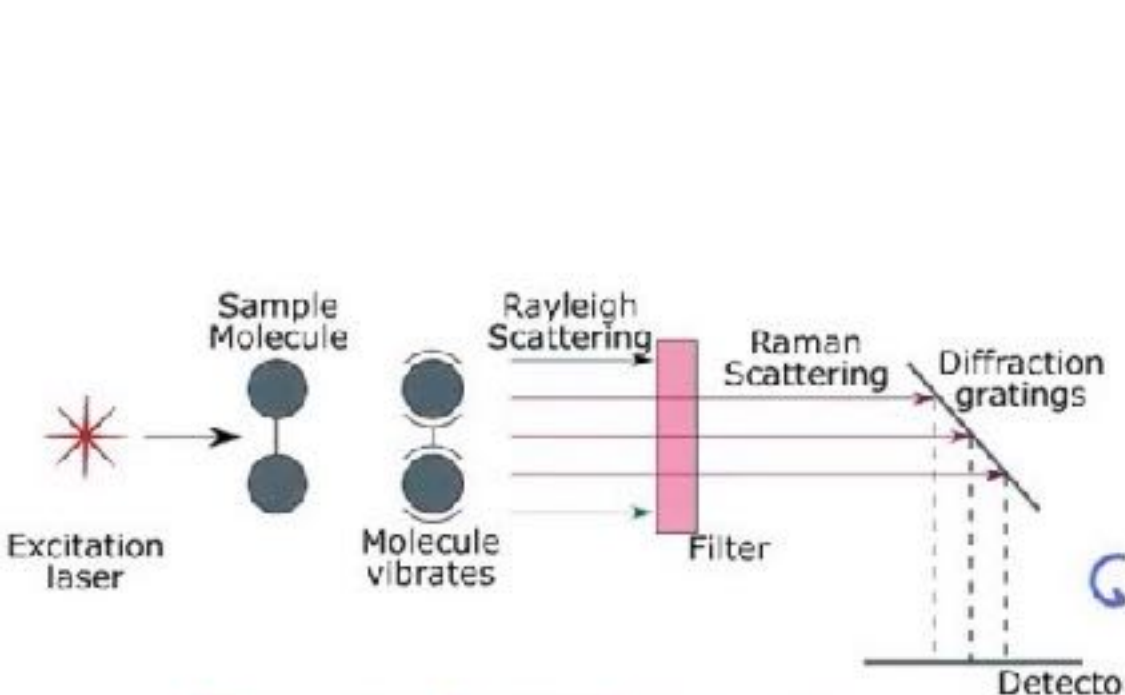
Born on November 7, 1888, at Thiruvanaikkaval, a small
village about 5 kilometres north of Tiruchirappalli in
South India

He won the coveted Nobel Prize for Physics in the year
1930 -

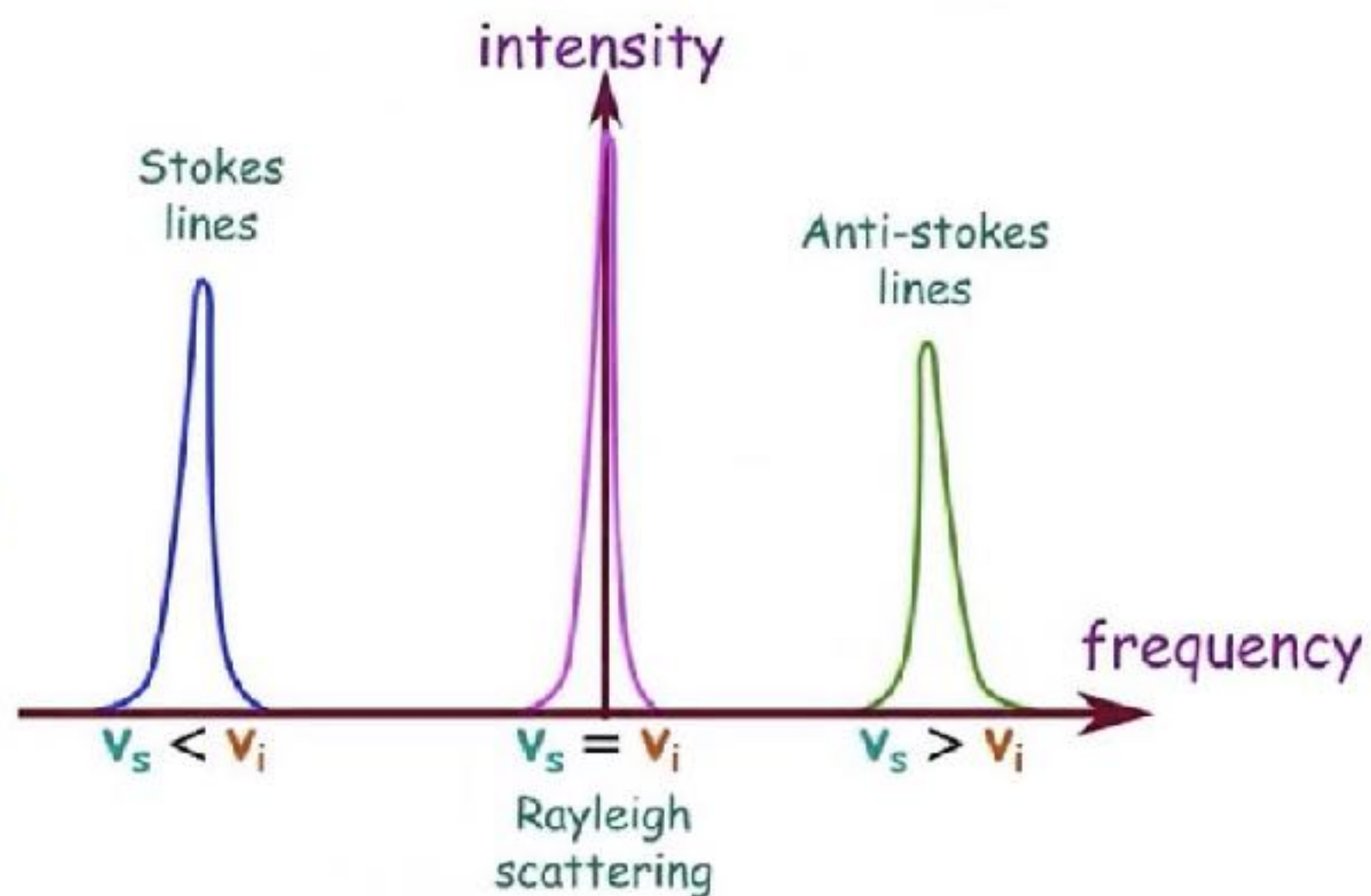
for the discovery of an Optical Phenomenon, later known as
the Raman Effect.

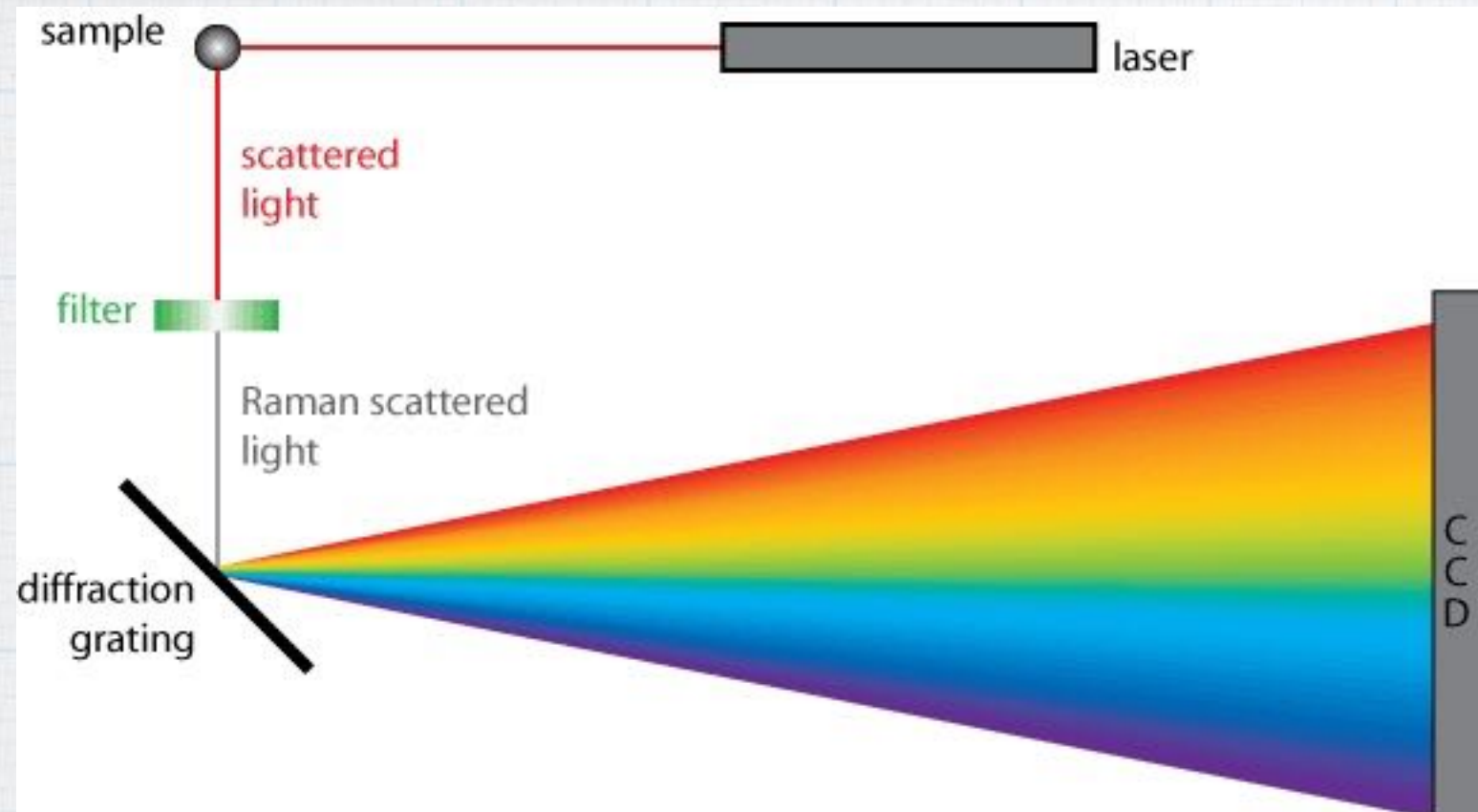
Raman Spectroscopy

Basics and Principles

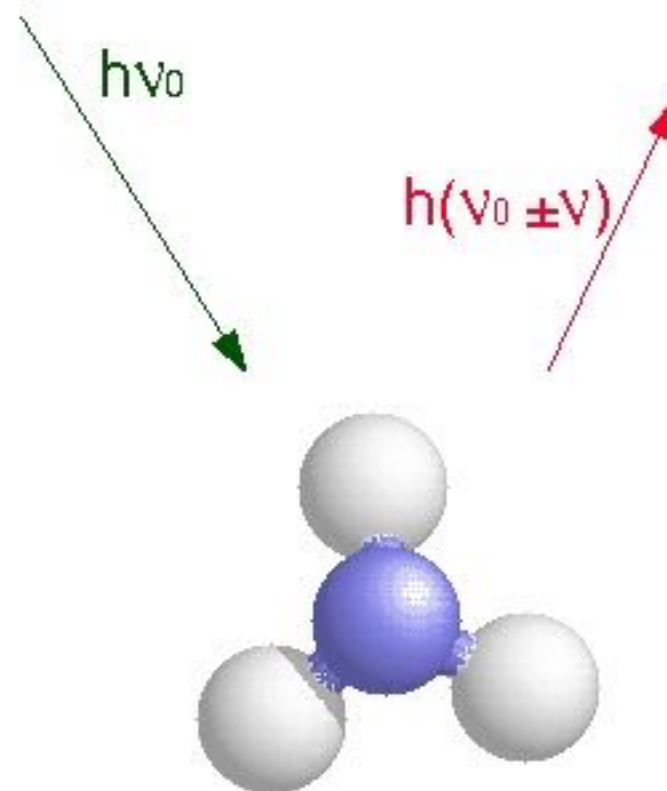


Raman Spectroscopy





What is the Raman effect?



- Raman and Krishnan, *Nature*(1928) 1930 Nobel prize.
- Predicted by Kramers, Heisenberg, Schrodinger, Dirac.
- Seen by Lommel (1878) and Wood (1928) before Raman's paper, but discounted.

- * Second Indian after Rabindranath Tagore to receive the much coveted Nobel Prize and the first Asian and first non-white recipient of the same in the sciences.

- * He was conferred a knighthood in 1929
- * Noble Prize for Physics in 1930
- * Bharat Ratna - the highest civilian award in India in 1954
- * Lenin Peace Prize in 1957

* The essay is an extract of a radio talk by Raman

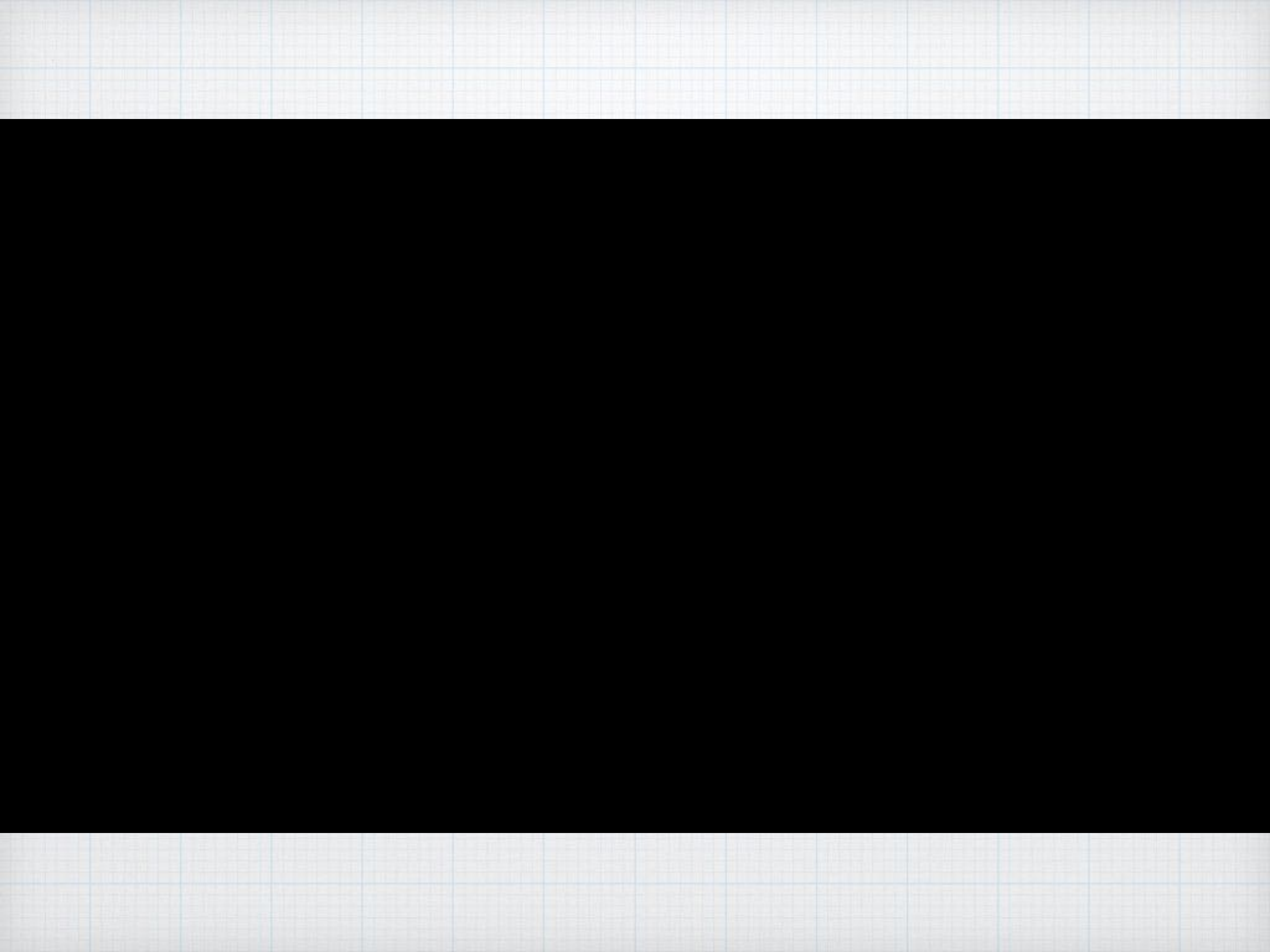
* Prof. Raman's view - Youthful spirit and outlook are the principal requisites for success in scientific research

- * The elderly and experienced scientists should function as torchbearers and provide ample opportunities, guidance and inspiration to the younger generation.

* Prof. Raman also refers to **science as the highest form of creative art**

* How?

* Scientists derive **inspiration from nature** and **fuses the aesthetic with the intellectual** to help the common man



IT IS CUSTOMARY in all branches of science to
associate the names of eminent men with the
facts and principles discovered by them which
form the foundations of the subjects.

Louis Pasteur -

Benjamin Franklin (1706-1790)

- 2 **Thomas A. (Thomas Alva) Edison** (1847-1931)
- 3 **Alexander Graham Bell** (1847-1922)
- 4 **Leonardo da Vinci** (1452-1519)
- 5 **Nikola Tesla** (1856-1943)
- 6 **The Wright Brothers**
- 7 **Orville Wright** (1871-1948)
- 8 **Wilbur Wright** (1867-1912)
- 9 **Guglielmo Marconi** (1874-1937)
- 10 **Robert Fulton** (1765-1815)
- 11 **Samuel Finley Breese Morse** (1791-1872)
- 12 **Eli Whitney** (1765-1825)
- 13 **Philo Taylor Farnsworth** (1906-1971)
- 14 **R. Buckminster (Richard Buckminster) Fuller** (1895-1983)
- 15 **Margaret E. Knight** (1838-1914)
- 16 **Steve Jobs** (1955-2011)
- 17 **Elijah McCoy** (1844-1929)
- 18 **William Kamkwamba** (1987-)
- 19 **Henry Ford**(1863-1947)
- 20 **Howard Hughes** (1905-1976)
- 21 **John Harrison** (1693-1776)
- 22 **James Watt** (1736-1819)
- 23 **Steve Wozniak** (1950-)
- 24 **Lewis Howard Latimer** (1848-1928)
- 25 **George Washington Carver** (1864-1943)
- 26 **Clarence Birdseye** (1886-1956)
- 27 **Jan Ernst Matzeliger** (1852-1889)

This practice is found to be useful since it helps to abbreviate and give precision to the terminology of science

It also serves **to commemorate the name and fame of the leaders of science** whose labours have helped to create a subject.

Indeed, this is how the student of science first gets to know the names of the great leaders in his subject.

The **touch of human interest** which the study of science gains in this way is of no small value, since it emphasises **the real nature of science** as a living and growing creation of the human spirit.

A study of the history of individual branches of science and of the biographies of the leading contributors to their development is essential for a proper appreciation of the real meaning and spirit of science.

They often afford much more stimulating reading than the most learned formal treatises on science.

To the teacher, such histories and biographies are invaluable.

Whenever he finds the attention of his listeners flagging a little, he can always enliven his class by telling a little story of how this or that great discovery in his subject was made or by recalling some anecdote about one or another of the famous investigators in the field.

In this way, the teacher can convey to the student an understanding of how science is made and of the intellectual outlook which is the essence of it.

What is meant by a scientific discovery? How is it made?

These are questions of perennial interest which are often asked and to which the most varied answers have been returned.

A **discovery** may obviously be either of a new fact or of a new idea.

It is clear however that an **unexplained observation** is of no particular significance to science.

An **idea unsubstantiated by facts** is equally devoid of importance.

Hence **to possess real significance a scientific discovery must have both an experimental and a theoretical basis.**

Which is more important ?

depends on the particular circumstances of the case, and a rough distinction thereby becomes possible between **experimental and theoretical discoveries.**

Rontgen's discovery of X-rays, for example, was clearly **an experimental one,**

while Planck's equally important discovery of the quantum of action was clearly in the field of theory.



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• Live



YouTube



The manner in which a scientific discovery is made and the attitude of the investigator which makes such a discovery possible are very different in the two cases.

This distinction between the **attitudes of the experimenter** and the **theorist is most obvious in the mathematical sciences.**

It is much less obvious in those sciences which rest more exclusively on an empirical foundation and in which **observation of facts and thinking about facts** are less easily separable processes.

The word **discovery** suggests a dramatic and exciting event, like **finding a fifty-carat diamond in a ploughed field**, for example.

The **history of science** is indeed full of such dramatic discoveries, **the drama and the excitement being particularly manifested in the personal behaviour of the scientist** immediately following the event.



I could tell one or two stories myself of such incidents in the life of a scientist.

The classic story is that of **Archimedes** who rushed into the street straight from his bath with nothing on, crying "**Eureka eureka**", when his famous principle of hydrostatics flashed into his mind.

ΣΥΡΣΚΑ!



Brucella 2007



Archimedes invented the term
'EUREKA'
in the BATHTUB.



The point of the story is the **intense emotion aroused by a sense of the overwhelming importance of the new idea.**

The joy and exaltation felt at such a moment are indescribable.

EUREKA! EUREKA! EUREKA! EUREKA!



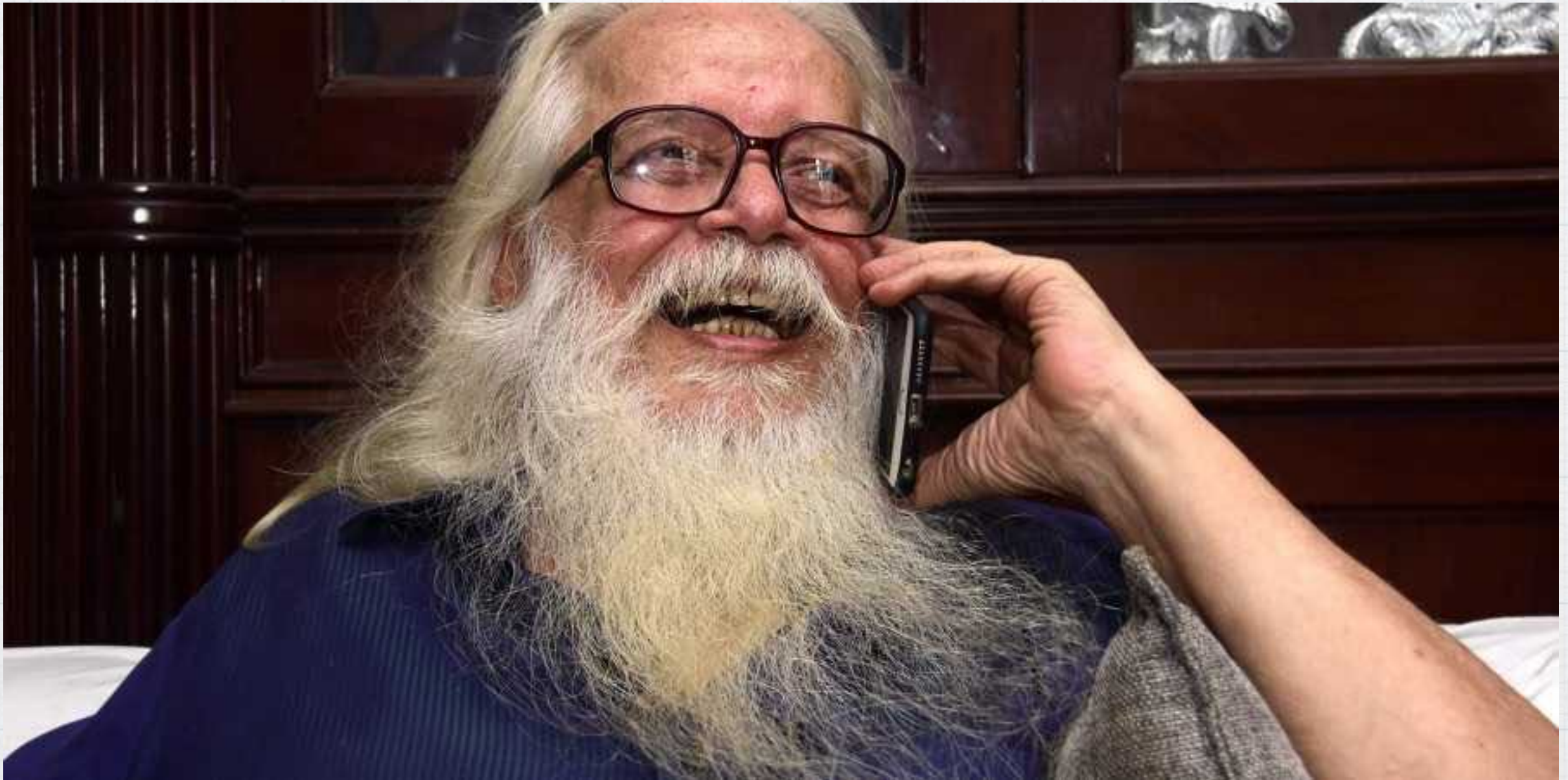
Indeed, **such dramatic moments come into the life** of even the most devoted follower of science but once or twice in his career.

They are the **greatest reward** of a lifetime spent in the pursuit of knowledge for its own sake.

Lesser discoveries come oftener and are a source of profound satisfaction and encouragement to the investigator.

But they do not make such soul-stirring drama.

It should be mentioned that the **reception given at first to even capital discoveries by the outer world is not always one of respectful admiration.**



One of the commonest ways in which the achievement is sought to be minimised by the unthinking or the envious is by **attributing it to accident or a stroke of luck akin to the winning of a lottery ticket**

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നോട്ടീസ്: ന്യൂനമൂല്യവർദ്ധനവ് ഉള്ള ഈ ലിസ്റ്റിന് കേരളാ പബ്ലിക് ലോട്ടറീസ് കമ്മീഷൻ അംഗീകാരം നൽകിയിട്ടുള്ളതാണ്. ഇതിന്റെ വിൽപനയും സാക്ഷാത്കാരവും സംസ്ഥാന ലോട്ടറീസ് കമ്മീഷൻ വഴിയാണ്.

Such comments are of course deplorable (disgraceful) and indeed quite meaningless.

The idea that a scientific discovery can be made by accident is ruled out by the fact that the accident, if it one, never occurs except to the right man.

The happy discoverer in science is invariably **a seeker after knowledge and truth working in a chosen field of his own and inspired in his labours by the hope of finding at least a little grain of something new.**

The **commentators** who like **to consider discoveries**
as accidents forget that the most important part of
a scientific discovery is the **recognition of its true nature by the**
observer, and this is scarcely possible **if he does not possess the**
requisite capacity or knowledge of the subject.

Rarely indeed are any scientific discoveries made except as the result of a carefully thought-out programme of work.

They come, if they do come, as the **reward of months or years of systematic study and research** in a particular branch of knowledge

If the **world is sometimes slow to recognise** the importance of fundamentally new experimental facts, it is not to be wondered at **if it is slower still in appreciating and accepting new theoretical ideas.**



Usually, such new ideas are looked upon with indifference or suspicion, and **many years of persistent advocacy and powerful observational support are required** before the investigator can hope to see his ideas generally accepted.

The story is often told of **Arrhenius and the doctorate thesis** which he presented to Stockholm University containing his **new ideas regarding the nature of solutions, supported by a great volume of experimental data.**



All that he received for his epoch-making work was a fourth-class degree permanently disqualifying him from an academic career.

Arrhenius happily **survived this experience**, and **lived to receive the Nobel Prize and to be venerated as his country's greatest scientist.**

But there are, unhappily, other instances of **youthful genius being repressed and completely suppressed as well.**

If there is one fact more than any other which stands out in the history of science, it is the remarkable extent to which **great discoveries and youthful genius stand associated together.**

Scores of instances can be quoted in support of this proposition.

Indeed, if one were to attempt to write a **treatise on any branch of science in which all discoveries made by youthful workers were left out**, there would be very little left to write about.

The fact of the matter appears to be that, other things being the same, **the principal requisite for success in scientific research is not the maturity of knowledge associated with age and experience, but the freshness of outlook which is the natural attribute of youth.**

The conservation (preservation) which develops with increasing age is thus revealed as a factor which militates (tend to prevent) against great achievement in science.

The great ideas seem to come most easily to youthful minds.

Since however much time is required to work out a new idea properly and fully, **age and experience are not altogether useless in science.**

Up to a certain point, the conservatism bred by age may even be useful as a **brake on the wilder flights of youthful imagination.**

Further even the elderly may, if they so choose, retain and cherish a youthful spirit and outlook.

So long, therefore, as **they do not allow the conservatism of age to function as a suppressor of youthful genius, the elderly may continue to find themselves useful as guides and inspirers of research**

On this view, indeed, **the principal function of the older generation of scientific men** is to discover talent and genius in the younger generation and to provide ample opportunities for its free expression and expansion.

So far I have said little about the **nature of the urge** which leads the elite few to devote themselves to science and live laborious days in its service.

This is a part of the larger question, **what is it that drives men to devote themselves to any type of idealistic activity?**

I think it will be readily conceded (acknowledge, accept) that the **pursuit of science derives its motive power from what is essentially a creative urge.**

**The painter, the sculptor, the architect and the poet,
each in his own way, derives his inspiration from
nature and seeks to represent her through his chosen
medium, be it paint, or marble, or stone, or just well-
chosen words strung together like pearls on a
necklace.**

The man of science is just a student of nature and **equally derives inspiration from her.**

He builds or paints pictures of her in his mind, through the intangible medium of his thoughts.

He seeks to resolve her **infinite complexities into a few simple principles or elements of action** which he calls **the laws of nature**

In doing this, **the man of science**, like the exponents of other forms of art, **subjects himself to a rigorous discipline, the rules of which he has laid down for himself and which he calls logic.**

The pictures of nature which science paints for us have to obey these rules, in other words have to be self-consistent

Intellectual beauty is indeed the highest kind of beauty.

Science, in other words, is a fusion of man's aesthetic and intellectual functions devoted to the representation of nature.

It is therefore the highest form of creative art.

