Prizewinners in Physics and Chemistry

Luis W. Alvarez

THE award of this year's Nobel prize for physics to Professor Luis Alvarez, Associate Director of the Lawrence Radiation Laboratory at Berkeley, will come as no surprise to those familiar with the history of elementary particle physics. Although he had many notable achievements in more than thirty years' work on fundamental particles, it is undoubtedly the contribution he made to the development and exploitation of the modern hydrogen bubble chamber that gained him his standing with the Nobel Committee.

Luis Alvarez is very much an American. His forceful manner coupled with a sense of loyalty towards his colleagues have enabled him to push many of his ideas to a fruitful conclusion where others would have foundered. His present role as a bustling plane-owning Californian well reflects the open-minded drive that has hallmarked his success.

The bubble chamber was originally invented by Professor Glaser in 1952—a feat for which he was also awarded a Nobel prize—but it was the work of Professor Alvarez in developing the larger hydrogen bubble chambers that opened the way to studying the interactions of elementary particles on a large scale. He was undaunted by the severe engineering problems that had to be overcome to maintain large volumes of hydrogen in the uniform conditions necessary for high energy experiments, and although chambers of up to 15 feet are now being planned, his original design of one about six feet in length was a great advance. He also foresaw that still larger bubble chambers would require on-line computational facilities to translate the wealth of data accumulated in an experiment into a manageable form, and many of the modern techniques of stereoscopic measurement involving rotating mirrors and other optical set-ups were originated by him.

Much of this work was carried out in the mid nineteen-fifties. Before the Second World War, Professor Alvarez was involved in the discovery of several new isotopes. He studied several elements that underwent beta-decay, including investigating the transition from nitrogen-17 to oxygen-16, and he also established that the process predicted of K-capture by Dirac's theory of the positron, where a nucleus captures a K-shell electron instead of decaying, did indeed occur in vanadium-48.

Professor Luis Alvarez.

Professor Lars Onsager.

At the end of the war, Alvarez built the linear proton accelerator at Berkeley, and in 1946 he took up a professorship at the University of California at Berkeley. Since then he has worked at the Lawrence Radiation Laboratory, situated on the hill above the Berkeley campus with a panoramic view over Oakland and San Francisco. It was in this setting that his work on bubble chambers was pursued and brought to fruition.

Lars Onsager

IT is said that news of the award of a Nobel prize for chemistry to Professor Lars Onsager of Yale University reached his wife by telephone during the recent meeting of the National Academy of Sciences at the California Institute of Technology. When told the good news by a newspaper reporter, Mrs Onsager is said simply to have asked "In physics or chemistry ?" This is not just a token of the ubiquity of Professor Onsager's contributions to thermodynamics and to statistical mechanics but also a reflexion of the style of his scientific work, which is as dry and economical as any Willard Gibbs—also a Yale professor—could have asked for.

Onsager is a Scandinavian by extraction, but has lived in the United States since childhood. He is distinguished as a teacher, but has also two distinctive pieces of work to his credit. The first of these consists of a series of theoretical arguments about the relationships which exist between the parameters which determine such things as rates of flow in non-equilibrium systems in a steady state. The second is the work which Onsager carried out, in the years immediately after the Second World War, to calculate the properties of a so-called Ising lattice—a two-dimensional net of points on which are placed two-valued elements—magnetic dipoles, for example—capable of interacting with each other. This model and elaborations of it have since become a familiar model for the calculation of order–disorder transitions—the ferromagnetic transition, for example. The so-called "Onsager problem", still unsolved, is that of calculating analytically the properties of a three-dimensional lattice when the elements placed at the lattice points can interact at least with their nearest neighbours.

Onsager's contributions to thermodynamics of flow processes are of great practical utility in treating problems involving the maintenance of transport phenomena by the influence of more than one kind of driving force. One simple case, for example, is the flux of some molecular species under the combined influence of its chemical potential and the chemical potentials of other molecular species. It is an entirely formal step to suppose that when the fluxes are not too great, each of them is determined by a linear relationship of the form

$$J_i = -L_{ik}\mu_k$$

where J_i is the flux of a species labelled i and L_{ik} are constants. Onsager's contribution has been to show that there is a certain symmetry expressed by $L_{ik}=L_{ki}$ and then to demonstrate how this can be applied in a variety of physical problems. This work undoubtedly played an important part in the development of non-equilibrium thermodynamics during the fifties.

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