Editorial

N Mukunda, Chief Editor

The ushering in of the quantum revolution in physics during the first quarter of this century occurred in three fairly distinct phases. The first phase began with Max Planck's discovery of the radiation law bearing his name in 1900. It then saw Albert Einstein introduce the photon concept in 1905, and use quantum ideas to tackle the problem of specific heats in 1907. In 1909 he also pointed out for the first time the existence of complementary wave and corpuscular aspects of radiation. All these developments and insights came out of statistical considerations.

Then after the discovery of the nuclear atom by Ernest Rutherford around 1911, the problem of the stability of matter took centre stage. This was the clear focus for Niels Bohr's work – applying Planck's and Einstein's ideas to the mechanics of the atom, and leading to his atomic model. Bohr's work made immediate contact with the extensive field of spectroscopy, and led to an explanation of Balmer's formula for the spectral lines of hydrogen and a calculation of Rydberg's constant. It also inaugurated the second phase of the quantum revolution, and led to the so-called Old Quantum Theory. This lasted till about 1924 by when its limitations and internal problems became acutely evident. Along the way came important contributions from Arnold Sommerfeld, and again from Einstein in his theory of stimulated and spontaneous emission.

The third phase began in summer 1925 with Werner Heisenberg's discovery of matrix mechanics, followed in early 1926 by Erwin Schrödinger's wave mechanics. Soon there was a mathematically well-elaborated quantum mechanics – subsuming the earlier matrix and wave versions – ready to be applied to a wide variety of problems.

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Werner Heisenberg

It is useful to go over this brief recapitulation of the growth of quantum mechanics, to properly appreciate the magnitude of the life work of Linus Carl Pauling, whom we feature in this issue. As is well appreciated, quantum mechanics was the result of a wholly European effort. Pauling visited Europe soon after, in 1927, and had direct contacts with many masters – Sommerfeld, Bohr, Pauli and Schrödinger. Around this time Robert Oppenheimer and Isidor Rabi also came to Europe to complete their training, to take back the new physics to the US, and to create a first rate school of physics there. Julian Schwinger, Richard Feynman and many others came out of this enterprise.

The time was ripe for the application of the new quantum mechanics to chemistry; it was inevitable. The first steps had been taken by Walter Heitler and Fritz London in Europe. In his article-in-a-box, J Chandrasekhar describes how much Pauling did, and how far he went, in creating quantum chemistry, indeed much of modern chemistry. One does wonder how it happened largely in the US rather than in Europe itself, the birth place of quantum mechanics. And in looking at Pauling's pivotal role, one is reminded of these thoughts from Heisenberg's essay on 'Tradition in Science':

"Looking back upon history in this way, we see that we apparently have little freedom in the selection of our problems.... our choice seems to be restricted to the decision whether or not we want to participate in a development that takes place in our time, with or without our contribution ... the scientist has not much choice in selecting his problems ... one may say that a fruitful period is characterised by the fact that the problems are given, that we need not invent them."

Upon reflection, we realise that in cases such as Pauling's this cannot be the whole story! He, like Rutherford, created the waves over which he rode. His name truly belongs up there with all the pioneers of quantum mechanics.