

which were used to study the properties of charmed particles with short lifetimes. He also saw the EHS as a bridge for the users to facilitate the transition from bubble chamber physics to counter-based physics, since he realised that the future of high energy physics was mainly in storage rings.

The proposal by Carlo Rubbia to turn the SPS accelerator into a proton-antiproton colliding beam facility was very strongly supported by Léon Van Hove since he realised immediately that the great strength of CERN's machine builders would enable European high energy physics to lead the world through the possible discovery of the intermediate vector bosons. During the early stages of this proposal, he worked tirelessly behind the scenes in convincing the more conservative accelerator physicists and engineers that this speculative project was much more important than extending the energy of the SPS as a fixed target accelerator, the current thinking at that time. He also supported the idea of having two major experiments and was instrumental in the decision to have a small simple exploratory experiment to look for new forms of matter suggested from cosmic ray events at very high energies.

The idea that CERN should enlarge its programme of physics by building electron-positron colliding beams was somewhat foreign to the CERN tradition and again it was Léon Van Hove who played a key role in preparing the groundwork for the decision to build LEP. The fact that the tunnel circumference is its present size is directly attributable to him, since at one stage many senior scientists believed that LEP should be built only to produce the Z boson otherwise the project could not be approved.

Léon was adamant that it was crucial to study the production of charged boson pairs and to make the ring as large as possible since he felt that the long term future of CERN lay in hadron colliders, and it was important to invest in tunnel estate for future generations of physicists. How right he was!

He maintained close links with his theoretical colleagues and continued to publish papers on his own theoretical ideas. It was as a result of this work that he was in a very strong position to support the 'gamble' of searching for quark-gluon plasma in high energy nuclear collisions. Relativistic heavy ion collisions are now a major part of the CERN programme and the odds will be further shortened by the introduction of a lead-ion source.

I was very fortunate to have worked closely with Léon Van Hove when he invited me to take up the post of EP Division Leader in 1978. He was well informed, always doing his homework, and had a very clear vision of the future direction of particle physics. He had a great sense of humour and was very warm-hearted despite his tough exterior. I remember on one occasion he was making a presentation to a group of journalists on how the CERN neutrino programme involved four large detectors, two counter experiments and two bubble chambers, situated one behind the other. One of the journalists asked him why the detectors were on an inclined plane. He stopped and Adolf Minten stepped in to explain that the protons were underground. Léon threw back his head, laughed loudly and explained to the group that he was not an experimentalist.

There is a saying 'behind every great man there is a good woman'. In Léon's case that was certainly

true. An evening spent at the Van Hove apartment with its excellent view over Geneva was always entertaining and stimulating due to the charm and kindness of Jenny Van Hove.

Léon was a passionate man, who believed strongly in scientific collaboration across national and international boundaries. He was chairman of the Scientific Directorate of the Max Planck Institute for Physics and Astrophysics in Munich from 1971 to 1974 and played a key role in the interface between CERN, the European Southern Observatory (ESO), and the European Space Agency (ESA). He was unique in that he was an outstanding theorist, a leader of science, and a first-class administrator who used all his skills in the pursuit of excellence. His death is a great loss to European Science as he had much more yet to do.

Physics and astronomy

by L. Woltjer

Good fortune made me meet Léon Van Hove nearly 30 years ago. A.D. Fokker, the relativist, was in the habit of from time to time inviting the Dutch theoretical physicists for a weekend at his home near Apeldoorn in the Netherlands; I had been invited to talk about some aspects of plasma physics remote from the interests of the other participants. I still vividly remember Léon's curiosity about subjects so far removed from his own research fields, his quick grasp of the essentials and his broad culture in physics.

Our ways crossed again in 1975 when I became Director General of

From notes prepared by Léon Van Hove for his talk at the meeting of the American Physical Society when he received the Heine-mann Prize. 1 – a representation of the intermolecular potential producing the 'good' behaviour for N going to infinity and two gas-liquid diagrams, one in agreement with Van Hove's Theorem and one violating it. 2 – the frequency distribution of a crystal, with a certain number of singular points, and the associated torus.

ESO – the European Southern Observatory. At that time the scientific-technical departments of ESO were located on the CERN campus. To see if everything was running smoothly between the two organizations we had an annual directors' meeting, and rarely have the business parts of the meetings been as short as those. Léon was always ready to provide assistance whenever possible; but it was also clear that astrophysics had begun to be part of his very broad interests.

Unfortunately, European politics decided that ESO had to leave CERN in 1980, just when scientific developments brought physics and astronomy much closer. At the inauguration ceremonies of the new ESO headquarters in Garching in 1981 Léon gave a review of 'Particle Physics in the Early Universe'. It is a pity that this beautiful lecture has been published in a relatively inaccessible book 'Evolution in the Universe' (ESO, 1982). Long before 'particle astronomy', as he called it, became popular, he gave a concise account of the subject that even today has lost none of its actuality.

'By necessity, work on early cosmology is highly speculative, and so are the recent theoretical developments in particle physics. Detailed considerations have to choose among many possibilities, and arguments of simplicity or even of taste are bound to come frequently into play. But the history of some recent discoveries, like the weak neutral-current interaction and charmed particles in high energy physics or neutron stars and the cosmic background radiation in astrophysics, has reminded us of the fact that even very daring scientific speculations deserve to be taken seriously.'

It was not Léon's style to make

The free energy of a classical system

Given the free energy of a system of N particles, F , calculate the free energy of n particles nF

$$F(V, N, T) = N \phi\left(\frac{V}{N}, T\right)$$

Mathematical significance:

$$\phi(V, N, T) = \int d\vec{r}_1 \int d\vec{r}_2 \dots \exp\left(-\frac{1}{kT} \sum_{i,j} v(r_{ij})\right)$$



$$\log \phi = -\frac{E}{kT} - \frac{3}{2} N \ln \frac{2\pi m}{h^2}$$

$$\frac{1}{N} \log \phi(V, N, T) \rightarrow p(r, T)$$

$$\frac{V}{N} \rightarrow v$$

Thermodynamic limit. Proof also implies $p = kT \frac{\partial \log \phi}{\partial v}$ density function



Extension to quantum case not carried out yet.

wild speculations, but he certainly had the taste needed 'to choose among many possibilities'.

It was only natural that when CERN and ESO decided to create a series of 'ESO-CERN Symposia', Léon Van Hove (together with Giancarlo Setti) undertook the task of organizing these. Three highly successful symposia resulted (1983 at CERN, 1986 at ESO, 1988 in Bologna).

European astronomy is indebted to Léon in many ways. He participated very actively in the creation of the 'Horizon 2000' long term programme of the European Space Agency which he later served as chairman of the Science Programme Committee. His profound and critical insight in so many aspects of physics, his vision tempered by realism and his natural au-

thority made a large impact on 'Horizon 2000' which for the first time gave Europe a long term view of its future in space science.

It was with much justice that the University of Bologna when celebrating its 900th anniversary awarded him a Laurea Honoris Causa in Astronomy. On that occasion he said 'Twenty-eight years ago I left university teaching to join CERN, the European Laboratory for High Energy Physics. Somewhat surprisingly, it is at CERN that I fully realized the importance of the universities for the advancement of science, because, as I discovered, it still is the university system which best provides the lasting intellectual symbiosis between research and learning, between eager students and experienced teachers, a symbiosis which is the lifeblood

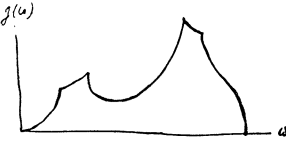
$$\lim_{\epsilon \rightarrow 0} \frac{1}{\epsilon} \int_{-\epsilon}^{\epsilon} \delta(E_2 - E_1) | \langle \psi | V | \psi \rangle |^2 dE_1 dE_2$$

$$\lim_{\epsilon \rightarrow 0} \int_{-\epsilon}^{\epsilon} \delta(E_2 - E_1) | \langle \psi | V | \psi \rangle |^2 dE_1 dE_2$$

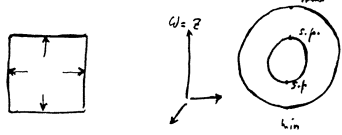
$$\lim_{\epsilon \rightarrow 0} \int_{-\epsilon}^{\epsilon} \delta(E_2 - E_1) | \langle \psi | V | \psi \rangle |^2 dE_1 dE_2$$

In determining the law of variation of the structural properties of a crystalline phenomenon

4th problem Harmonic crystal
 Elastic frequency distribution



frequency as function of wave vector $\omega = \omega(\vec{k})$
 periodic $\omega(\vec{k} + n_1 \vec{e}_1 + n_2 \vec{e}_2 + n_3 \vec{e}_3) = \omega(\vec{k})$
 A periodic function of 3 variables has at least
 a minimum ($\frac{\partial \omega}{\partial \vec{k}} = 0$)
 a maximum
 6 saddle points (Theorem of Harnack)
 (In 2 variables: 1 min, 1 max, 3 saddle points)



Conclusion: Power of mathematics to throw some light on natural phenomena
 has made a discovery in physics and chemistry possible
 Still mathematics is off with some beauty in other questions
 This is how hard to illustrate in our lecture
 (The beautiful and mysterious power
 common in quantum case not carried over yet.)

E. P. Wigner
 "The unreasonable
 effectiveness of mathematics
 in the natural sciences"
 Rev. General Relativity 9:194
 Comm. Pure and Applied Math
 XIII (1960)

of scientific progress.' Also at CERN, Léon Van Hove was an experienced teacher who could clarify complex issues in simple terms and who took pleasure in doing so. The European physics and astronomy communities have lost one of their most distinguished members.

A gifted teacher

by N.M. Hugenholtz

Notwithstanding his many and important papers on basic problems in physics, it may well be that Léon Van Hove's influence on the physics community is in a large part due to the fact that he was a gifted and devoted teacher. It is perhaps unfortunate that the period of his life during which he was a university professor and gave basic train-

ing to young students in theoretical physics was rather short. Nevertheless those six years at the University of Utrecht from 1954 to 1960 left a lasting impression on physics in the Netherlands. Many Dutch physicists still remember his classes on Statistical Mechanics, Quantum Mechanics and Field Theory. He as no other mastered the art of organizing a subject and then presenting it with extreme clarity, without hiding the difficulties. No wonder that his lecture notes on these subjects were much in demand. When in 1960 Léon decided to accept a position at CERN, the University of Utrecht hastened to offer him an extraordinary chair so that the physics community in the Netherlands could continue to profit from his talents.

Of course his role as a teacher

was not restricted to teaching young students. There are many physicists in Holland and elsewhere who learned essential parts of their speciality in either Statistical Mechanics or Particle Physics from the advanced courses Léon presented all over the world. For many years after he had left Utrecht he returned regularly, first to Utrecht, and later to Nijmegen to give courses on advanced subjects. In the spring of 1982 he was Lorentz-Professor in Leiden. These were occasions where all Dutch physicists would meet to enjoy his lectures and learn about the latest developments in particle physics. The topics he chose for these lectures were not his personal hobbies but they were what he considered to be the most significant developments in the field. He presented these subjects clearly, elegantly and with no more mathematics than strictly necessary. One always came home after such lectures wishing to learn more. It is no wonder that he was always a welcome speaker in Les Houches and other summer schools.

However there was another, even more important, aspect to his teaching. I profited most from my personal interaction with Léon. He taught me how to do research. I remember the period I worked for my PhD in Utrecht under his guidance as most stimulating due to our daily discussions. He helped, made suggestions, criticized and all that in such a way that a lasting friendship developed. I know that many others had such experiences during one phase or another in their scientific career. They have fond memories of the many discussions they had with Léon, mostly but certainly not always about physics, and always leading to better understanding.