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TOM WILKERSON BONNER

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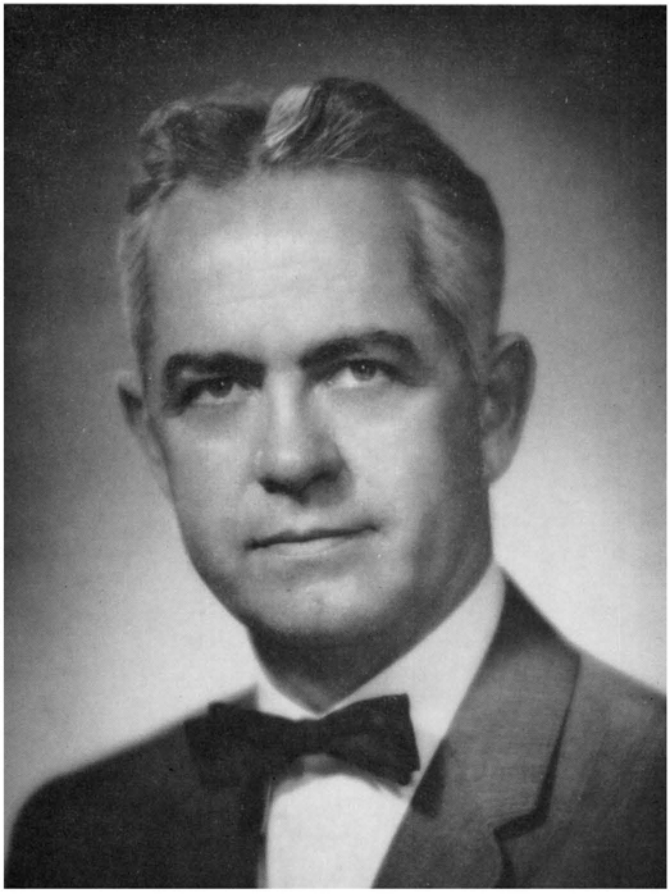
A Biographical Memoir by

W. V. HOUSTON

Biographical Memoir



J. W. Bonner

TOM WILKERSON BONNER

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BY W. V. HOUSTON

DR. TOM WILKERSON BONNER was born in Greenville, Texas, in 1910. He has spoken of the fact that his father, a lawyer, had a high mathematical aptitude. His mother was and is an artist. Between them they inculcated in Tom the idea that school was a place for study and was to be taken seriously. Four years of preparatory school work in Latin gave him plenty of opportunity to develop a classical and humanistic approach to his work in science, to regard science as a major cultural activity. Along with many other boys in the 1920s, he developed mechanical skill on radios, Ford automobiles, and various electrical devices in need of repair. It was a field, and a period, in which a young man with a vigorous mind could gain a sense of great accomplishment in dealing effectively with matters that were still mysteries to his parents and even to many of his teachers.

When Tom was ten years old his family moved to Dallas, where he attended high school and Southern Methodist University. Here his interests began to focus on physics and mathematics. At this time also he began the study of geophysics, and did field work in the summer of 1930. This was an interest he maintained the rest of his life and he gave an occasional course in geophysics at Rice University. In 1931 he definitely com-

mitted himself to graduate work in physics and accepted an appointment as a graduate assistant at Rice because of his high regard for the accomplishments and reputation of Professor H. A. Wilson.

It was Professor Wilson's philosophy of graduate education that a student should start research as soon as possible. So the new student from Dallas started to work on one of Dr. Wilson's favorite subjects, the luminosity of flames. He worked on it so vigorously, and so effectively, that after starting graduate work in September 1931 he presented a paper at the meeting of the Physical Society in New Orleans in December of that same year. The second half of the academic year was occupied in trying to detect an effect of a magnetic field on X-ray scattering in iron. It was a time when various people looked for such an effect, and those who did their work well, as Tom Bonner always did, got a negative result.

It was in the spring of 1932 that an important decision was made. After the award of a Master's degree based on his studies of flames and of X-ray scattering in iron, there arose the opportunity of selecting a problem for his further research. Here Bonner showed his instinct for picking important problems. He read of the work of Professor James Chadwick, interpreted as the discovery of neutrons, and decided he wanted to study them. It was his own choice, and thus began the work which was the central theme of his professional life. By November 1932 he was producing neutrons, and very soon published a study of neutron energies resulting from nuclear reactions.

In 1934 the enthusiastic support of Professor Wilson and others at Rice, together with his already remarkable list of publications, led to the award of a National Research Fellowship, which he held at the California Institute of Technology. There he worked with Professor C. C. Lauritsen in the High Voltage Laboratory, which was beginning to be a laboratory

for nuclear physics. With a graduate student, W. M. Brubaker, he designed and built an automatic high-pressure cloud chamber with which he studied proton recoils to obtain neutron spectra. In this work he developed the cloud chamber technique to a point of precision and reliability that represented a major advance in the art, and his work in this field established a standard that was unsurpassed for a long time thereafter.

I have an interesting statement from one of his co-workers in the California Institute laboratory of that period. It runs as follows: "I think that, in addition to his warm friendliness and quick sense of humor which you know as well as we, the sharpest impression we have from that time was his uncanny ability to make things work. To the rest of us, it was almost mysterious the way he would turn on a whole lab full of equipment with no fuss at all, and somehow run it all night without a bit of trouble. I suspect it was just the fact that he could not be irritated, and that nothing could affect his calm, even attitude that made him so successful both with machines and people." Similar comments have been made by others who knew him later in his life.

In the summer of 1936 Tom Bonner went to Europe and made firsthand acquaintance with Sir John Cockcroft. He visited Cambridge University and talked with Lord Rutherford, with M. L. Oliphant and P. I. Dee. It must have been stimulating for Bonner to visit the laboratory that was the earliest world center of nuclear research.

In September 1936 he returned to Rice as an instructor in the physics department and started on his work that has contributed so much to the development of the university, to the development of a group of well-known graduate students, and to the development of neutron physics.

In 1937 he and Jara Prasilova were married and established one of the influential families of Rice University. All those who

have known them see evidence of Jara Bonner's personality in the influence which Tom exerted on those with whom he came in contact. Their family of three fine children, of whom the oldest is now a senior and the second a freshman in Rice University, contributed a kind of stability and serenity to Tom's life that made itself felt wherever he was known.

In 1937 also it was decided to build a Van de Graaf accelerator at Rice, and Bonner's work was associated with such accelerators from then on. Bonner himself did not have a primary interest in building large machines. He spent the year 1938-1939 on a Guggenheim fellowship in Cambridge and then spent the summer of 1939 with Professor R. G. Herb in Madison. When he returned to Rice in the fall of 1939 the machine was essentially built and Bonner was given the responsibility of using it. In the short period remaining before he was diverted to military research he turned out several pioneering papers on nuclear reactions.

In April of 1941 Bonner joined the Radiation Laboratory at M.I.T., where he worked on radar until the end of the war. He received the presidential certificate of merit in 1946 for this wartime work. He himself tended to dismiss this war work as not of a fundamental scientific nature. He once said that his only work of a fundamental nature during the war years was concerned with the large absorption of 1.25 centimeter radiation by water vapor. From this work, however, he was able to conclude that radar of this wavelength was not suitable for long-range work.

One may well wonder why a pioneer in the study of neutrons, and one of the first group of Americans to begin the study of nuclear reactions, did not join the Manhattan Project. This was evidently a difficult decision for many people. The work on nuclear fission had a tremendous fascination, for it was in the forefront of physics and a new field of almost un-

limited extent was envisioned. On the other hand, the possibility of a military application in time to be of use was very doubtful. The radar developments, on the other hand, were being immediately applied and were influencing in an important way the outcome of the war. Dr. Bonner's decision was to stay at M.I.T., where he had come to occupy a highly responsible position in the airborne radar division. He probably later regarded his decision as correct, for the rapid application of radar was an important element in bringing hostilities to such a stage that the nuclear weapons provided only a dramatic and terrifying finale to a foregone conclusion.

After the war he returned to Rice and continued his research and teaching in nuclear physics. Upon the retirement of Professor H. A. Wilson in 1947 he was appointed chairman of the department and continued in that position for the duration of his life.

When Bonner returned to Rice in 1945 he made another major decision. Quite in keeping with his earlier attitudes he decided to plunge immediately into the study of nuclear reactions with the equipment already built, rather than start upon the construction of larger and more elaborate accelerators. He told me once that it seemed to him better to let others wade through the engineering design problems and then later to select the type of machine that had proved to be the most effective. It was a decision well justified by the results. And so with the relatively primitive Van de Graaf accelerator, in a green shack behind the physics building, he took up again the work he had left in 1941, and firmly established his position as an authority on low-energy nuclear physics and on neutron physics.

Tom Bonner's most significant contributions to neutron physics and to nuclear physics were concerned with techniques and instrumentation. His ideas were quickly recognized and

widely adopted. Many have become standard laboratory practice. I will mention three.

I have in fact already referred to the first, his development while a graduate student and a National Research Fellow of the technique of high-pressure cloud chambers. By industry and insight into the physical situation he developed this technique to a high point of usefulness and precision. As early as 1933 he showed energy spectra of the reactions first used for producing neutrons, and during his fellowship at the California Institute of Technology he applied this method to the study of neutrons produced by accelerators, with what were, at that time, high energies.

A second technique, which again showed his ingenuity and insight into the physical situation, was his method for detecting thresholds of endothermic nuclear reactions in which neutrons were emitted. By using a "long" counter to monitor a large background of faster neutrons, and a small counter with only a minimum of hydrogenous material around it, and also by taking account of the forward concentration of the slow neutrons, he was able to devise a ratio method of detecting the slow neutrons in the presence of a large background of faster ones.

A third technique which it seems appropriate to mention was his use of a polyethylene sphere surrounding a lithium detector to provide a neutron detector of known spectral sensitivity. Bonner used such a detector to discover a previously neglected high-energy tail of the neutron spectrum from fission reactions. He also showed that a sphere twelve inches in diameter provides a highly accurate simulation of the biological effect of neutrons in a human body. Such devices are being used in biophysical work.

All of these techniques are of extreme simplicity. They involve no subtleties of analysis, but they do suggest a physical

understanding of the processes involved which seems to have lain at the basis of Tom Bonner's mastery of his experimental equipment.

During the postwar period Bonner was a consultant at the Los Alamos Laboratory and frequently spent a good part of his summers there. As early as 1948 he measured the neutron energy spectrum from the fission of U^{235} in the region of very low energies. This, combined with the higher energy measurements of Bob Watt, a former student of Bonner's, is sometimes still regarded as the best over-all neutron spectrum of this process. During later summers he continued with various associated activities and again aroused the admiration of colleagues at his ability, rapidly and confidently, to get things to work.

In the last few years, Professor Bonner was the recipient of increasing recognition for his work and of a steadily growing number of honors and distinctions.

He was a member of the National Research Council Fellowship Board to consider AEC predoctoral fellowships from 1947 to 1954; he was a member of the Nuclear Cross Sections Advisory Group to the AEC from 1951 on, and was held in unusually high regard by other members of that group. It was said on one occasion that Dr. Bonner would attend a meeting, see what needed to be done, and go home and do it.

He was also a consultant to the Socony Mobil Oil Company. He was a member of the Council of the Oak Ridge Institute of Nuclear Studies; a member of the Physics Advisory Committee to the National Science Foundation; a member of the Physics Visiting Committee to the Brookhaven National Laboratory; a member of the National Committee of the International Union of Pure and Applied Physics from 1957 to 1960; a member of the Board of Editors of the *Physical Review* from 1951. Professor Bonner was a Fellow of the American Physical Society; a member of the American Nuclear Society, the Physical

Society of London, the Dutch Physical Society, and the Japanese Physical Society. He was elected a member of the National Academy of Sciences in 1959.

His sudden and completely unexpected death on December 6, 1961, was a heavy loss to the National Academy of Sciences, to Rice University, and to the community of physicists as well as to his more immediate friends.

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KEY TO ABBREVIATIONS

Nucl. Phys. = Nuclear Physics
Phys. Rev. = Physical Review
Proc. Internat. Conf. Nucl. Struct. = Proceedings of the International Conference on Nuclear Structure

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