Preface

C.V. Raman did many things during his life. He started and ran research institutions; he established and published scientific journals and persuaded scientists of India and abroad to publish in them; he established an Academy to encourage talented scientists; he gave popular lectures in schools and colleges and inspired youth to devote themselves to science; he fought anything he felt was a threat to the self-respect and self-reliance of the country and he did all this with gusto. But all these activities were subsidiary to his one real pre-occupation and passion – that of doing science. The pursuit of science was the one basic reason for his existence. Nothing else really mattered. From 1905 to 1970, day in and day out, he did science. For 35 years, when his intuition was at its peak, his science was almost unmatched. His intuition did decline later but not so his passion for science. Altogether he published 475 papers and wrote 5 monographs on topics so varied that one's mind boggles.

Given this range of interests, it would clearly have been a difficult task to organise a conference where one attempted to recall his numerous outstanding contributions; nor would it have been appropriate. Instead, the RAMAN RESEARCH INSTITUTE felt that the best way to commemorate the centennial of its founder was to hold an international conference on WAVES and SYMMETRY. These topics not only excited him, but underlay his thinking throughout his scientific career. Raman was fascinated by wave phenomena even from his youngest days. A few examples may be worth citing.

The common drum with a uniform membrane is musically defective as it cannot produce harmonics. Raman showed that the Indian concert drums – the Mridangam and the Tabala – are true musical instruments which produce at least five harmonics because the membrane is centrally loaded (see page 1016). In the hands of an outstanding player, it can be played like a stringed instrument. He showed that the Indian veena and tambura violate the Young-Helmholtz law because their bridges are curved. Raman's *magnum opus* in this field is, of course, *"The mechanical theory of bowed strings of the violin family"*, and it is cited by acousticians even today, 75 years after it was written. One cannot but marvel at his experimental skill in producing vibration curves of great precision and sharpness much before the triode valve or the condenser microphone were invented.

The obsession he had for the beauty of the haloes around the sun and the moon when seen through a thin cloud of water droplets resulted in the discovery of the "speckle" phenomenon, as early as in 1919 (the cover shows speckles in white light). Replacing light by X-rays and droplets by molecules which are closer together, he developed the theory of diffraction of X-rays by liquids. Replacing the molecules by electron clouds, he derived for the first time the X-ray structure-factor of an atom. And allowing for the cloud of electrons moving, he was able to derive on a classical basis the "Compton effect formula".

The picture on page 1153 shows the similarity between periodic precipitates in Nature and the wave phenomenon. It had already been attributed to a diffusion wave, but Raman gave substance to this analogy by actually detecting in these precipitates, the existence of phase relationships in the form interference and diffraction effects.

The mathematics introduced by Raman and Nath to deal with the diffraction of light by ultrasonic waves was used twenty years later for the multiple beam dynamical theory of electron diffraction. The first qualitative statement of the presently accepted theory of the scintillation of stars as due to random corrugations of a plane wave front arriving from a distant star due to density variations in the atmosphere was given by Raman. It is interesting also that he made detailed studies of the not-too-well-known ability of the unaided eye to detect polarised light as bees do. And there are many more examples. His deep interest in gems and minerals, birds and butterflies, exemplified his passion for understanding symmetry in nature.

The Symposium on WAVES and SYMMETRY was not intended to recall his numerous contributions to the field, but to see where the frontiers of the subject lay today. The scene has shifted from linear phenomena connected with waves and their interactions to nonlinear phenomena. One of the paradigms of physics today is that *broken* symmetry has many more important consequences than symmetry itself. The distinguished speakers at this Symposium have addressed a very wide variety of topics ranging from phenomena in the microscopic world to the Universe at large. A certain unity in this diversity can be discerned. Sadly, conferences like this are no longer common today. We felt, therefore, that it would be worth publishing these lectures, because as a collection it is somewhat unique.

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