SIR C. V. RAMAN AS A MAN OF SCIENCE AND HIS INTEREST IN GEOLOGY

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AMONG the leading savants who have held aloft the torch of science in India and added to its lustre by their own outstanding contributions, and enabled it to shed its light far beyond the confines of our country, the name of Sir C. V. Raman will ever occupy an honoured position. He belongs to that galaxy of scientists who appear on the scene, in the history of science, from time to time, and who are remarkable not only for their own direct contributions in their special subjects, but more so for enlarging the scope of their studies and opening out new lines of enquiry by their far-sighted vision and versatile outlook, thus leading to co-ordinated research in different directions so as to make our knowledge of science more complete and comprehensive. They stand out for all time as the beacon-lights which guide and illuminate these new pathways of science; and their greatness, far from being dimmed by the passage of time, actually grows as the years pass by, and we begin to recognise more and more fully the magnitude and importance of their fundamental contributions; and even long after they have disappeared from the scene, their memory will continue to serve as a perennial source of inspiration to the younger men.

Sir C. V. Raman was a specialist in Physics; but he was not the kind of scientist whose specialisation ultimately resulted in his knowing 'more and more about less and less' even in his own subject. He was one of the great master minds who maintained that all scientific endeavour should be to try and succeed in effacing the conventional lines which we often draw between subject and subject and thus 'compartmentalise' them. He firmly believed that all science is one and indivisible, and its ultimate objective should be to 'unite and not 'divide' knowledge.

With his most versatile outlook, Dr. Raman developed, apart from physics, a keen attachment to all other branches of science, in several aspects of which he was greatly interested as a physicist. What attracted him to these other subjects was the opportunities they gave him to express his love and admiration of "Colours in Nature"—their origin and perception—in the fundamental understanding of which he was so involved as a man of science and which ultimately led him to his famous work on the "Physiology of Vision".

Sir Raman's contacts with geology started with his absorbing interest in the colours of minerals. He was struck by the endless variety in colour and lustre exhibited by minerals; and he soon set about making a thoroughly representative collection of these from all parts of the world, now seen as the most beautiful part of the Museum in the Raman Institute. 'Diamond' was the mineral which first attracted his attention by its many unique crystallographic and optical properties; and this became the subject of his very intensive research as a physicist for several years, resulting in the publication of several monographs of the greatest value and importance. He retained his interest in this mineral till the last, and had got together one of the best collections of 'natural diamonds'. He took a special interest in the geology of the diamond mines of India; and only a couple of years back he gave a most illuminating lecture on this subject.

Apart from the diamond, the other minerals which attracted his special attention were those which exhibited the most striking optical features like 'iridescence', 'fluorescence', 'opalascence', and 'play of colours'. He studied these phenomena as a physicist and offered new explanations for these optical effects. Sir Raman was always willing to address gatherings of geology students, and was a frequent 'lecturer' at the meetings of the Geological Society of the Central College, where his very presence was a source of inspiration to all of us.

Any geologist who, like the present writer, had opportunities of meeting Sir C. V. and talking to him intimately about recent developments in any aspect of geology,—as for instance, micropalaeontology which is so far removed from physics—was soon struck by his amazing capacity to follow all that you said with a clear insight into the nature of your problems; and he would soon follow up by putting a number of questions of a fundamental character in the concerned field which were most thought-provoking and immediately opened out an altogether new outlook in your approach.

Sir C. V. Raman was not merely a 'physicist'; he was a true 'scientist' in the widest and fullest sense of the term. He had an endless curiosity to probe into and unravel the mysteries of Nature in all their diversity and the results of his scientific work have therefore an enduring impact on all branches of science; and it is only natural that all scientists will remember him with the highest reverence, regard, affection and goodwill.

PROFESSOR RAMAN—THE ARTIST-SCIENTIST

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Early Interest in Music

IF one were to summarise Professor Raman's life as a scholar, one would say that he was a scientist to the core. Science was the only thing that mattered to him and the pursuit of scientific enquiry was the one dominating impulse that led him through all his life. Even in science, Raman had always been fascinated by the beautiful part of it; beauty not only in the theory, but also in the objects and phenomena which he studied during his researches. It is not surprising that the earliest studies taken up by Raman were in the field of musical acoustics. Starting from the monumental work of Helmholtz, he devoted his time to the study of musical instruments, the quality of their tone and the theory of production of the musical tone by these instruments. His classical work on the theory of bowed strings is well known, and it is not at all surprising that the editors of the *Handbuch der Physik* chose Raman to write the article for them on "Musical Instruments and Their Tone" (1927).

Molecular Scattering of Light

The study of acoustics is intimately connected with the study of vibrations and waves, and it is not surprising that Raman's interests passed from his early love for acoustics on to a life-long devotion to optics, the other great domain of classical wave mechanics. In fact, if one may talk of a unifying trend in the scientific work of Raman, it may be said to reside in the study of wave phenomena. His very first paper, which he published as a young student when he was a teen-ager, studying in the bachelor's degree class of his college, was devoted to the diffraction of light. In fact, diffraction is nothing but the result of the interaction of optical waves with material media, and this one aspect has dominated Raman's researches right from 1914 to the very end of his life. When he was called to take up the chair of Physics in Calcutta, he devoted his time immediately to the study of the diffraction of light by the molecules in a continuous medium, and came out with his first monograph on the "Molecular Diffraction of Light" in 1922. It was this interest in the interaction between light and matter that led him to study this subject in intimate detail during the decade of the 1920's, and which culminated in the celebrated discovery of the scattering (or diffraction) of light with change of frequency, which is known as the Raman Effect, in 1928.

Photon-Phonon Interactions

The fact that the diffraction of light by a continuous medium is associated with the existence in it of acoustical waves, traversing the medium in all possible directions, was also enunciated during the 1920's, and this phenomenon is known after the name of Leon Brillouin, the well-known French scientist. Raman was fascinated by this type of interaction between one wave and another and sought to establish the possibility of there being a change in frequency of the light wave as a result of its interaction with the thermal sound wave in the medium. During the 1930's, a number of papers appeared from the Raman School in Bangalore in which this change in frequency was demonstrated by interferometric methods.

At about the same time, Raman realised that the same theory which explains the scattering of light as the interaction between light waves and thermal sound waves, in which the sound waves are incoherent and are going in all directions, could also be developed to take care of the coherent diffraction of light waves by sound waves. This phenomenon was observed in Germany in the early 1930's with