

Iowa Physics Through the Years

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(From Proceedings of the Iowa Academy of Science, Volume 82 No. 1, pg. 52-56)

The ensuing paragraphs will attempt to review the development of physics in Iowa from its early beginnings to the present. Since much of physics activity is and has been supported by institutions of higher education, the developments at the several colleges and universities will be pertinent to the story. But since physics is essentially a human activity, the persons who made our contributions to the development of Iowa physics must become a significant part of this review.

THE EARLY YEARS

The first offering of topics in physics antedate the organization of the Iowa Academy of Science by some two decades. In 1856, nine years after the legislative charter establishing the University of Iowa, but only one year after the first actual classes were begun, a course in the Department of Natural Philosophy was available to students in Iowa City. Included were such physics topics as mechanics, hydraulics, electricity and magnetism, acoustics, optics, and meteorology. A \$500 appropriation had been made the preceding year for laboratory equipment in chemistry and physics. This early emphasis on laboratory instruction placed The University of Iowa among leaders in the field, since 1871 there were only about four institutions in the nation with a systematic plan for laboratory-type instruction; the Massachusetts Institute of Technology and The University of Iowa were among them. Professor L.W. Andrews early served the University as Professor of Physics and Chemistry and Director of Chemical Laboratory. In 1867 Gustavus Hinrichs published papers on the topic "Automechanics," a few years later received international recognition for his development of student laboratory programs in physics. The first astronomical optical observatory at the University was build in 1874, and physics and astronomy became established as a separate department in 1887, with Professor A.A. Veblen as its first chairman (1887-1905).

At Iowa State University instruction in physics began very soon after college-level classes were initiated in 1869. W.A. Anthony was appointed Professor of Physics in 1872, but disagreement arose over compensation for summer employment for installing laboratory equipment, and there was further misunderstanding regarding opportunity for personal research. In his 1942 history of Iowa Sate, E.D. Ross remarks: "The consequence was the loss of physicist of energy and creative mind." Professor Anthony was replaced in 1873 by J.K. Macomber who also taught elocution and Shakespeare, and was librarian (!). He was one of a group which took part in the formation of the Iowa Academy of Science in 1875. By 1887 the Iowa State University catalog listed two years of physics instruction for sophomores and juniors; the course content was closely tied to the needs of students in "Mechanics Arts" (i.e., engineering). The applied nature of the work led to early provision of laboratory facilities in light and sound, and an optional senior course in analytical mechanics offered "two afternoons per week" in the laboratory. Two years later the physics equipment was valued at \$8,000, a figure which

would surely be much enhanced if expressed in 1975 dollars! By 1893 there were 17 physics courses listed, including the areas of astronomy and photography. The Department of Physics and Electrical Engineering had been established by 1890; Professor W.S. Franklin came a year later to be chairman of the department. In 1896-1897 Professor Franklin became the first member from the physics discipline to serve as a president of the Academy.

At the University of Northern Iowa, a physics course was offered under the title "Natural Philosophy" in 1878. Diela Knight was in charge of "Natural and Physical Sciences and Gymnastics" (!), followed by A.C. Page (natural and physical sciences) in 1889 and L. Begeman in charge of physics in 1899. Professor Begeman remained on staff until 1935; as a graduate student at the University of Chicago, he had played an important role in the Millikan oil drop measurements of the fundamental charge on the electron.

In addition to the physics offerings at the three state schools, the pre-1900 period saw physics courses established in some 14 private Iowa colleges, including Coe College and Drake University (both initiating courses in 1881), Luther College in 1884, Simpson College in 1888, and Parsons College in 1889. The course content of most of these physics offerings would be regarded by present standards as rather limited; perhaps many present-day high school physics programs would eclipse the pre-1900 college offerings in both breadth of coverage and depth of intellectual demand. (In defense of the Iowa physics of that period, however, it should be said that the physics included in those college courses probably represented a far high percentage of the then extant total physics knowledge than does the physics of our present first-year courses when compared to the present enormous body of technical information.)

Research interests, while necessarily subordinated to instructional duties in the early years, grew in importance as the start of the 20th century approached. Frank F. Almy (Grinnell) was taking X-ray pictures in early 1896, within a month or two after the discovery of this penetrating radiation by Roentgen. The first papers on physics topics presented to an Iowa Academy of Science meeting appear to have been in 1887 by L.W. Andrews (primarily a chemist): "On a New Astatic Galvanometer with a Spiral Needle," and by T. Proctor Hall (primarily a geologist): "Physical Theories of Gravitation." In 1899 the presidential address by W.S. Hendrixson (Chemistry Section) recognized the spectacular developments in physics which were to lead to the coming century of "modern physics" by devoting more than four pages to this field. Just after 1900 began a continuing series of papers by physicists: in 1901, A.A. Veblen (The University of Iowa) on "Relation of Physics to the Other Material Sciences" and "Some Improved Laboratory Devices and Apparatus," and W.M. Boehm (The University of Iowa) on "A Ruling Engine for Making Zone Plates"; in 1902, F.F. Almy (Grinnell) on "Observations on Action of Coherers When Subjected to Direct Electromotive Force."

THE MIDDLE YEARS

The first four decades of the 20th Century saw a fulfillment of the earlier promises: development of physics departments to full stature and expansion of instructional activities. There was also growing interest in graduate level physics and gradual establishment of ongoing programs of graduate research at the two larger state institutions.

The University of Iowa was the first to offer graduate work in physics, beginning in 1900. The first recipient of a Master of Science degree was LeRoy D. Weld, with a thesis: "A Brief Elementary Treatise on Terrestrial Magnetism." (He then served Coe College as chairman until 1940, and was coauthor of a widely used general textbook in physics for engineering students.) In 1909 George W. Stewart took over the chairmanship of the department from Karl Guthe, and in 1910 the first Doctor of Philosophy degree was granted to Lee Paul Sieg, who presented a dissertation on the topic "A Study of Some of the Elastic Properties of Platinum-Iridium Wire." Professor Stewart made many contributions in the field of acoustics and its applications. He is also well remembered for his "June Colloquium of College Physicists," initiated by him in 1936 and continued except for three World War II years until 1959. These annual meetings served Midwest physicists well as a gathering-place for discussion of both research and instructional topics. Until his death in 1956, Professor Stewart planned these meetings with continuing fresh points of view and topics. His genial spirit as he acted as host at each meeting pervaded the sessions with a recognition of the importance of each man's contribution to the field of physics, whether by innovative teaching or by an active research program. Professor Stewart served as president of the American Physical Society in 1942. He relinquished the departmental chairmanship to Louis A. Thurner in 1946, but continued to be active in physics. The growing interest of the physics profession in nuclear research was reflected at the University in the building of a Cockcroft-Walton 400 KeV nuclear accelerator in 1937 under the leadership of Alexander Ellett.

Iowa State University began the 20th Century with a combined department of physics and electrical engineering, headed by Professor Louis B. Spinney from 1897 until 1909, when separate departments were established. Professor Spinney continued as head of physics until 1930, and was active in the department until close to the time of his death in 1951 at the age of 81. He was known nationally for his general textbook of physics which went through five editions from 1911-1937, sold more than 100,000 copies, and was at one time used by 150 colleges and universities. Dr. Jay W. Woodrow became department head in 1930, after coming to Iowa State from the University of Colorado in 1921. He guided the department through the difficult wartime years, and retired from administrative work in 1947. He continued active in the department until his death in 1951. Growth in the undergraduate program in physics was matched by increasing emphasis on graduate work. The first Master of Science physics degree was granted in 1917 to Everett R. Collis; his topic was "A Study of the Cooling Effect Due to the Peltier E.M.F." A total of 18 master's degrees preceded the first Doctor of Philosophy degree, which went to Robert M. Bowie in 1933. His dissertation was entitled "The Determination of the Thermionic Work Function of Nickel by a New Method"; the work was done under the direction of Gerald W. Fox. The growth in research activity at Iowa State University during the years preceding World War II is shown by the fact that from 1933 through 1940 21 Master of Science degrees in physics were awarded, and 20 Doctor of Philosophy degrees.

The emphasis on teaching training at the University of Northern Iowa delayed the formal entry into graduate physics work until the decade of the 1950's. However, a student, Eugene F. Grossman, was actively interested in "wireless telegraphy" in 1916; his experimental apparatus made possible exchanges of messages between

President Homer H. Seerley, of the (then) Iowa State Teachers College, and President Raymond A. Pearson, of (then) Iowa State Teachers College. President Pearson transmitted (via Grossman) "...I send greetings by wireless telegraph. The genius of the engineer may make it possible for us to talk by wireless telephone..." Grossman made contributions to "wireless telephony" while at UNI, and later while with the American Telephone & Telegraph Company. He became operating engineer for the National Broadcasting Company when it came into existence in 1927. Among students at UNI who achieved national reputations in physics are listed: Robert D. Huntoon, who became Deputy Director of the National Bureau of Standards; Harald C. Jensen, long-time physics teacher at Lake Forest College and recipient of the AAPT R.A. Millikan Lecture Award for 1974; and Leonard O. Olsen, professor of physics at Case until 1960, later with the U.S. Naval Postgraduate School, and president of the American Association of Physics Teachers, 1960-61.

During the first half of the 1900's, the private colleges of Iowa made many contributions to the developing field of physics and physicists. Physics departments were established at Coe College (1905), Luther College (1912), Drake University (1923), Parsons College (1924), and Westmar College (195). During the 1920's and 1930's, Coe College, with Dr. Arthus Erskine, operated an X-ray laboratory, investigation radiation fields from X-ray tubes, filters, and absorption characteristics of materials.

At Drake University the department of physics and astronomy was guided from 1900 to 1922 by D.W. Morehouse (whose discovery in 1908 of a comet with unusual behavior attracted much attention among astronomers) and from 1923 to 1964 by Paul S. Helmick. Drake alumni of note are: Jay W. Woodrow ('07), selected to be a Rhodes Scholar at Oxford, and later head of the physics department at Iowa State University; Seth B. Nicholson ('12), who served for more than 40 years as astronomer at the Mt. Wilson Observatory of the Carnegie Foundation; and Erling N. Jensen ('32), who spent about two decades at Iowa State University, becoming Professor Physics and Senior Physicist in the Ames Laboratory of the Atomic Energy Commission, and nearly a decade as President of Muhlenberg College in Pennsylvania.

Physics at Grinnell received major early inspiration from Frank F. Almy, who came to the campus in 1893 and brought with him a background of work with Henry Rowland at Johns Hopkins involving the diffraction grating, and indirect contact with European work on the newly discovered electron and cathode rays. Almy's guidance incited O.E. Buckley ('09) to go on to Cornell University for his doctorate; he later became director of research at the Bell Telephone Laboratory, and from 1940 to 1951 he was president of AT&T. Samuel R. Williams ('01) made major contributions to the field of magnetism during his Ph.D. work at Columbia and his tenure at Oberlin (1908-1924) and Amherst (1924-1995). Grant O. Gale took over the headship of the physics department at Grinnell in the inauspicious depression year of 1933. In spite of financial limitations, the department engaged in research projects in radio circuitry and thermodynamics, and was prepared to make significant contributions to the army training program during the ensuing wartime years.

Among the several score of recipients of bachelor's degrees of physics at Luther College during the early portion of the 20th Century were: M.H. Trytten ('16), long-time teacher at Luther College and at the University of Pittsburgh, and for more than a

decade and a half Director of the Office of Scientific Personnel of the National Academy of Science; S. Legvold ('35), Professor of Physics at Iowa State University and Senior Physicist in the Ames Laboratory at the AEC, with many contributions to the knowledge of rare earth properties; and L.O. Herwig ('43), research scientist with the Westinghouse Electrical Corporation and director of solar energy research work with the National Science Foundation.

THE WARTIME YEARS

The advent of World War II had an understandably significant effect on the Iowa physics community. The undergraduate teaching of physics was seriously disrupted by the draft of most males of student age, but the military services set up training programs for their officers and draftees. The University of Iowa, Iowa State University, Grinnell, and other schools operated extensive specialized training classes which in many cases were somewhat comparable to the usual first-year college courses.

With the change in teaching emphasis came a marked drop in the graduate teaching and academic research programs. Figure 1 shows the paucity of graduate physics degrees granted by Iowa State University during the war years and those immediately following the war. But since World War II had a technological base far more extensive than any earlier war, Iowa physicists found themselves needed in research programs oriented toward military goals. Ballistics, electromagnetic radiation (in radar, infrared, and optical wavelength regions), underwater sound- all received significant research contributions from the Iowa physics community. Above all, however, the development of nuclear energy was the most spectacular; the Manhattan Project centered around physics, but was carried forward by cooperative efforts by physicists, chemists, mathematicians, and engineers. In 1942 the sudden demand for uranium metal of extreme purity and unprecedented amounts led to the formation of a group at Iowa State University under the direction of Dr. F.H. Spedding. Physics and chemistry research merged to investigate the characteristics of uranium, plutonium, and other elements pertinent to the nuclear energy development. Much of the pure uranium used in the first nuclear reactor of the University of Chicago campus came from the ISU pilot plant. Though the production methods were later turned over to industrial corporations, ISU supplied directly the Manhattan Project over two million pounds of highly purified uranium.