

The Raman Effect—75 Years

'If we assume that the X-ray scattering of the 'unmodified' type observed by Prof. Compton corresponds to the normal or average state of the atoms and molecules, while the 'modified' scattering of altered wavelength corresponds to their fluctuations from that state, it would follow that we should expect also in the case of ordinary light two types of scattering, one determined by the normal optical properties of the atoms or molecules and another representing the effect of their fluctuations from their normal state. It accordingly becomes necessary to test whether this is actually the case. The experiments we have made have confirmed this anticipation and shown that in every case in which light is scattered by the molecules in dust-free liquids or gases, the diffuse radiation of the ordinary kind, having the same wavelength as the incident beam, is accompanied by a modified scattered radiation of degraded frequency.'

— C. V. Raman and K. S. Krishnan, Communicated 16 February 1928
[A new type of secondary radiation, *Nature*, 1928, **121**, 501 (31 March 1928)]

'Further observations by Mr Krishnan and myself on the new kind of light scattering discovered by us have been made and have led to some very surprising and interesting results. . . . Using sunlight with a blue filter as the illuminant, the modified scattered radiation was readily detected by the appearance in the spectrum of the scattered light of radiations absent from the incident light. With a suitably chosen filter in the incident light, the classical and modified scatterings appeared as separate regions in the spectrum separated by a dark region.'

— C. V. Raman, Communicated 8 March 1928
[A change of wavelength in light scattering, *Nature*, 1928, **121**, 619 (21 April 1928)]

Raman discussed the origin of the frequency shift in a lecture at Bangalore on 16 March 1928 while inaugurating the South India Science Association at the Central College.

'... such a possibility is already contemplated in the Kramers-Heisenberg theory of dispersion. If we accept the idea indicated above, then the difference between the incident and scattered quanta would correspond to a quantum of absorption by the molecule. The measurement of the frequencies of the new spectral lines thus opens a new pathway of research into molecular spectra, particularly those in the infra-red region.'

Source: G. Venkataraman, *Journey Into Light*
Indian Academy of Sciences, Bangalore, 1988, p. 211.



Reproduced from *C.V. Raman – A Pictorial Biography*, Indian Academy of Sciences, Bangalore.

NEW THEORY OF RADIATION — PROF. RAMAN'S DISCOVERY

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CALCUTTA, Feb. 29.

Prof. C. V. Raman, F. R. S., of the Calcutta University, has made a discovery which promises to be of fundamental significance to physics. It will be remembered that Prof. A. H. Compton of the Chicago University was recently awarded the Nobel Prize for his discovery of the remarkable transformation which X-rays undergo when they are scattered by atoms. Shortly after the publication of Prof. Compton's discovery, other experimenters sought to find out whether a similar transformation occurs also when ordinary light is scattered by matter and reported definitely negative results. Prof. Raman with his research associates took up this question afresh and his experiments have disclosed a new kind of radiation from atoms excited by light.

The new phenomenon exhibits features even more startling than those discovered by Prof. Compton with X-rays. The principal feature observed is that when matter is excited by light of one colour, the atoms contained in it emit light of two colours, one of which is different from the exciting colour and is lower down the spectrum. The astonishing thing is that the altered colour is ~~quite~~ independent of the nature of the substance used. It changes however with the colour of the exciting radiation, and if the latter gives a sharp line in the spectrum, the second colour also appears as a second sharp line. There is in addition a diffuse radiation spread over a considerable range of the spectrum. He will deliver a lecture demonstrating these phenomena first at Bangalore on the 16th March.

◀ First newspaper announcement of the Discovery of the Raman Effect made on 28th Feb. 1928