

J. LECOMTE

FATHER OF FRENCH SPECTROSCOPY: PIONEER
OF INFRARED: FRENCH SCIENTIFIC AMBASSADOR

In May 1976 European Spectroscopy News was privileged to be able to visit the home of Monsieur J. Lecomte in Paris. Harry Willis, Gunter Heyden and Rudolf Schötteldreier (Office Manager of Heyden & Son GmbH, Rheine) were made welcome by the hospitable Mon. Lecomte and his charming wife, and were able to talk to Mon. Lecomte about his long and influential spectroscopy career. He also showed us many curios collected by him in his travels and some of his vast collection of slides.

ESN: Please tell us something about the early French contributions to infrared spectroscopy.

JL: A very early contribution was undoubtedly that of Ampère who, in 1835, put forward some basic ideas about the general nature of visible and "heating" radiation. It became clear that these radiations were of the same general kind. Several prominent French scientists, Fizeau, Foucault, Mouton, Dessin, and, of course Curie, expressed occasional interest in the value of measurements in the infrared region of the spectrum. On the whole, however, the real developments were taking place elsewhere. Between 1890 and 1920, outstanding advances were made at Tübingen, by Paschen, and by Rubens in Berlin. At about the same time Coblenz was very active in the United States, and it is true to say that he laid the foundations for the application of infrared spectroscopy in chemistry and mineralogy. His work at the National Bureau of Standards in Washington resulted in a pioneering publication in 1905, but the work suffered from lack of funds, and for a while it was dropped. Then H. M. Randall, a pupil of Rubens, established the outstanding spectroscopy school at Ann Arbor in Michigan. For more than 30 years Ann Arbor provided the heads of the schools of infrared spectroscopy throughout the U.S.A. It is interesting that Coblenz lived to a ripe old age and Randall was almost a centenarian at his death.

ESN: When did your spectroscopy career begin?

JL: It began in 1919 when I joined the Laboratory for Research in Physics at the Sorbonne. Lippmann was the Director at that time. I started by preparing a bibliography of work in the infrared.

ESN: What was the general attitude to infrared work when you started?

JL: I felt that it was sadly neglected. After Rubens died in 1922, you could count on the fingers of one hand the laboratories which were investigating infrared spectroscopy. The technique had a really terrible reputation — it was far too difficult for the paltry results which could be expected. When I said I wanted to take it up, everyone tried to dissuade me from the adventure. Fortunately I did not follow this false advice and after half a century I still congratulate myself on the decision.

ESN: When you began, whom did you study under?

JL: I had no one to teach me at first as there was no one in France who was interested. It was very difficult to get advice. However, when Cotton became Director of the Laboratory following Lippmann he said that although he did not know anything about infrared he would help me because he did know something about optics. He was one of the best physicists in the world — I'm sure you have heard of the Cotton Effect.

ESN: What financial support did you have for your work?

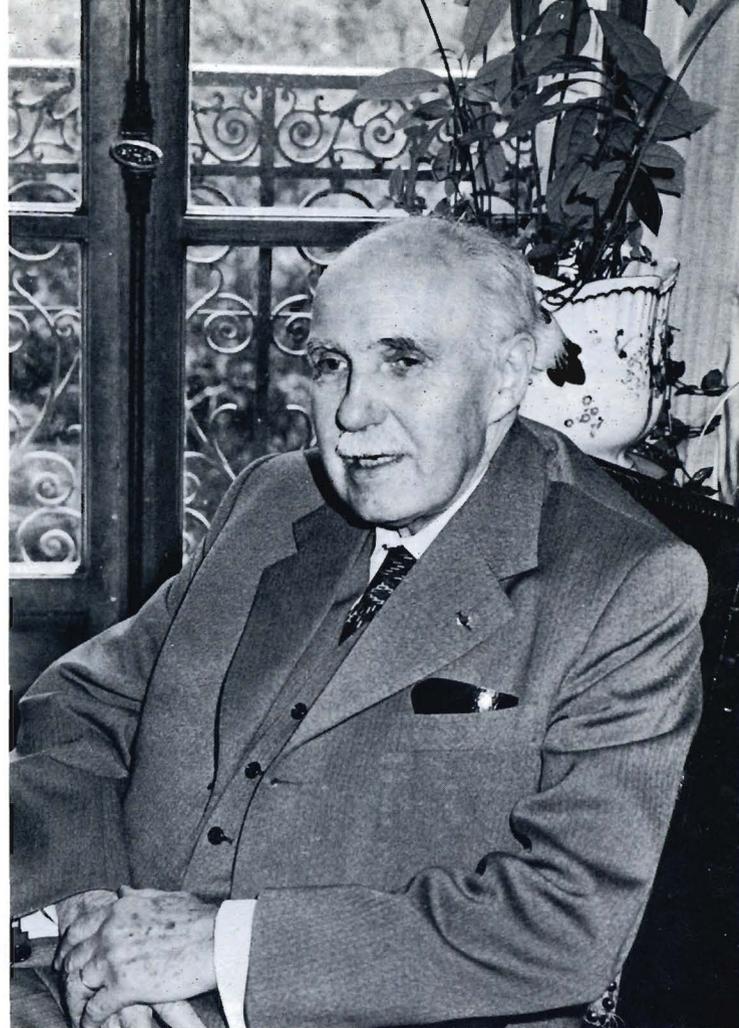
JL: We had very great difficulty until the beginning of the war because we had no financial support. In fact, I had no official appointment at the Sorbonne until 1939 when I became Master of Research in the National Centre of Scientific Research. I was appointed Director of Research in 1943, and I held that appointment until I retired in 1971.

Mme Lecomte: My husband was not obliged to work for money. His father was a diplomat, a French Secretary in Germany. His father said to him: "Look, boy, you can do what you like but one thing, go to the top. If you want, study music or anything else, but just aim for the top". He replied: "If you want me to, I'll do it". My husband was a very lonely man then — he had no immediate relatives. He loved his father very much and wanted to please him because he was the only interest that his father had.

JL: I said I wanted to make something interesting and new, and my father gave me money not for distractions, but to work on instruments: there was plenty of work to do on instrumentation in infrared spectroscopy. As you know, for almost a hundred years the lack of a sensitive, fast and

accurate detector had been the biggest reason for delay in the development of infrared spectroscopy. In most cases the principle of the detector was to convert the very weak heat signal into an electric current and even when this was achieved the result was poor. When I started, the most sensitive detector available was the moving magnet galvanometer, and this caused sleepless nights for all infrared spectroscopists. The success which Paschen had with this instrument was due in no small measure to the fact that he worked in Tübingen, where there was no electric tramway which, almost everywhere else, was the source of stray electric fields. This was why Rubens couldn't use the moving magnet galvanometer in Berlin. However, he achieved remarkable success with the microradiometer. Unfortunately this instrument was so slow in response that it was almost impossible to tell when the maximum deflection had occurred. Myself, I lost two years trying unsuccessfully to stabilize the random movements of a 20 mg moving magnet galvanometer, trying out antivibration mounts and metal cans to cut out stray magnetic fields. The Sorbonne, where I had to work for a quarter of a century, in the middle of the Paris traffic, was about the worst place you could imagine for trying to do delicate experiments. Eventually I succeeded in getting a moving coil galvanometer modified according to some ideas I had, and at last I was able to get some work done. Much later Moll and Zernicke built instruments which fully justified my solution to the problem.

GUNTER HEYDEN



ESN: The spectrometers at that time: did you build them yourselves, or were they purchased equipment?

JL: Most of the equipment we built ourselves, and we made the first infrared spectrometer recording in France. Later we had a Hilger spectrograph which I bought from my own funds. We also constructed a prism spectrometer which recorded both the galvanometer deflection and the prism position (wavelength) directly on photographic paper.

ESN: What sort of problems were you investigating in the 1920's?

JL: I presented my doctoral thesis in 1924 and one of the main points in it was the idea of localized vibrations in molecules. Previous studies were based on the idea of each molecule having its own set of vibration frequencies. We measured such a lot of spectra that we found evidence for localized vibrations: for instance the O—H group shows a band at around 3000 cm^{-1} and the C=O group at about 1700 cm^{-1} .

Thus we were able to show that there was a relationship between the chemical structure of the molecule and the positions of the bands in the infrared spectrum. Later, when we could make more precise measurements, we showed that frequency shifts, often quite small, in the absorption bands gave information about the environment of the groups in the molecule. This is the basis of infrared spectroscopy as it is used today to determine chemical structure. As my friend Norman Jones said, the infrared spectrum is the Fingerprint of a substance.

ESN: So you soon became interested in the chemical applications of spectroscopy?

JL: Yes, I've always been very keen on chemical and especially industrial applications of spectroscopy. As soon as I had finished my thesis I formed a team, many of whom came from French industry. We showed them how to do the measurements and used the results for industrial problems. You could say that we were pioneers in setting up relations with industry. We also recorded an enormous number of spectra. For instance, we measured the spectra of more than 6000 inorganic compounds, although a lot of our work was aimed at organic chemistry and biology.

ESN: Would this have been about the time of the discovery of the Raman effect?

JL: Yes, Raman published his discovery in 1928. I realized the importance of the discovery, and saw how useful it was to have available both the infrared and Raman spectra of a substance. Even so, I never built a Raman spectrometer — we used other people's results in conjunction with our own infrared spectra.

Cabannes, in France, came very near to discovering the Raman effect experimentally in 1928, when he found scattering near the frequency of the exciting line. Unfortunately he was unable to obtain consistent results. Later he gave a simple interpretation of the Raman effect. He worked principally on the Raman spectra of single crystals. I knew Raman well, and visited him twice in India. I liked making these trips overseas because I was able to combine my interests in science and archaeology.

ESN: Can you mention any other French contributions to spectroscopy in the pre-war years?

JL: Oh yes, I can think of some most important discoveries. My friend Freymann discovered in 1933 the Hydrogen bond. This is a remarkable illustration of how each molecule influences its neighbours, and of course this effect shows up strongly in the infrared spectrum. We also discovered in 1935, by means of the infrared spectrum, the existence of rotational isomers. Sometimes a molecule can be converted into another by a discrete rotation about a single bond. So you can see that by the end of the 1930's we were very advanced in spectroscopy in France.

ESN: It was the interest in hydrocarbons for aviation fuel during the war that really got spectroscopy going in England and in the U.S.A. Was there similar interest in France?

JL: We were years ahead in France! We were using infrared spectroscopy to look at automobile and aviation fuels in 1928 — ten years before the Americans. We had about 7000 spectra of the components of fuels and we published them, although I never published any interpretation. We offered our services to French aviation.

ESN: When the war came and the invasion took place did things come to a standstill in France?

JL: No, not at all. I was able to continue much of my work. Of course, before the Germans came in 1940, I sent all our documents to our friends in England, so that they could use exactly the same methods. The response, I recall, was simply "This is very useful"! However, I soon had no outside contacts.

ESN: You evidently speak German well.

JL: Yes, I learned it in my childhood from a German nanny. Also, my father spoke it well; he was a diplomat in Berlin between 1880 and 1885. He was a secretary at the French Embassy.

ESN: Did you have any special friends in Germany?

JL: After the war I was fortunate to be friendly with Professor Mecke in Freiburg. He was really the grandfather of spectroscopy in Germany. He built up a laboratory for infrared work and did a great deal in teaching the study and application of infrared spectroscopy.

ESN: It must have been exciting after the war to discover at last what had been done in Britain and the U.S.A.?

JL: I was very interested in the developments, and I straightaway realized the importance of electronics in spectroscopy. I encouraged my pupils to take up these new ideas, but I have always liked to take part in the work myself — I have often repaired a spectrometer with a screwdriver and an adjustable spanner.

ESN: Many of your pupils at that time are now well known in French science. Will you tell us about them?

JL: Several of them hold key positions in Universities, the CNRS and so on. I imagine one of the best known is Professor Hadni, now at Nancy. Then there's Bachewitz. I first knew him when he was a prisoner of war, and I helped him with his thesis. He is now at Orsay. Then there's Clement Duval at the Institute of Chemistry and Maurice Parodi at the Conservatoire des Arts et Métiers. Now I think about it, there are many more. There's Mlle Josien at Bordeaux, Pr. Delorme, rector at Orleans, Jacques-Emile Dubois, Director of DRME, Mlle Vergnoux at Montpellier, Mme Mathis at Toulouse and, of course, Mme Vincent-Geisse, who took over as leader of my research group in 1970.

ESN: You have mentioned three of your girl students. Have you always had a number of girl students?

JL: I have always tried to run a friendly laboratory and having some girl students can prevent a laboratory from getting too serious. I have always invited my students to my house, and of course with the girls I had to be careful also to invite their husbands or boy-friends. I invite the wives of my male students too, of course. I've always thought that a good social relationship outside the laboratory is most important. Many times I have invited students along to see some of my travel slides — as many as 80 people at a time.

ESN: I think you also had a number of students outside the University?

JL: Well, as I've told you, I was always very keen on the application of infrared spectroscopy in industry, so in 1958 I set up LIRTA (Laboratoire d'infrarouge technique et appliqué) at Gif-sur-Yvette. I had about 15 people there at one time. LIRTA used to award proper academic qualifications, the Diplôme Supérieur and also a Doctorate degree. Unfortunately the Laboratory is no longer functioning. I bought the Laboratory and set it up with my own equipment, but we did not receive enough support from CNRS. I tried to obtain outside support to provide funds, but eventually we had to close. However, we had some good people in the Laboratory who were able to go back into industry and set up really strong laboratories.

ESN: How do you think present-day students compare with those in the 20's and 30's?

JL: They had to work a lot harder then when they started, because they had to build their own equipment then, and they had to know a lot about optics. Now, of course, they are able to buy instruments from the manufacturers.

ESN: Do you think the opportunities for students were better then than they are now?

JL: Today the number of students working in spectroscopy is much greater, but the chance of achieving something really outstanding has decreased. Also the career prospects are not so good as there are not enough university opportunities. Ten years ago too many people were brought into the universities, so now the positions are all occupied.

ESN: Is there any chance of the situation improving?

JL: Yes, if more new universities are built. At one time Paris had only the Sorbonne, but now there are many new universities, not only for sciences but for languages, economics and so on.

ESN: Can we leave the French scene and hear about some of the spectroscopists around the world with whom you have become acquainted?

JL: At the end of the war, when it was possible to travel, I soon became very friendly with spectroscopists from all over the world — I felt I should try to play the role of French Scientific Ambassador. There immediately come to mind Ketelaar in Holland, De Hemptine, Migeotte, Duchesne and Duculot in Belgium, Mangini, Lorenzelli and Bonino in Italy, Stamreich in Brazil, Plyler, John Howard, Foil Miller, Van Zandt Williams and Perkins in the United States, Herzberg and Norman Jones in Canada, Hidalgo and Bellanato in Spain, and of course Sutherland and Thompson in England. I vividly remember the Tercentenary Celebrations of the Royal Society in 1960. That was the meeting at which I gave an address before H.M. Queen Elizabeth and also the King of Sweden. The President of the Royal Society was then Professor Hinshelwood. Mme Lecomte and I had the great pleasure of meeting H.R.H. The Duke of Edinburgh; he is a very interesting and knowledgeable man. I was wearing my ceremonial uniform and the Duke asked:

“Who designed this uniform?”

I replied “David by order of Napoleon”, and he said: “Well, at least once in his lifetime he did something good!”

Professor Terenin was a good friend of mine. I was invited to give a lecture in Moscow and he translated it into Russian for me. It is very helpful to know your translator when you are dealing with technical papers. Another Russian friend is Mandelstam.

Mme Lecomte: At the first Congress I attended Terenin gave a folk dance in an embroidered Russian costume —

that was in Meridon, New Hampshire, in 1958. There are many good dancers and musicians in spectroscopy. Kovacs played his guitar, I recall, at the Budapest Congress.

ESN: Tell us about your connection with the CSI.

JL: The beginnings of the CSI were very important to spectroscopy. I had founded the European Molecular Spectroscopy Group in 1947 with Kastler and I particularly remember the wonderful international European Congress of Molecular Spectroscopy, in Paris, in 1947. I was able to welcome such a lot of my friends. It was a wonderful and memorable occasion, and I am sure everyone who was there remembers it with affection. Again I was able to act as host to scientists from all over the world at the Paris Congress in 1953. GAMS added to our Congress the Colloquium Spectroscopicum Internationale. It is in Philadelphia this year, and has reached a special new importance in joining with the FACSS Meeting in the American bicentennial year.

ESN: With so many friends throughout the world, you must have travelled widely?

JL: I have always been a great traveller. Even in those times when the French did not travel I went all over the world — India, Nepal, South America, Indochina. I have photographed many of the largest waterfalls in the world, like Niagara and Victoria. As well as many souvenirs I have a collection of about 25,000 colour slides. I have a very good friend in Kodak who used to be in my laboratory, Pr. Clement, now director of Kodak research. With 35 mm film it is easy to take lots of photographs, it was different in the old days when there were only nine on a reel. My slides range from churches in the Kremlin in Moscow to close shots of crocodiles in Africa. Many beautiful places in France continue to attract me. When I go to Nancy I never fail to visit the little Lorraine Museum.

ESN: Have you been as happy in your home life as in your scientific work?

JL: Yes, I was happily married for many years, and I had enough money to live comfortably. Sadly when my first wife died we had no children, so I was very fortunate to meet my present wife whom I married in 1958. I was able to adopt her three children by a previous marriage, and we were so pleased to have another child, a son, after our marriage, and now we have three grandchildren.

ESN: It has been rewarding to listen to a story which is so rich in activity and which spans such a long and happy career. May we hope that you will have a long and equally happy retirement. We are sure that your close friends all over the world will enjoy reading this interview in ESN
