

KONINKLIJKE NEDERLANDSE AKADEMIE VAN
WETENSCHAPPEN

BIJZONDERE VERGADERING
DER AFDELING NATUURKUNDE

OP ZATERDAG 27 JUNI 1953, DES NAMIDDAGS 3½ UUR,
VOOR DE PLECHTIGE UITREIKING DER LORENTZ-MEDAILLE

Voorzitter: A. J. KLUYVER

Secretaris: M. W. WOERDEMAN

De plechtige bijzondere vergadering wordt te 3½ uur geopend, waarna wordt overgegaan tot de uitreiking der LORENTZ-medaille aan Prof. Dr FRITZ LONDON van Duke University in Durham (N. C.) U.S.A.

Aanwezig zijn de leden der Akademie, Afdeling Natuurkunde, de echtgenote en familieleden van de begiftigde, familieleden van wijlen Prof. LORENTZ, zomede verschillende autoriteiten en verdere genodigden, waaronder talrijke buitenlandse natuurkundigen, voorts verschillende Nederlandse hoogleraren in de natuur- en scheikunde en andere beoefenaren van deze takken van wetenschap.

Nadat de heer LONDON en zijn echtgenote tegenover de bestuurstafel hebben plaats genomen, houdt de voorzitter de volgende toespraak:

Dames en Heren,

Ik open deze bijzondere vergadering der Afdeling Natuurkunde van de Koninklijke Nederlandse Akademie van Wetenschappen en heet U allen welkom.

Uiteraard geldt dit welkom in bijzondere mate diegenen onder U, die de Akademie de eer aandoen als gast deze plechtige samenkomst bij te wonen. In hun aanwezigheid hier ter plaatse zien wij een stille hulde aan de nagedachtenis van de man, wiens naam is verbonden aan het zo aanstonds uit te reiken eerbewijs. Maar tevens leeft in onze gasten ongetwijfeld mede het verlangen getuige te zijn van het ogenblik, waarop het hoogste Nederlandse wetenschappelijke college zijn hulde betoont aan een befaamd buitenlands geleerde, Dr FRITZ LONDON.

Waar het hier geldt een burger van de Verenigde Staten van Amerika te eren, schenkt het ons bijzondere voldoening, dat ook van de zijde van de officiële vertegenwoordigers van deze natie van belangstelling in deze gebeurtenis wordt blijk gegeven.

His Excellency, the Ambassador of the United States, has informed

us of his regret that other duties prevented him from accepting our invitation to attend this ceremony. His Excellency informed us that Dr MARSHALL SWAN, Cultural Officer of the Embassy, would be here as his representative, but owing to unforeseen circumstances Dr SWAN was at the last moment prevented to act as such.

In the meantime it is a great privilege for me to welcome here the United States Consul General in Amsterdam.

Mr VAN DEN AREND, we all realize that a consul's tasks are both multifarious and strenuous. To us scientists it is, therefore, particularly gratifying that you have succeeded in harmonizing your activities in such a way that science is not excluded from your sphere of interest. We are most thankful for your presence at this occasion.

De Minister van Onderwijs, Kunsten en Wetenschappen berichtte ons, dat Zijne Excellentie tot Haar leedwezen verhinderd is aan onze uitnodiging gevolg te geven. Ook onzerzijds betreuren wij dit ten eerste, doch het strekt ons tot voldoening, dat Gij, Mijnheer WIJFFELS, hier zijt gekomen om er getuigenis van af te leggen, dat ook aan de hoogste bestuursinstelling op het gebied der wetenschap deze hoogtijdag in het Akademie-leven niet onopgemerkt voorbij gaat.

Mijnheer de Commissaris der Koningin in de Provincie Noord-Holland, reeds enige malen mocht ik van deze plaats uitspreken, hoe zeer de Akademie Uw warm medeleven in haar verrichtingen op prijs stelt. Het zal voor U als oud-medewerker van LORENTZ wel een grote voldoening zijn, dat Gij in Uw kwaliteit van President-Curator der Leidse Universiteit in zo belangrijke mate hebt kunnen bijdragen tot de grote internationale belangstelling, waarin de plechtigheid van heden zich mag verheugen. De Akademie is er U voorts ten eerste erkentelijk voor, dat U door Uw aanwezigheid aan deze plechtigheid meerdere luister hebt willen bijzetten.

Alors c'est pour moi un privilège tout particulier de pouvoir souhaiter la bienvenue au Professeur CHARLES MANNEBACK, représentant de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique. Je puis lui assurer que nous apprécions hautement que la plus ancienne des Académies belges a bien voulu nous donner un témoignage de ses sentiments bienveillants en laissant se représenter à cette occasion.

Mijnheer VAN ITTERBEEK, sinds korte tijd is in U als het ware een personele unie belichaamd tussen de Koninklijke Vlaamse Academie voor Wetenschappen, Letteren en Schone Kunsten van België en deze Akademie. Ik vertrouw, dat U in de eerstvolgende bijeenkomst van onze Vlaamse zusterinstelling uitdrukking zult willen geven aan onze bijzondere erkentelijkheid voor het feit, dat ik U hier thans als haar vertegenwoordiger mag begroeten.

Mijnheer de Rector Magnificus der Vrije Universiteit en Mijnheer de wvd. Rector Magnificus der Gemeentelijke Universiteit, als steeds bij gelegenheden als deze stelt de Akademie het op hoge prijs, dat Gij door Uw aanwezigheid hebt willen getuigen van de geestelijke banden, welke

er tussen de door U gerepresenteerde instellingen en de Akademie bestaan. Tezamen toch dienen wij de wetenschap en vormen daardoor in de structuur van Amsterdam een element, dat daarin sinds eeuwen aanwezig is en daarin ook niet straffeloos zou kunnen worden gemist.

Het verheugt de Akademie voorts in hoge mate, dat ook ditmaal de uitreiking van de ter ere van HENDRIK ANTOON LORENTZ geslagen medaille mag geschieden in tegenwoordigheid van verschillende van zijn familieleden. Ook hun roep ik hier een hartelijk welkom toe, dat in het bijzonder uitgaat naar Mevrouw DE HAAS-LORENTZ en ons medelid DE HAAS, die de grote geleerde niet alleen in de familiekring doch ook als vakgenoot zo na hebben gestaan. Wij allen hopen, dat zij in de plechtigheid van hedenmiddag andermaal het bewijs zullen willen zien, dat de nagedachtenis van LORENTZ in de Akademie in onverzwakte mate voortleeft.

Mevrouw KRAMERS, Uw aanwezigheid hier ter plaatse roept weemoedige herinneringen op aan de laatste uitreiking van de LORENTZ-medaille thans vijf jaren geleden. De Akademie waardeert het in hoge mate, dat Gij ook thans van Uw medeleven in deze voor haar zo belangrijke gebeurtenis blijk hebt willen geven.

The circumstance that this year exactly a century has passed since LORENTZ's birth lends a special character to the present ceremony. It induces me to testify once more — and this time in the sacred surroundings in which LORENTZ himself has so often led and beneficially influenced the debates — of the great debt the Academy owes to its former and incomparable president. Elsewhere I had the opportunity of dwelling upon the invaluable services LORENTZ has rendered to the Academy; I shall not repeat this here. But I may not omit to stress that the convocation in commemoration of both LORENTZ and KAMERLINGH ONNES which was initiated by Leiden University is responsible for a most gratifying feature of our present gathering.

For it is to this commemoration that we owe the presence of so many distinguished foreign physicists amongst the audience. It is impossible for me to welcome them all personally, but I feel certain that nobody will feel hurt, if I make an exception for two of them.

Your astonishingly many-sided and brilliant life-work, Professor BOHR, so completely devoted to theoretical physics, justifies my statement that the mere fact of your presence sheds a special lustre on this occasion. The Netherlands physicists all owe you a great debt. Several of them — to whom I also may reckon the LORENTZ-medallist of five years ago, our beloved colleague KRAMERS whom we so grievously miss here — have received from you a stimulus which may have been largely responsible for their successful career as a scientist.

Then I should also like to tender a special word of welcome to Professor PAULI of Zürich. Quite apart from his great scientific merits he has a right to our special attention, because he is the only one present on whom the LORENTZ-medal has been conferred in earlier years. I still

remember very well how 22 years ago Professor EHRENFEST in one of his characteristic and enthusiastic addresses digressed on the merits of the scientist who enriched theoretical physics by his "Pauli-Verbot".

In the meantime I hope that all foreign guests — also those whom I did not mention by name — will be convinced that the Academy feels greatly honoured by their willingness to attend this ceremonial meeting.

Now at last the moment has arrived that I may address myself to the cynosure of our convocation.

Doctor London,

I bid you a hearty welcome in our midst, and I may perhaps add at once that we are happy to see here also Mrs LONDON who more than anybody else is entitled to be a witness to the tribute paid to you.

I feel absolved from the duty to dwell upon the circumstances which have led to the foundation of the LORENTZ-fund in 1926. I need only remark that it was at once decided that part of the revenues of the fund should be reserved for the institution of a gold medal which the Academy should confer every four or five years on a scientist who had distinguished himself by contributions of special merit in the field of theoretical physics. The arduous task of assigning this scientist was entrusted to a committee to be appointed by the Academy.

Until now the medal has been awarded five times. It seems to me, Dr LONDON, that the names of the preceding medallists are particularly suited to throw a clear light on the value of the distinction which this time falls to your share. In chronological sequence they are: MAX PLANCK, PAULI, DEBYE, SOMMERFELD and KRAMERS.

It will, Dr LONDON, undoubtedly give you a special satisfaction to receive a honour previously bestowed on your former master, Professor SOMMERFELD. As for the Academy there is reason for a twofold satisfaction. Firstly because this is the first time that the name of a citizen of the United States is added to the list of honour. But secondly because this very name is in literature so often intimately linked with that of our unforgettable VAN DER WAALS.

It is not up to me to give here a survey of the considerations which have led the committee to its decision. I am happy that I may leave this to Professor KRONIG, the president of the committee, who is particularly qualified for this task.

I, therefore, now call upon Professor KRONIG.

Dear London,

When the committee that chooses the recipient of the LORENTZ medal delegated to me the task of addressing you at the present occasion, I discovered that this task was made both easy and attractive by a circumstance which certainly was not premeditated. I refer to the fact

that all your salient contributions to physics have a close bearing on fields of research in which scientists of this country have played a very predominant rôle.

In looking over the past I recall our first meeting at Munich in the summer of 1925 where, as a pupil of SOMMERFELD, you had directed your attention to the interpretation of the intensities in the band spectra of diatomic molecules. On the general problem of the intensities in atomic or molecular spectra, regarding which only qualitative predictions could at that time be made at the hand of BOHR's correspondence principle, new light had been shed by the measurements of ORNSTEIN and his collaborators at Utrecht who had arrived at the surprising conclusion that in certain cases the intensities of spectral lines are in the ratio of small integers. As I myself, in part together with GOUDSMIT, had been much interested in this question for the case of atomic multiplets and their ZEEMAN components, you and I immediately had a point of common interest, and I recall with pleasure an instructive evening spent at your rooms.

The development of quantitative intensity rules was only a first and very slight step in the transformation of the old quantum theory with its many shortcomings into quantum mechanics as we know it to-day. When this transformation had been completed in the years 1925-1927, it became possible to attack a number of problems that until then, by reason of the lack of appropriate general principles, had defied the efforts of the theoreticians. It is in this period that your investigations fall which illuminated a concept also closely associated with the work of a Dutch scientist. I refer to the concept of the homopolar chemical bond which in the hands of VAN 'T HOFF many years previously had become so powerful a tool in the classification of chemical compounds and the interpretation of their properties.

This concept, in spite of its wide range of applicability, had from a more fundamental point of view remained very obscure until you, jointly with HEITLER, in 1927 published your classic paper on the interaction of two hydrogen atoms in their ground state. The fact that you directly recognized the saturation of valencies as a consequence of the exclusion principle of PAULI paved the way for the extension of the theory from the simplest prototype of molecule formation to chemical forces in more complicated systems. Further theoretical investigations in which you took an active part allowed to refine the rough valency concept of the chemist and to make also the exceptions to the general rules amenable to theoretical treatment. In particular the application of the methods of group theory, employed by you already at an early stage, proved very helpful in dealing with the interaction of atoms containing many electrons. The foundations were thus laid for incorporating theoretical chemistry into physics by letting chemical affinity appear as the result of the elementary electrostatic interactions between the atomic nuclei

and electrons of which all matter is composed. In principle the chemical behaviour of any atom could now be predicted by computation, although the mathematical difficulties involved in most cases are great and often practically insurmountable.

Large is the tree of knowledge which has grown from the seed you have sown twenty-five years ago. The concepts of directed valencies, of distributed valencies in ring configurations and many other fertile notions which had been introduced intuitively by the chemists on the basis of extensive experimental evidence have found their proper place in the ramifications of this tree, so that to-day your name is surely as well-known among chemists as among physicists.

While in the problem of the interaction between atoms the strong chemical forces called in the first place for an explanation in the frame of modern atomic theory and quantum mechanics, once this problem was solved in principle it was natural to attempt a discussion also of weaker and therefore less striking effects of interatomic action that had been known already for a long time. In his work on the behaviour of gases as a function of pressure and temperature VAN DER WAALS was led already in the last century to postulate between two gas molecules, next to short range repulsive forces connected with their finite volume, attractive forces of longer range, now commonly known under the name of VAN DER WAALS attraction. It are these forces which make possible the condensation of gases like hydrogen, nitrogen or oxygen, formerly called permanent, because in the early days they defied liquefaction. The nature of these forces, which appear in pure form where valency forces clearly are absent, such as between the atoms of the rare gases, had long remained a puzzle.

Extending your previous work by taking into account second order perturbations in the quantummechanical treatment of the interacting atoms you were able to demonstrate the VAN DER WAALS attraction as the result of the same elementary forces between atomic nuclei and electrons which in first approximation are responsible for the valency forces. Going beyond the investigations of your predecessors who had to base their conclusions on experimental data, only indirectly and statistically related to the basic interactions between pairs of atoms or molecules, you were able to derive from first principles the dependence on the distance of the attractive forces as well as their absolute magnitude. The understanding thus gained has been very helpful in a large number of related fields. I mention here only the discussion of the crystal structure of the gases mentioned before when brought into the solid state and the theory of adsorption of gases on solid surfaces. It may truly be regarded as a fitting circumstance in this connection that the ceremony giving recognition to-day to your scientific work takes place in the city of Amsterdam, where VAN DER WAALS did most of his work, in the presence of the official representatives of province and town as well as of the local academic life.

The next chapter in the story of your achievements introduces a new subject, also dear to science in the Netherlands. The phenomenon of superconductivity, discovered at Leiden in 1911 by KAMERLINGH ONNES, has now throughout more than forty years kept physicists here and abroad busy both on the experimental and theoretical side. It was only natural that with the arrival of quantum mechanics attempts were soon made to apply the new principles to the interpretation of electrical conduction in metals, for which LORENTZ and DRUDE at the beginning of the century had laid the first foundations. While the phenomena of ordinary metallic conduction soon yielded to the attack of the theoreticians, at least as far as their more essential features are concerned, it gradually became apparent that the problem of superconductivity is one of particular difficulty, all the early attempts at a kinetic interpretation having failed completely. On the other hand from the growing experimental evidence a number of features emerged one by one which prepared the ground for a novel approach. Thus the important experiments of MEISSNER and OCHSENFELD showed that in the inside of a superconductor not only is it impossible to maintain an electric field, but that in addition the magnetic induction vanishes. From here it was only a step to the notion that, at least in pure materials, the passage from the superconducting to the ordinary state of a metal by application of a magnetic field and vice versa is in fact a reversible process. Supported by thermodynamic arguments due to RUTGERS, CASIMIR and GORTER, this notion soon became more widely accepted and led to the conviction that instead of directly attempting an interpretation of superconductivity on an atomistic basis it might be more fruitful to begin by casting the newly gained experience into the form of phenomenological laws, differing from those that describe the electric and magnetic behaviour of ordinary substances.

It is here that your contribution to the present subject comes in. On replacing the customary relation between the current density and the electric field strength by a new relation between the current density and the magnetic induction you were able to show that a considerable body of experimental facts could be elegantly described. In a number of papers published in the middle thirties, in your monograph entitled "Une conception nouvelle de la supra-conductibilité" and in your recent book "Superfluids, vol. I, Macroscopic Theory of Superconductivity" you have fully discussed the consequences of the new approach.

Of course the step taken is only a first step, for as far as the kinetic interpretation of the new phenomenological equations is concerned we have not advanced very much further in the last twenty years. Yet, although superconductivity still is one of the enigmas of physics, your contributions to the subject have done much to clarify the situation, and we can only hope that you will continue to give your attention to this complex and intriguing problem.

The last topic to which I would like to refer in connection with your scientific career is your work on liquid helium. While it was still given to KAMERLINGH ONNES to achieve the liquefaction of helium at his laboratory, we owe to his successor KEESOM the discovery that liquid helium at very low temperatures is a fluid with most extraordinary properties. More particularly we have learned to distinguish between liquid helium I, existing from above 2.2° K to the boiling point and behaving much like any other liquid, and helium II, the form met with between absolute zero and 2.2° K which is the black sheep deserving our particular attention.

It was you who was the first to make a suggestion with reference to the transition between the two phases of liquid helium. Already in 1924 EINSTEIN had pointed out that an ideal gas whose molecules obey the statistics which we know to be valid for ordinary helium atoms would show at a given density a transition temperature, below which the molecules would partly "condense" in their lowest stationary state; the extent of this condensation increasing as the temperature is lowered further below the transition temperature until at absolute zero all molecules are present in the lowest stationary state. Your suggestion was that, although helium is by no means an ideal gas, just by reason of the VAN DER WAALS forces previously discussed, still the change from helium I to helium II might be a reminiscence of the effect to which EINSTEIN had called attention. Indeed the observed transition temperature and the theoretical one were quite comparable, the difference perhaps being attributable to the VAN DER WAALS forces.

The chief heuristic value of your suggestion has lain, I believe, in the fact that it was instrumental in leading up to the concept of the two-fluid model of helium II. The notion of two groups of atoms, the condensed and the uncondensed ones, indeed made it appear plausible to modify the phenomenological laws of hydrodynamics for helium II in a way which has its parallel in the modification of the electrodynamic laws for a superconductor previously referred to. Here, too, as in the discussion of superconductivity the kinetic interpretation is postponed and an attempt is made to express the numerous experimental results on flow and heat transfer in helium II in a unified way. That this modified hydrodynamics has led to the prediction of new effects, such as the phenomena of second sound, which have later actually been demonstrated by experiment, is the best proof of the fruitfulness of this development.

One of the necessary consequences of your starting-point was that the helium isotope of mass number 3 should behave quite differently from the usual isotope in view of the different statistics which it obeys, and that it should not show a transition temperature and the anomalies connected with it. Recent experiments seem to confirm this interesting conclusion.

After thus sketching your activities in physics in an incomplete and

fragmentary way, for which I must appeal to your leniency, it is only fitting that I should devote a few words to him whom we commemorate by conferring this medal. The fact of its being a hundred years ago that LORENTZ was born was the immediate motive for holding the congress that preceded this session. It has brought into our midst to-day a large number of distinguished foreign physicists. Thus there will be many among us who still have had the privilege of knowing LORENTZ personally. They will remember him not only as a scientist with an intellect of exceptional power and clarity, but also as a man of great charm and wisdom.

The contributions of LORENTZ to science have been adequately commented on during meetings of the recent congress already referred to, and it would be falling into repetition if I were to dwell on them here. His great personality and his ideals of scientific endeavour, on the other hand, we cannot often enough keep before our mental eye at a time when science, and in particular physics, is beset by dangers which nobody would have dreamt of in the last century. We may think here in the first place of the enormous growth in the application of science. Undoubtedly many of the most prominent scientists in the past have devoted part of their time to investigations of a practical nature and have therefrom derived much stimulation for their work. Indeed, LORENTZ himself did so when computing the changes in water level to be expected from the construction of the Zuider-Zee dyke; that the floods at the beginning of this year did not take on a form still more catastrophic is surely the fruit also of his labours. That science as such can greatly be aided by reason of its applications we cannot forget either in a country where several large industries in a very liberal way also support pure research. But there certainly is the possibility that this and future generations get accustomed to think of science primarily as a source of material welfare rather than as one of the activities of mankind that raises human life from a purely animal affair to a spiritual level.

Much more serious, however, is the circumstance, unforeseeable at the time LORENTZ was born, that physics has become one of the instruments of political and military power. To guard against getting involved in such power purposes, set up by statesmen and politicians, will be one of the things physicists constantly will have to keep in mind. The increasing strength of collective forces in various forms, that can bring pressure to bear on the scientific investigator, is a direct threat to the true spirit of research. For notwithstanding the spontaneous contacts with their colleagues which scientists always have felt as a source of inspiration and in some cases, where the task was too formidable for one man, as a practical need, science like art in last instance is an individual adventure. Although the term pure science has hitherto been used in contrast to applied science, we could also employ it in the sense of science, pure in its intentions, and in this respect we may think of LORENTZ as a great example. And in this spirit I want now to present to you the medal

bearing the portrait of LORENTZ and express at the same time our best wishes for your future work.

Nadat de heer LONDON de medaille in ontvangst heeft genomen, dankt hij daarvoor met de volgende woorden:

Mr. President, Ladies and Gentlemen,

I am deeply confused by the great honor which you have decided to confer upon me. At the same time I feel very proud to receive this high distinction from the Netherland's Royal Academy of Science.

During most of my life I have been so fortunate that I could do the thing which my own nature drove me to do. It is embarrassing to earn so much respect for doing just this.

Yet, it is a great satisfaction for me to receive this particular sign of recognition, because it tells me that the work which was done, apparently by an internal necessity, has been found to be of some objective value.

Indeed I do not know of any scientific body which I would consider *more* competent to pass judgment on my scientific work than the Netherlands Royal Academy of Science: As pointed out by the preceding speaker the greater part of the tantalizing problems which occupied my thoughts were brought into the open first by Dutch physicists. Probably nowhere in the world has the impact of these problems been felt as much as here. I am well aware that most of these problems have not yet found a satisfactory solution. Science is like a ball game: Someone throws the ball, some other one catches it and carries it a bit further and then it is thrust out of his hands again by someone else. The single individuals merits are difficult to appreciate, particularly, as long as the game is still going on. I was fortunate to hold the ball sometimes for a while and to carry it a bit further.

I feel the encouragement which your recognition means for me and I wish to thank you for this. You have brought me in a line with the finest minds of our time. I think here with particular emotion of the two last recipients of this distinction for whom I feel an unalterable profound veneration: of KRAMERS who represents for me the rare embodiment of the true humanist, the man in whom human and scientific wisdom have found their harmony, and of SOMMERFELD who was my teacher, actually the teacher of my generation of theoretical physicists. I feel very humble in this noble company and can only say that I shall endeavour to justify your judgment.

De voorzitter wendt zich hierna tot de begiftigde met de volgende woorden:

Dr LONDON, in the name of the Koninklijke Nederlandse Akademie van Wetenschappen I congratulate you on the distinction which has

just now been conferred upon you. In addition I wish to assure you that your courteous acknowledgement is highly appreciated. In concluding I should like to express the hope that after your return to Duke University from time to time a stray glance at the medal will make your thoughts wander back to the country of VAN DER WAALS and LORENTZ where your name will always remain in high esteem.

Als laatste taak rest mij nog de leden van de commissie en in het bijzonder de heer KRONIG, die hun aller inzicht op zo voortreffelijke wijze heeft vertolkt, dank te zeggen voor de door hen mede in het belang der Akademie verrichte werkzaamheid.

Met deze hamerslag verklaar ik deze bijzondere vergadering gesloten.

De heer LONDON begeeft zich hierna met zijn echtgenote naar de koffiekamer, waar allen, die de bijzondere vergadering hebben bijgewoond, in de gelegenheid worden gesteld hem geluk te wensen.