

LIQUID SCINTILLATION COUNTING
RECENT APPLICATIONS AND DEVELOPMENT
VOLUME I. PHYSICAL ASPECTS

A TRIBUTE TO PROFESSOR JOHN B. BIRKS

Donald L. Horrocks

Scientific Instruments Division
Beckman Instruments, Inc.
Irvine, California

It is with deep regret that I have to inform the members of this conference of the death of Dr. John B. Birks. On March 1, 1979, Dr. Birks passed away while visiting at his son's (Dr. J. Birks) home in Cambridge. He will be greatly missed by his many friends and acquaintances all over the world. The loss, of course, is hardest for his colleagues at the University of Manchester where Dr. Birks had been since 1957. So highly esteemed by his fellow Physic department colleagues was Dr. Birks, that a special named prize is being established and will be "awarded annually to the first year postgraduate student showing most merit, both in the understanding of physics, and in the execution of a research project."

A brief summary of Dr. Birks' career has been supplied by Dr. Scott Hamilton of the Department of Physics, Schuster Laboratories of the University of Manchester. The summary is printed here as received:

Dr. John Betteley Birks
Died 1 March 1979

- 1940-45 Telecommunications Research Establishment,
Malvern, (now Royal Radar Establishment)
- 1946-47 ICI Research Fellow, Glasgow University (Ph.D.)
- 1947-51 Lecturer Glasgow University
- 1951-54 Professor of Physics, Rhodes University,
Grahamstown, South Africa
- 1954-57 Research Manager, British Dielectric Research,
London (Part of British Insulated Callendar
Cables)

1957-58 Senior Lecturer, Manchester University
1958- onwards Reader in Physics, Manchester University
1965-66 NSF Senior Fellow and Visiting Professor,
Louisiana State University

Published over 180 papers, starting with secret wartime reports (MIT Radiation Laboratory Series, Vol. 26, p. 276 and JIEE 93, IIA, 647, 1946), did work on microwave properties of ferrites for Ph.D. then started work on scintillators (Proc. Phys. Soc. A65, 1044, 1950) and he continued in the fluorescence field until his death, except for a period in industry involving research in dielectrics (editor of 8 volumes of Progress in Dielectrics) and semiconductors. Editor of Proceedings of Rutherford Jubilee International Conference (1961), Rutherford at Manchester (1963) and Proceedings of Symposium of Nuclear Instruments (1962). Probably best known for his books on Scintillation Counters (1953), Theory and Practice of Scintillation Counting (1964), and Photophysics of Organic Molecules (1970). Also, editor of Organic Molecular Photophysics (Volumes 1 and 2) 1973/4, and the Wiley-Interscience series in Chemical Physics; and author of several monographs on liquid scintillation counting (published by Philips and Koch-light). He was consultant to several companies (e.g., Nuclear Enterprises, Philips, Rank Xerox) and government research establishments.

He set up the Molecular Physics Group in the Physical Laboratories in Manchester. It flourished and grew into one of the larger research groups (now Atomic, Molecular, and Polymer Group), covering organic fluorescence (and vacuum UV spectroscopy using synchrotron radiation), electron scattering, microwave spectroscopy, lasers, and polymer studies using laser light scattering involving some 45 staff, research fellows and students. He was also responsible for setting up the Honours School of Chemical Physics at Manchester.

As noted in this summary, Dr. Birks' first publication in the field of scintillator studies was in 1950 (Birks, 1950). This makes Dr. Birks, one of the pioneers in this field as it was only 3 years, prior to this that Dr. H. Kallmann (Kallmann, 1947), published his famous article which launched the study and use of organic scintillators. Dr. Birks, partly because of his great insights, was shortly afterwards recognized as one of the leading world experts in the field of organic scintillators, especially in understanding and proving the theory of the scintillation mechanisms in liquid solutions excited by ionizing radiations.

Dr. Birks, in this 1950 paper, showed that the scintillation efficiency of a naphthalene crystal could be increased by dissolving a small quantity of anthracene in the naphthalene crystal. The excitation energy, from ionizing radiations, was very efficiently transferred from the solvent (naphthalene) to the solute (anthracene) which emitted its characteristic fluorescence. Thus, was the first of many papers by Dr. Birks dealing with the study of the many competitive processes which comprise the scintillation process: energy absorption, molecular excitation, ionization, disassociation, internal conversion, energy migration, excimer formation, energy transfer, quenching, fluorescence yields, and many others. Dr. Birks has published papers dealing with every aspect of the liquid scintillation process.

Dr. Birks was one of the first to study the phenomenon of the formation of dimers between an excited and a nonexcited state of a molecule (Birks and Christophboron, 1962). These excited dimers were given the name "Excimers." These studies led to the understanding of the phenomenon of "concentration quenching" of some excited molecular species.

Since those early papers, there had been a steady number of publications dealing with scintillation and photophysical studies. Probably the most cited reference in the field of liquid scintillation is the excellent book by Dr. Birks, "The Theory and Practice of Scintillation Counting" (Birks, 1964). In writing this book, Dr. Birks provided one of the most complete sources of information and references on scintillation counting. However, as he noted in the preface of that book, the field was advancing so rapidly that before the book was completed he found it necessary to add a post script. The post script alone contained over 114 references to cited literature.

Because no one else could have accomplished the difficult task of summarizing Dr. Birks' many years of interest in organic scintillators, Dr. Birks undertook the task himself upon his silver jubilee (Birks, 1974). In the plenary lecture at the International Symposium on Liquid Scintillation Counting held during August, 1973, in Sydney, Australia, Dr. Birks presents the very interesting story of how he became involved with organic scintillators.

The story opens in 1948, in the Department of Natural Philosophy at the University of Glasgow where I was completing my Ph.D. studies on the microwave properties of ferromagnetic materials. All my colleagues were engaged in research related to nuclear physics, and Professor P. I. Dee suggested that I should seek a suitable project in this area and join the "team." In one of the laboratories I found an unusual instrument consisting of a large naphthalene crystal attached to a

photomultiplier. Its designer, G. M. Lewis, explained that this was an organic scintillation counter of the type discovered the previous year by H. Kallmann. "Ionizing radiations impinge on the scintillator and produce light flashes or scintillations," he explained. "Why?," I asked. "We don't know," he replied. The next day, I informed Professor Dee of my new project, the study of the scintillation process in organic molecular systems. Twenty-five years later, I am still working on it. It was a much tougher assignment than I had realized, but en route there has been a lot of interesting physics. We've found answers to many of the original questions, and in turn we've uncovered many new questions that we didn't know existed.

Also presented as a part of this paper is a summary of what Dr. Birks considers as the highlights of those 25 years of research. Dr. Birks also included a list of his publications in the field of organic scintillation which numbered 134 references. An insight into the humor of Dr. Birks was provided at the same conference (Birks, 1947a) when Dr. Birks was presented with the task of summarizing the conference proceedings in the closing remarks.

Dr. Birks was always gracious with his time when asked to participate in conferences and symposia concerned with organic scintillators. By his own account, Dr. Birks attended fifteen conferences dealing with scintillation counting. I first met Dr. Birks in 1960 at the conference on Organic Scintillation Detectors held at the University of New Mexico. Six years later, I found myself organizing a conference on Organic Scintillators, held at Argonne National Laboratory. Dr. Birks was kind enough to attend this conference and present one of the two feature lectures. (By the way, the other feature lecture was presented by Dr. H. Kallmann.) Figure 1 is a photograph of the attenders of this conference. You may be able to recognize many of the faces in this photograph. I have pointed out only three key persons (at least in my estimation); Dr. H. Kallmann, Dr. F. N. Hayes, and Dr. J. Birks. These three played very important roles in the development of the theory and practice of organic scintillators.

Dr. Birks would have been the first to admit that there is much more to be discovered about organic scintillators. It will now be necessary for that work to be accomplished without the assistance of Dr. Birks. We will all miss Dr. Birks.

DR. J. BIRKS



DR. F.N. HAYES

DR. H. KALLMANN

FIGURE 1

REFERENCES

- Birks, J. B. (1950). Proc. Phys. Soc. A63, 1044.
- Birks, J. B. and L. C. Christophorou (1962). Nature 194, 144.
- Birks, J. B. (1964). "The Theory and Practice of Scintillation Counting." Pergamon Press, London.
- Birks, J. B. (1974). In "Liquid Scintillation Counting - Recent Developments." pp. 1-38. Academic Press, New York.
- Birks, J. B. (1974a). *ibid.* pp. 477-481.
- Kallmann, H. (1947). 2. Naturforsch. A2, 439, 262.