5. Physics on Dickson Street (1952-1993)

New Building Proposed

One fine fall day in late 1950 Dr. L. B. Ham walked out of his office into the hallway of University Hall only to be confronted with the terse statement from President Lewis Webster Jones that Dr. Ham was to specify what physics would want in a building! This information was to be provided in two weeks.

The Engineering School had just had a review team visit them and, among other things, their report said that the crowded and poorly developed space for physics in Old Main was a detriment to the engineering program.

President Lewis Webster Jones approached T. C. Carlson, Vice President for Finance, to find out what money was available. A fund was being held back to build a new Building and Grounds (Physical Plant) facility on the south side of Dickson Street. Dr. Jones decided that this money would be used to build the Physical Plant Building immediately but that it would be used "temporarily" by the Physics Department.

When this word "temporary" came to the attention of Dr. Ham and the department it was time for another memo and another meeting!

Ham Writes Memo

The situation in 1951 is aptly described in a February 28, 1951 memo from the Head of Physics, L. B. Ham, to Arts and Sciences Dean G. D. Nichols and Graduate School Dean V. W. Adkisson.

"In a departmental discussion on details related to the proposed new building, the conversation unexpectedly turned again to a formulation of a proposal for abandonment of the Physical Plant building project as a major elementary and advanced teaching medium for physics. The elements of timing and the extent of temporariness in the relocation project were the chief points of differences to consider in the proposal."

The above quotation from the long February 28, 1951 memo of Dr. Ham (all of Dr. Ham's memos were long) is taken from a long document prepared in 1982 by Dr. D. O. Pederson (most of Dr. Pederson's documents were long also) summarizing the physics department space needs. The original Ham memo continued to analyze in detail the issues related to the proposed Dickson Street building: temporary, inadequate research space for physics, inadequate control of the physics space in the "physical science" building, etc.

Meeting with President Jones

Dean Guerdon Nichols was contacted and he and L. B. Ham, Willard Bennett, Paul Sharrah, George Lingelbach and H. M. Schwartz made an appointment to see President Lewis Webster Jones. We did not know then that he had just had some hard conferences in Little Rock on the financial needs of the University. The President stood behind his desk, with one of his constant cigarettes, nervously shuffling some papers. He did not ask us to have a seat. He pointed down at the floor and shouted "temporary, temporary, you will retire out of that building." We were out of his office in less than ten minutes! Dean Nichols told us not to worry. We didn't! We have been in the building since 1952 and several of us have retired out of it!

L. L. Browne, Buildings and Grounds Director, did not know that he would never be permitted to move Buildings and Grounds into this Dickson Street building. He would come down the hill frequently and look through the building, even late in the 1950's, as though he were planning where to put things. The large physical plant complex on Razorback road was added much later and was in use by 1971.

The physics department did win one point and was given complete control of the space layout of the upstairs and downstairs floors of the west wing and central wing totaling about 13,600 square feet (approximately 60%) of the over 20,000 square feet of total usable space. This was true even though it was being said repeatedly that this building was to revert to Physical Plant Offices and Shops sometime.

Dickson Street building near completion in fall of 1951. Original 1905 Engineering Hall can be seen in the upper left of photo.

Front of new Physics Building facing Dickson Street. This building was completed in June of 1952

The department of physics was to move into this space in the spring and summer of 1952 and is still working here!.

Ham Describes New Building

In a slightly more joyous vein, Dr. Ham describes the building to the former students in his customary Christmas Letter dated December, 1951.

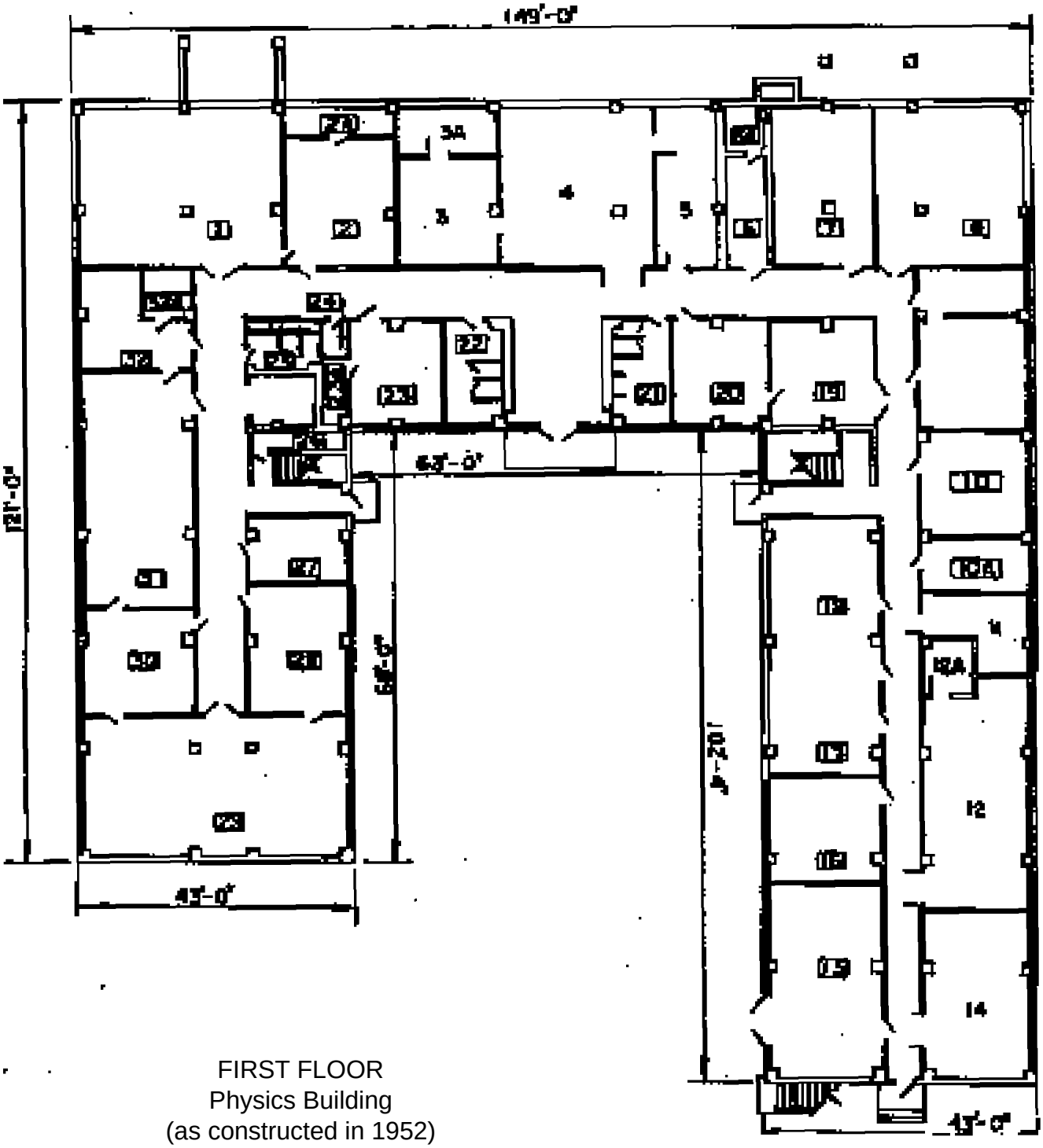
"For us Physicists, the highlight of this year is the new Physics Building, plans of which were announced rather unexpectedly by Pres. Jones about a year ago. It is to cost three hundred thousand dollars is being built on the south side of Dickson Street next to the temporary Institute of Science and Technology Building with appropriations allotted to Buildings and Grounds but has been designated for use by the Physics Department until money is available for a permanent unit to house Physics. Actually the building has been rather loosely labeled "Physical Science Building" because it will also house physical science research which involves government contracts, the theory being that such contracts are more easily obtained if good housing facilities are available. It is a U-shaped, two-story, hadite block and brick structure facing north and the Physics Department will occupy the west half. The total instructional space will be about the same as our present set-up (in Old Main) but such space will be better organized. We hope to be in the building not later than September." December 1951 letter from Dr. Ham to the Physics Alumni.

Building under construction in 1951 showing hadite block and brick walls.

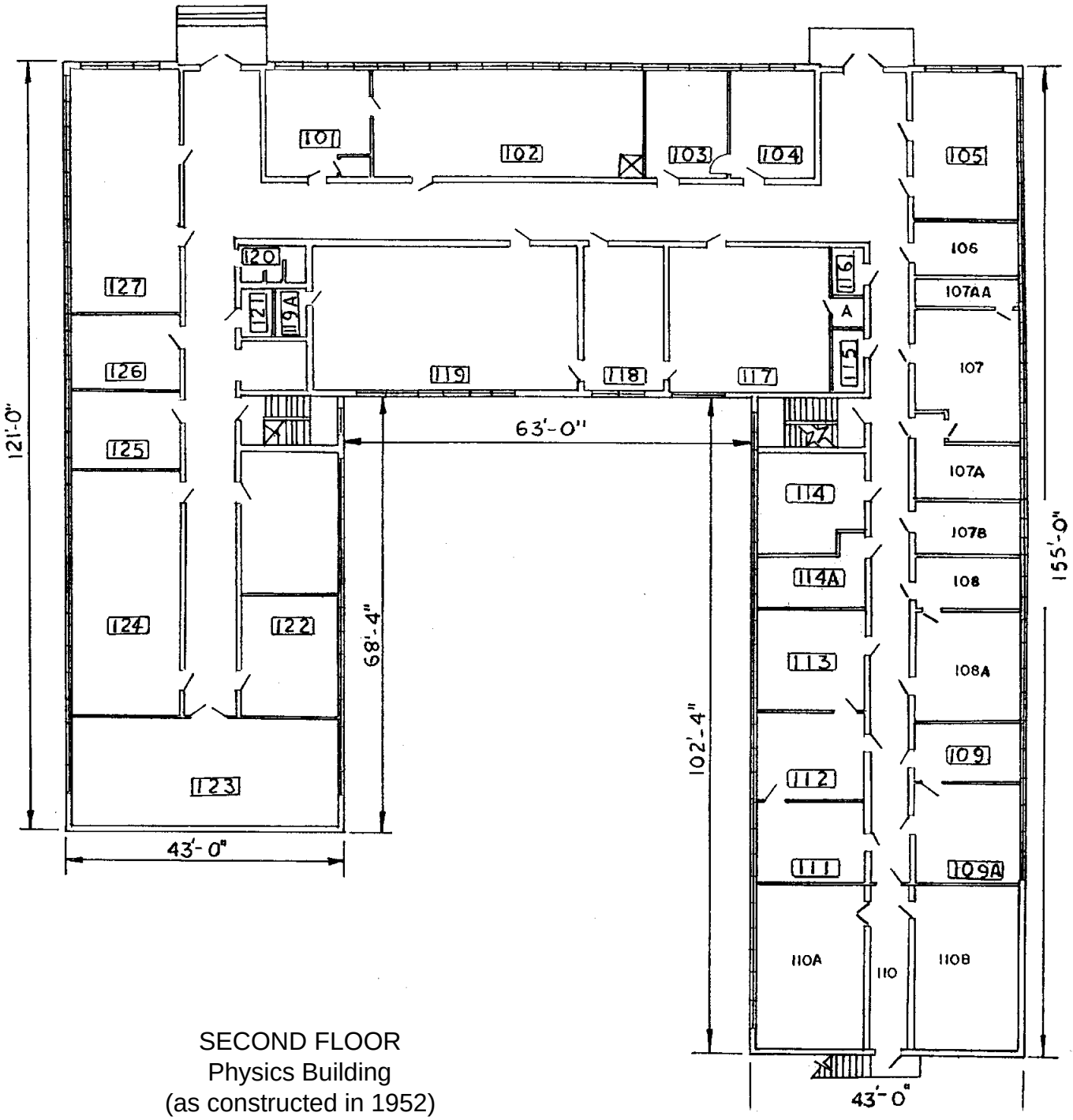
It was an exciting time and in the December 1952 letter to former students Dr. Ham continues to talk about the new Dickson Street Building.

"This is the first Christmas Season since moving to our new Physics Building. The rooms on the east end, both ground and first floor, are reserved for physical science research work, the remaining space belongs to the Physics Department. The department now enjoys better facilities than it had.

"Authorization for this new building was announced about the middle of the school year 1950-51. The President wanted our plans outlined to the architect within two weeks. We had long had certain rather specific plans in mind and were able to make our wants and



FIRST FLOOR
Physics Building
(as constructed in 1952)



SECOND FLOOR
Physics Building
(as constructed in 1952)

needs known by the end of four weeks. Building started late in the fall of 1951 and was finished, except for minor details, in June of this year. We conducted a few of the elementary laboratories in this new building near the end of spring 1952. Regular occupation began in September of this year." Dr. L. B. Ham, December 1952.

Building Planned

Just how did this physics building on Dickson Street get designed? One Saturday afternoon in early 1951 there was a meeting with the architect from Fort Smith to lay out the space to be used by physics.

So Dr.'s Ham and Sharrah, along with L. L. Browne, head of Buildings and Grounds, later called Physical Plant, and a representative of the architect firm from Fort Smith met and established the floor plan that Saturday afternoon! Dr. L. B. Ham had done much work on this in advance and most of his ideas were accepted. He insisted that there be an elevator, for example, and that the primary offices be of adequate dimensions. Five large offices were provided! These offices had adequate room for books, small experimental set ups under development, and a chalk board for teaching small groups.

It had been made clear that the east wing, both basement and first floor, were off limits to the Physics Department. The Institute of Science and Technology as well as other research projects were to go there. Elaborate laboratory tables, sinks and air ventilating equipment were installed in this space. If physics could have had only a fraction of that money spent on its space! Narrow hallways were to characterize the east wing because less traffic would be expected in the research areas.

It was also made clear at about this time that the building would actually be called The Physical Science Building. We were most surprised! The use of the term Physics Building finally was accepted during the 1960's! Petty stuff. It only shows how hard it was for "physics" to establish itself in the pecking order of things, at least in the minds of some of the higher administrators!

More and more of the east wing was assigned to physics as time went on. Sharrah and Schwartz used one room for cosmic ray work (Room 105). Chemistry and geology and physics used the research space in the east wings for the next few years as the research programs in the IST were gradually phased out or were absorbed into the various academic departments by 1957. Brenton Stearns and Berol Robinson and R. H. Hughes and O. H. Zinke and Richard Anderson and Charles B. Richardson used space primarily for research and by 1982 the department had been assigned approximately 17,742 square feet of the 21,300 square feet of usable space.

The summer programs along with increased research activity made it necessary to introduce various air conditioning units as time and funds permitted. Teaching space Room 1 and research space rooms 8 and 9 and two or three other rooms in the east wing were being cooled by small units by 1960.

By 1980 there were three large installations cooling rooms 118, 119, the physics library and Room1. Chilled water cooling and heating lines from the central plant were installed in the laser laboratories and some of the offices and the planetarium. In addition there were over a dozen window units variously placed and cooling the laboratories adequately but creating a rather unsightly building.

Further information on the progress and growth of the department in this building will be the topic of this and subsequent chapters. It was used continuously by the expanding physics program for over forty years with only minor changes.

Excitement grows now, Fall 1993, because renovation of the present building and a 5,000 square foot expansion will help put physics on the move here again. This exciting time and the finished product are described in Chapter 12.

Space Utilization

By September of 1952 the physics department had fully moved into the Dickson Street building, and the department was ready to teach all the physics lectures and laboratories there.

In the short time that had been available for planning, it is no surprise that the elementary lecture space and laboratories were similar to the equivalent Old Main space in use from 1936

to 1952.

However, the rooms set aside for advanced laboratory work on the first floor, or basement floor, were far more adequate than the Old Main space had been. There was plenty of space for the advanced laboratories in Old Main but it wasn't all that well organized. The new building provided an electrical measurements laboratory, a modern physics laboratory, an electronics laboratory, an x-ray laboratory with a lead-lined room, the Philips x-ray diffraction facility, an acoustics laboratory with sound absorbing walls, a laboratory for the Littrow spectrograph, and an optics teaching laboratory. Four dark rooms were established and the Littrow spectrograph room had its own dark room. Film was an important sensing tool in physics then.

Probably the most noticeable improvement in the new Dickson Street Physics space as compared to Old Main was the provision of adequate storage. Six storage rooms were provided and two of these were quite large.

But even the advantage of having adequate storage was to erode away during the first few years due to pressures for research space. But probably the saddest loss of all was the disappearance of adequate space to store and develop physics demonstrations! Only one of these original six storage rooms remained by 1974!

The loss of storage space was partially offset through the years by the addition of wall storage cabinets in many of the laboratory rooms. But it was very hard to get the money to do this. The department chairman came very close to being called on the carpet for pushing this work too vigorously. These cabinets were built and installed in the early 1960's by carpenter Leonard Gabbard of the research services shop.

Truly adequate storage and space in 1995 for the development of demonstrations is still waiting for the phase-II physics expansion planned for the teaching space. This will include a large lecture hall, a demonstration room and demonstration development room, and a modern planetarium. The completion in 1994 renovation of the 1952 building and the phase-I expansion has proved to be a boon to the introductory physics teaching program. Even in this somewhat limited space a greatly improved laboratory teaching environment is already reaping results.

Above: Physics Department library about 1965. Prof. L.D. Lingelbach can be seen assisting a student. Below: same library in 1960.

A few of the basic teaching facilities as provided in the original space may be worthy of noting. The rooms used for lectures included 118, 119, 127 (doubled as laboratory space), 104 and later the large Room 110. Some small class groups met in the laboratory Room 28, and Room 1 was much used for summer institutes. Some small lecture classes or seminars were held in offices.

At first all of the elementary laboratories were on the top floor. Rooms 123 and 124 and 127 and for a time Room 108 served the physics and physical science laboratories. The honors section of University Physics laboratory worked in Room 1. I can see Dr. Day and Carl Rutledge operating this laboratory.

Later the elementary physics laboratories moved to the first floor Rooms 29 and 30 and Room 1. Physical science laboratory for elementary teachers was in Room 124. Astronomy laboratory used Room 123 and Physics and Human Affairs used Room 127. Musical chairs!

One other significant improvement the Dickson Street Building made over the Old Main space was the provision of space for the physics library. This room containing 714 square feet and housed many of the magazines and physics reference books. This was quite an improvement over the two large book shelves called the physics library in Old Main (page 29). The library expanded into the physics office space (Room 101) in 1972 to add another 272 square

Dr. Ham, second and last head, spent much time in the acoustics laboratory.

feet for a total of 986 square feet.

The 1993 remodeling of the building includes a library room on the south side of the top floor providing approximately 1500 square feet in excellent surroundings. This library boasts having the new computer card file system and network access to library data base systems elsewhere! We could have only dreamed about such a thing in 1952 when physics moved into the Dickson Street building!

Physics librarian and departmental secretary.

Room 101 on the top floor was the head office from 1952 until about 1972. Ham and Sharrah and Day worked there. Then rooms 103 and 104 became the "office." Day and Pederson and Richardson and Lieber and Hermann worked there. Then in 1990 Room 105, the original 1952 cosmic ray laboratory and later a classroom, and a part of Room 106 became the head office for physics. Gupta and the two office secretaries and Singh worked there.

Physics secretary Mino Jo Austin's work was done principally in the west end of the physics library. Underwood typewriter is still on display in the department office in 1995.

By 1982 with the coming of the laser program and the development of these facilities the department was using approximately 18,000 square feet of the approximately 21,320 square feet of space in the Dickson Street Building. By 1992 the department was using all of the useful space in the building.

The Dickson Street Building has been used continuously and has served the department well for over forty years with only minor changes and adaptations.

Paul C. Sharrah, first chairman (as opposed to *head*) of the Physics Department (1957-69) working in the head office, room 101, ca 1967.

People at Work

Let us look at the people and facilities again. Dr. L. B. Ham, head of physics was working in the head office (Room 101) long hours during the nine months, but frequently was absent during the summer on a long vacation. The head office was a large office adjacent and just west of the physics library room. He also enjoyed teaching courses in sound and working with experiments in the sound-proof room.

In the library one would see the only secre-

tary working on a Remington or Underwood mechanical typewriter and then a few years later on an IBM Selectric. Half of her salary came from University Library Funds as late as 1960. There would be only one secretary until the 1970's except for the short-term supplementary help during the summers in the science institutes.

Physics instructor Lamont Woodruff cutting cake.

Dr. H. M. Schwartz worked in his office on the front of the building (Room 103) and had a fairly advanced classical mechanical desk top calculator with a motor drive (either a Monroe or Marchant) for his research. He and Mrs. Dick Fink (Veronica) spent hours and hours calculating the ground state of helium. Their work held the world record for accuracy. The clunk-clunk-rattle-rattle sound of that machine still echoes through those two offices and the library and the hallway! This work was part of the chemistry department's Atomic Energy Commission Grant (AEC 277). Dr. H. M. Schwartz later was to spend a year at the University of Tel Aviv and he wrote a textbook on Relativity when he returned.

Above: Dr. Robert F. Kruh of chemistry adjusting the X-ray diffraction instrument he and Sharrah designed. Below: Bent and ground salt crystal used as a focusing monochromatic for the theta-theta diffractometer used at the Oak Ridge National Laboratory and at Arkansas for the study of liquids. Sharrah had conceived of the idea about 1942 while studying under Newell Gingrich at U. of Missouri.

Dr. Sharrah studied and wrote in Room 104, and taught several small classes there. He taught Howell Lem-ming there, or did Howell Lemming teach him? Most of the advanced teaching was done in Room 117, a lecture room with an inclined floor and seating arrangement. Dr. Sharrah would go to Oak Ridge Tennessee for the summers 1951, 1952, 1953, and for the complete year starting in the summer of 1954 and extending to late summer 1955.

Wray Wilkes, first director of the computing center with the IBM-7040 computer in the Science-Engineering Building, about 1966. It was the second IBM used by the University.

G. D. Lingelbach had the responsibility of the elementary laboratories and taught a section or two of college physics. His office was in Room 125 on the west side of the top floor. He was the only physics instructor to be invited to join the Pre-Med Student Society! He also supervised the student shop, housed originally in Room 123 and moved to Room 15 about 1964.

Room 126 had one or two graduate students, including Frank Biggs. He was one of the bright students at that general time of growth. He helped Sharrah with an interesting court case in Ft. Smith.

Dr. E. S. Amis of the chemistry department had a research project in one of the east rooms upstairs. Dr. R. F. Kruh of the chemistry department had his office downstairs. He and Sharrah were to write a successful joint proposal to the AEC in 1956. This space would be used later by Dr. Harold C. MacDonald of the geology department.

James B. Pearson and another short-term employee of the IST operated the Littrow spectrograph in Room 8. The Philips x-ray machine in Room 20 continued to serve the IST with physics graduate student B. S. Garrett and Paul C. Sharrah serving as operators.

George Kirsch and Leonard Gabbard worked from 1952 to 1960 in the research services machine shop and carpenter shop, both housed in the building in Rooms 15 and 14 respectively.

Berol L. Robinson at his office desk about 1955.

These rooms were to house the University's first computing center with its IBM-650 and the Research Services shop was moved into a large building at the old fair grounds. The IBM-650 was used from 1960 to 1964 when an IBM-7040 was installed in the computer space provided in the new Science Engineering Building. The IBM punched cards still dominated the scene and would be used until the late 1970! Computers and microcomputers come in for a more complete description in a later section.

Dr. Brent Stearns worked in an office on the east wing upstairs during the 1950's. He and Dr. R. H. Hughes were co-directors of one of the ordnance research projects, Arkansas Research Naval Ordnance, ARNO, in the IST for a time after its original director Z. V. Harvalik went to the U. S. Army Research Center at Ft. Belvoir, Virginia. Stearns was completing his thesis for the Ph.D. and went on to Tufts University.

Dr. Berol Robinson was employed part time from 1952 to 1956 on the AEC-277 grant with chemistry and established an excellent nuclear physics research laboratory in two of the rooms in the east wing of Physics. He was to have an interesting career at Case-Western Reserve and with UNESCO (United Nations Educational Scientific and Cultural Organization) in Paris, where he and his wife still live. And for those who want to know, his son-in-law is the distinguished teacher of Greek and classics Daniel B. Levine of the University.

Later part-time employees on the AEC-277 grant were Dr. Matti Nurmia from Finland, Dr. Mykola Saporoschenko originally from Russia, and Dr. James Scobi from Scotland.

Dr. Walt Canon of electrical engineering and Sharrah in 1957 used a 20 megahertz receiver and a 40 megahertz receiver to detect the Russian Sputnik I, the first artificial satellite of the earth, as it passed over the area. Dr. Matti Nurmia measured the Doppler shift to determine some of the orbit parameters. Nurmia published a short note on this work in the Journal of the Academy of Sciences of Finland.

Thus in the 1950's there were usually four or five full-time faculty members and two or three graduate students and one secretary directly involved in physics working in the building. The research services shop and chemistry and geology and IST research personnel added five or ten other workers for a total of between fifteen and twenty people in the building.

We find today, Fall 1993, even in the midst of the noise and turmoil of remodeling, a total of close to fifty persons working or studying regularly in the building. This includes four secretaries, one shop supervisor, sixteen full-time staff members, twenty-nine graduate students, one building custodian, one retired temporary volunteer and two undergraduate students working part time.

The number working on the remodeling job varies but often is close to seven or eight at one time, and this does not include those working outside on the new wing.

The move in 1952 from Old Main to the Dickson Street building was no "quantum leap"!

Frank Sperandeo in shop.

But it was significant that there was space for the department to use for research expansion later. Thus from 1959 and onward for the next several decades when the faculty was increasing and graduate research was developing, the department could provide research laboratories of reasonable size in the east wing, where the IST and other activities had originally operated.

When physics could have moved into the new Science Building directly south of the old Chemistry Building in the 1960's (originally designated Science Building B), the department told Arts and Sciences Dean R. F. Kruh that we would rather stay in "inadequate space temporarily than be moved into inadequate space permanently!" There was not enough room in that Science Building for both chemistry and physics!

The department is about to take a "quantum leap" in 1993. The Dickson Street building is being remodeled and a new teaching wing is to be added south east of the present U-shaped structure. The useful floor space will be increased by approximately 25% for a total of slightly more than 25,000 square feet when this Phase I addition is completed

But we still desperately need another educational structure being called Phase II! It would provide additional teaching and laboratory space and a physics demonstration and display facility and, hopefully, a medium size planetarium equipped with state of the art star projection equipment.

A Typical Day in the Shop

As mentioned above, the physics student shop was in Room 23 from 1952 to 1964. Then from 1964 to 1982 a larger shop was in operation in Room 15. This larger shop served as both the "student shop" and as the professional shop. Part-time and later full-time help worked in this shop. Then in 1989 a combined professional shop and student shop were established in Rooms 29 and 30. Frank P. Sperandeo III provides service primarily to the research programs and oversees the student shop.

Mr. Sperandeo de-scribes a typical day in the shop and the major equipment and the projects underway at this time in a June 1993 note.

"I've been in the Physics department 12 years here at the U. of A. and growth is eminent. We are under a 5 million dollar renovation and it is sorely needed, especially at the rapid rate we're growing in 1993. I am the only one here in the west wing and have been for the past year doing the design work/manufacturing for the student/faculty personnel.

"During the day I hear power sawing, jack hammering, explosive nailing and all sorts of vibrations going on around me. I feel like I'm doomed to wander on the ice pack of life here. The air conditioner isn't hooked up and it is warm. Through all these difficulties the comraderie of knowing all the construction workers make my day here in Room 29, June, 1993."

College of Physical Sciences Flap

These were exciting times during the 1950's but all that was happening around the University was not always all that coherent.

Guerdon D. Nichols, Dean of Arts and Sciences pledged to Graduate Dean V. W. Adkisson the support of his office to assist the Physics Department in every way possible to develop a Ph.D. progrtam.

There were some power struggles going on and at one time Dr. Raymond R. Edwards (page 32) of the chemistry department tried to establish a College or School of Physical Sciences. This was to include chemistry, geology and physics and the idea did get some agreement from the University officials, including none other than the President John Tyler Caldwell! A special meeting was convened to promote

this concept but some relevant opposition arose.

Sharrah was in Oak Ridge Tennessee working at the Oak Ridge national Laboratory and was not privy to what was happening at first. Edwards sought out Sharrah back in his laboratory in the chemistry division of the Oak Ridge National Laboratory and tried to enlist his support. He was desperately needing more votes.

Edwards thought the science departments would have better success at getting funds if they were separate from the other Arts and Sciences departments. He was most surprised when Sharrah told him that he would contact his department head L. B. Ham, before making a decision!

Dr. Ham wasn't so keen on the idea of forming a college including chemistry, geology and physics, but the smaller departments were about to be run over!

Guerdon Nichols' Memo

It came down to the point where it was necessary for the Dean of Arts and Sciences Guerdon D. Nichols to respond. The following memo certainly defined the problem clearly.

G. D. Nichols (March 21, 1955)

To: All faculty members in the departments of Chemistry, Physics and Geology:

"I regret very much that I am unable to go along with the move to establish a separate College or School of Physical Sciences distinct from the College of Arts and Sciences. It does not seem to me that the differences between the departments of Chemistry, Physics and Geology on the one hand and the rest of the College on the other hand are sufficient to justify such a radical move.

"With respect to curriculum, there seems to be fundamental agreement as to educational philosophy and the place of liberal subjects in a professional course, with only the details of application at issue. Surely further discussion and a meeting of minds should resolve differences as to methods of implementing our common philosophy.

"Any charge that the physical science departments are being discriminated against budgetwise seems to me completely lacking in any foundation in fact. The real difficulty all over the College is lack of sufficient funds to carry on activities at the desired level, but I think it can be proved that the physical sciences are getting their fair share of available money.

"I do not believe that there is any College policy with respect to term chairmanships that is so inflexible as to prevent the Physical Science departments from having the type of departmental organization best suited to their needs.

"I would be most happy to discuss with you the points at issue, but as Dean of the College I cannot willingly be a party to its dismemberment. The College needs the Physical Science departments, and in my opinion the Physical Science departments need the rest of the College. I invite you to join with me in an effort to reconcile the differences between the two groups and to help build a better College of Arts and Sciences." G. D. Nichols, March, 1955.

Struggle Continued

There were still echoes of this power struggle lasting into the fall of 1955 but fortunately the College of Arts and Sciences survived. When Sharrah became chairman of physics in 1957 there was an excellent spirit of cooperation displayed between physics and the College Dean's office and the Graduate Dean's office. We all tried a little harder!

When Raymond Edwards was moving out of chemistry here to become head of the GIT in Little Rock, some thought that the world was coming to an end and that the loss here was a catastrophe! Dr. Aubry E. Harvey of chemistry, the newly appointed Associate Coordinator of Research, was going ahead performing his work efficiently. Someone asked him why he wasn't worried about losing Dr. Edwards. He said he had noticed that every time someone leaves the University we almost always find a better person (he said man) to take his place.

Demonstration, Aids

Let us look at some of the earlier aids and the use of demonstrations in the teaching of physics.

A demonstration room was provided in Old Main and one professor and two or three stu-

dents spent considerable time developing and maintaining the demonstrations and seeing that some were set up each week in the lecture hall.

An even larger room was provided in the 1952 Dickson Street Building for demonstration storage and demonstration development

As might be expected, some teachers integrated the demonstrations very effectively into the presentation of the material but some rushed through them and acted like they were only incidental to the teaching process.

When a distinguished engineer returned to the University in the 1970's to assist in the dedication of the Bell Engineering building, he was asked to relate some of his memories of the early teachers at Arkansas. Among other things he described in detail one of the demonstrations the physics teacher (Paul C. Sharrah) had shown the physics class in Old Main in the 1940's!

The demonstrations covered the whole field of general physics with examples from mechanics, heat, sound, electricity and magnetism, and optics. A few demonstration in atomic physics and nuclear physics were being introduced also. Some very large teaching devices were in existence in Old Main in the 1940's. Two large sound focusing reflectors with a diameter of 6 ft were placed at opposite ends of the hallway to demonstrate sound focusing and a 72-foot Foucault pendulum. It was mounted in the stairwell to extend from the ceiling to the basement and was a spectacular display. Two very large Weston station-type galvanometers were mounted on the front wall of the lecture hall in Old Main and they were also in the physics lecture hall in the Dickson Street Building as late as 1970!

Certain other aids were in use in the teaching of physics. Very early use was made of the lantern slide projector. Some of these old glass lantern slides are still in storage in physics. A number of very interesting slides were used in the astronomy course also. Many of these large glass slides were commercially available. A few demonstrations used the lantern slide projector to demonstrate magnetism using small magnets and iron filings. A project galvanometer was also a standard component of the 1930-1940 vintage lantern slide projectors.

Other early optical aids in the teaching of physics were the 16mm movie sound projector, 35mm color slide projectors, and film loop projectors. The movie film and slide projectors were to rule supreme until video tapes and disks were to come onto the scene in the 1970's. These video devices and the phenomenal development of small computers have brought about a revolution in some aspects of teaching.

The development of the overhead projector in the 1950's can be included as a teaching aid in physics. It not only made possible more effective teaching in a large lecture hall if properly used, but also began to be used more and more to project selected demonstrations onto the screen for better visibility. By the late 1980's electronic computer readout attachments were developed for the overhead projector that made it possible to display microcomputer output onto a screen for all the class to see! The video projector also served this same purpose.

The use of physics demonstrations was to experience a special thrust during the late 1950's and early 1960's when they were developed for the summer institute program for high school teachers. Out-standing lecturers on physics demonstrations brought to the department then were Richard Sutton of Swarthmore, Wallace A Hilton of William Jewell College and Herb Gottlieb of Martin Van Buren high school in New York. The department received many requests to give lectures and demonstration lectures to school and other groups. Paul Sharrah gave many of these lecture demonstrations. During the 1970's many such presentations were given by Richard J. Anderson of physics and James A. Wisman of chemistry.

Enrollment pressures and the research demands on the always limited faculty in the early 1970's caused Chairman S. M. Day and the department to begin combining lecture sections and teach them in large lecture rooms outside the physics building. Demonstrations were hard to transport and many that were visible to a class of forty or fifty just didn't work!

The department kept trying to get its act together during the 1970's with respect to the development of the teaching laboratories and demonstrations. Two individuals (Larry Albert and Ken Hagar) were employed and worked hard to keep things going. In retrospect, the elemen-

tary laboratories did experience some real improvements but, with all the efforts, the demonstrations only experienced very spotty attention. Each individual rendered excellent service to the laboratory teaching and the planetarium installation. But even when the first of the above individuals was employed, the department took over the large space for storage and development of demonstrations and used it as a conference room! What a loss! Also the job descriptions of the laboratory and demonstration curator keep changing, much to their confusion. Each time the department simply did not follow through with adequate work space and a budget to support the work and each individual went on to better things elsewhere.

Finally in 1992 the department was defining again its needs and goals in teaching, including laboratory management and the need for physics demonstrations. Somewhat better space for storage and development of laboratory and demonstration devices was being made available again with the renovation and expansion of the physics building, and adequate funds for the purchase of instructional equipment became available when the University started charging students TELE (teaching equipment and laboratory enhancement) fees. A new college graduate, J. Brad Shue, from Appalachian State University in Boone, North Carolina was employed with the title Instructional Equipment Curator. He came with a very strong background in laboratory and demonstration teaching devices and the use of computers in the laboratory. Many new pieces of laboratory teaching apparatus were purchased. Demonstration devices for the laboratories and other devices visible in the large lecture halls will be developed as needed and as time permits.

Report by Brad Shue

The following report submitted by James Brad Shue in March of 1995 describes his work in curator's office.

"My name is Brad Shue and I am the "Instructional Laboratory Curator" for the Physics department. In the fall of 1991, I graduated with a Bach-elor of Science degree in applied physics, with a concentration in lab and demonstration management from Appalachian State University in Boone, North Carolina. I was just starting my work toward a second bachelor's degree, this one in computer science, when a position as Laboratory Curator at the University of Arkansas, Fayetteville, was brought to my attention. As I have always enjoyed doing physics demonstrations and tinkering with all manner of scientific equipment, this position was right up my alley. I was disappointed to see the closing date for the job had already passed. But on the optimistic off-chance I might still be able to be considered, I called the Physics Department at Arkansas. Jean Eaton, the office manager, told me the deadline had been extended and if I hurried I could still be among the applicants considered for the job. That weekend I conducted a crash course in resume writing and faxed my first (ever) resume to the Department first thing Monday morning.

"I applied for the position in February of 1992 and received an invitation for an interview in March. The job was offered to me in April. I started one month early, June 1, 1992, because there was much to do, in light of the renovation soon to begin.

"In preparation for the renovation, there was a lot of "dirty work" to be done. Many of the labs had accumulated a lot of "junk" that had to be inventoried, surplused, and/or thrown away. We also tried to preserve as much historical equipment as possible for future display. As best as I can remember, I think I filled the dumpster about 15 times as I surplused four large truckloads of equipment (1000+ pieces of equipment).

"Things were pretty chaotic at times during the renovation. The undergraduate labs were all moved to the Science Engineering building across the street prior to my arrival and organizing the equipment was quite a chore. Much of the equipment needed major repairs before it could be used.

"One of the most enjoyable duties I was assigned during the construction was the pictorial documentation of the renovation and construction of the new addition. I took many pictures of the progress of this work and got to know most of the construction workers and worked closely with the subcontractor supervisors when minor problems or questions arose.

Typical slide rule from the early 1940s.

Dr. Paul Sharrah and I made an attempt at obtaining a multiple-week time lapse film using a classical Bolex movie camera but one of the components failed. We did succeed in obtaining a videotaping three full-days of construction and this will be converted to a time lapse video sequence.

"Things are running very smoothly now that we have settled into our new building. The equipment storage facilities are centrally located to all of the laboratories and each laboratory also has storage space for special equipment. I am currently working with Dr. Charles Richardson on a new University/College Physics I laboratory manual and a new College Physics II manual. I am also consulting with one of our new professors, Dr. Gay Stewart developing an integrated laboratory/lecture version of the University Physics II course. I am also working with Dr. Raj Gupta and Dr.Paul Sharrah in putting together a display of historical items to be housed in a special case to be located in the first floor of the new addition.

"Work continues on unpacking and preparing the old demonstrations for classroom and laboratory use. The second phase of the new building should prove to be a catalyst for this project and it will allow us to buy and develop new demonstrations. The next phase will include a planetarium surrounded by an "exploratorium" type discovery room and a large lecture hall with a turntable adjacent to a large demonstration stockroom. I am looking forward to the next big adventure with phase 2!"

The previous enthusiastic description of the work with the laboratory equipment and the development of demonstrations was submitted by the Instruc-tional Laboratory Curator J. Brad Shue March 1995.

Slide Rules, Computers

It took over two hundred years to go from the discovery and development of the principles of logarithms by John Napier in 1614 to the development of the "modern" slide rule. When Mannheim created the "modern" slide rule in 1859 he started a revolution in the field of numeric calculations. This ability to multiply and divide using two mounted logarithm scales was an act of genius. He invented the first desk-top or lap-top device for calculations and scientists and engineers and others made good use of these machines for over a century. The ten-inch slide rule in its leather holster hanging on the belt became the symbol of engineering students everywhere.

Slide rules for scientific and engineering use added trigonometric scales and other refinements. Both straight and circular slide rules were manufactured in pocket editions. For slightly more accurate work longer slide rules were manufactured and the University College of Engineering had a cylindrical slide rule with effective length of thirty two feet on display in the 1940's. One physics professor and all his students at the University of Missouri did all of their Fourier transform calculations of x-ray diffraction data using a slide rule eighteen inches long.

The slide rule was so important to engineering students that most freshmen took a course learning how to do calculations using the slide rule. One physics laboratory session in those days was devoted to the slide rule and an inexpensive one was issued with some of the elementary laboratory experiments.

A good slide rule with all of the extras cost a little over $20 in the 1940's and 1950's. That was about two times the cost of a typical college text then!

Then electronics became of age and the modern computer appeared on the scene.

Things have come a long way since Dick Tracy in the comics used a wrist radio. Things have

come a long way since that bright student was actually brought up on the carpet for using a pocket calculator with memory storage during a test! Naughty girl! It was alright to use a slide rule, but not one of those new things that could calculate more accurately and remember important numbers, like the general gas law constant, the atomic weight of hydrogen etc. And a University is supposed to be a forward looking organization. And to think, the girl didn't really need cumbersome logarithms anymore and hadn't come to the University using a horse and buggy!

What do we remember about those days before the modern electronic computers came to the front?

We remember the early adding machines by Burroughs. Other machines by Monroe and Marchant followed. Some of these could multiply by repeating the addition process. Some of the machines even learned how to divide! The later ones were all motorized and they were rather noisy.

A room full of girls and noisy machines made all kinds of calculations for the Naval Ordnance Laboratory in Washington, D.C. during WW II. They even learned about natural functions and trigonometry functions, etc. One was always setting up a work sheet with columns of numbers to be produced to get some kind of answer. We were certainly pleased to get five or ten points on a curve, not hundreds as one might often see with a modern computer.

As mentioned above, Ms. Veronica Fink calculated for months on one of these machines in Dr. Herman Schwartz's office. They calculated the ground state of helium and the result they published in the *Physical Review* held the world's record for accuracy!

Some of the graduate students in theoretical physics studying under Professor Robert B. Lindsay at Brown University in Providence, Rhode Island in the 1930's spent months calculating certain acoustical wave propagation parameters in periodic systems.

During the recovery period after the "great depression" of the late 1920's under President Franklin D. Roosevelt, a number of people were employed to calculate certain standard mathematical tables. They took on the name WPA tables, for the Works Progress Administration under which the work was funded. These people got probably 25 or 35 cents per hour for their work. Not bad! As of 1993 two reprints of these WPA mathematics tables are on deposit in the physics library of the University of Arkansas. Of course most of these tables were to become quickly obsolete as soon as the high speed computers were developed.

Blaise Pascal in France is credited with having developed a machine to add numbers as early as 1642 but again there would be a long lapse of time before truly practical calculating machines would develop, reminiscent of the time required to develop the slide rule after Napier discovered logarithms.

Hand operated and motor operated calculating mechanical machines were common by the middle of the twentieth century.

Some valuable experience was gained at Harvard during the 1940's and 1950's when a "flip-flop" device capable of storing ones and zeros was none other than the electrical relay. It was fast for those days but those who were there remember how noisy that room was with all those relays opening and shutting.

The modern computer developed very rapidly as soon as electronic circuits were developed with the fundamental binary property of being on or off, or "flip flop". These type of circuits were first used extensively in radiation counting or scaling circuits.

But how did these developments begin to influence the University of Arkansas? The business office accounting methods responded slowly to new methods and the registrars office would not begin to use computers until the1970's.

The new faculty coming on the scene in the 1950's and 1960's and the students in science and engineering who were having training experiences in industry and government elsewhere were beginning to use computers.

Each major laboratory, it seems, built a machine of its own design for high speed computing. The Oak Ridge National Laboratory had its ORACLE, for example, by the late 1940's. Computer programmers were beginning to occupy an important niche in the structure of things. One of the young professors in mathematics at

Arkansas took a position at the University of Tennessee and worked part time as a computer programmer on the ORACLE in Oak Ridge.

In 1951 the Oracle at Oak Ridge could do one of those Fourier transforms of x-ray diffraction data in a few seconds that took the graduate students at the University of Missouri in the early 1940's hours to do by graphical methods, even using a few tricks. A planimeter type instrument moving on a sphere, called a Coradi analyzer, was in existence at the Massachusetts Institute of Technology in the 1940's but most of the Fourier analysis work was still done the hard way using a planimeter.

A fast Fourier transform method was developed by G. C. Danielson and C. Lanczos at the Franklin Institute in the early 1940's but this was to have little impact on the computing field until the high speed electronic computers were developed. This method was tested briefly at the University of Missouri in 1942 by the author, but the tedious methods available for calculating the numbers involved made it of little use at that time.

By 1957 a Bendix digital computer was in use in the UA Animal Industry Department.

From the local point of view, except for certain highly specialized instruments and forays to other institutions, including the Oak Ridge National Laboratory, the modern computer had little effect on the goings on in at the University until the IBM-650 was installed in the basement of physics in 1960. Everyone was proud of it and showed the computer to visitors and felt like we had finally arrived. The computing center staff headed up by J. W. Wilkes, worked long hours and was always ready to help develop and implement programs to solve the research problems.

Spitz A-1 planetarium installation (photo ca 1972).

Spitz A-1 planetarium installed in excellent refurbished space in room 117 of the Physics Building

This machine and its successors used the punched cards for inputting data and programs. A high speed rotating magnetic drum was a major feature of the system. Power failures were a catastrophe. Physical Plant officials learned not to open main power switches casually but there was no control over lightning!

Even as we were learning to enjoy the new freedom brought on by the high speed electronic computer, the pocket calculator and the microcomputer were on the horizon.

The physics department bought Hewlett Packard calculators in the early 1970's and mounted them on the elementary laboratory tables. They were so novel and expensive, $400 each, that most of them were stolen out of their security bases one night. The students were very rapidly starting to buy their own and prices were soon down to under $100 for an excellent scientific calculator. Both magnetic storage and internal electronic storage of constants and programs became a valuable feature of the pocket calculators. Liquid crystal display screens, some fairly large, replaced other numeric displays.

Even before the pocket calculator had found all its potential, the desk-top microcomputer burst onto the computing scene. The Department of Physics purchased two Commodore Pet microcomputers in March, 1980.

A variable credit course entitled "physics software" helped students to use the programmable calculators and the new microcomputers! It was elected by students in physics and in other departments. Radio Shack and Commodore Pet and Apple and Atari and Texas Instruments and Hewlet Packard and Sinclair and Zenith and IBM all came into the field. Some suggest today that the success and acceptance of the desk-top microcomputer by the public far exceeded the expectations of the early producers. Even though IBM was a little slow to enter the field, its sixteen bit system and excellent software support etc. brought it almost instant success. IBM clones are everywhere!

Astronomer Claud H. Lacy studying and doing research on binary stars at his desk in room 109 about 1980.

Not only was the micro-computer an instant success in the scientific and engineering community and in business, but the development of games to be played on these machines was very successful. It seemed that everyone was playing if he was not working! The children especially learned a little about computer "hacking" and computer lingo early. And like most new developments, some of the oldsters thought that this thing was some kind of evil device, even possibly a creation of the devil! One of my most conservative friends, a professor even reluctant to praise many of the aspects of the new world of technology in general, wouldn't be without his fine word processing machine with its fine graphics capabilities!

By the end of the 1980's the desk-top computer had become the "word processor" replacing overnight the typewriter. Students and faculty learned how to program their own calculations. Commercial and public domain software became very active.

Another feature of the microcomputer which is of great value is the ability to use the device as a terminal connected to the central computer on campus or elsewhere. It may be directly coupled or the transfer of information may be over a telephone line through a modem, modulation-demodulation device or directly using coaxial cable. These modems are connected through the telephone line and use two tones The rate of transmitting information depends on the modem and the quality of the telephone line. All of this has caused a new expression to appear, namely "e-mail", and e-mail directories and Internet.

The ability to couple the desk-top microcomputer with the main-frame computer on campus immediately makes it relatively easy to access information on the national and worldwide networks. Also the ability to access the on-line computerized library "card file" system is of great value.

The ability to project computer information and graphics onto a large screen has great pedagogical value. Some discussion of this application to an interesting problem is presented by Dr. William Harter in his "memo" in Chapter 8.

Astronomy: Planetarium and the Telescope

The department began teaching the three-hour descriptive astronomy course in 1967 when Professor Davis Richardson of the Mathematics Department retired. The Physics Department had cooperated with the management of the planetarium since its installation in 1951 in a World War II temporary structure located just north of the fine arts building.

Planetarium demonstrations had been given by the physics graduate assistants to each of the elementary physics and physical science laboratory sections at least once each semester. The department agreed to provide some of the cost of maintenance. In fact Dr. Sharrah from the Physics Department was on the committee headed by Dr. Davis P. Richardson and Dr. B. H. Gundlach of mathematics which proposed in 1950 that the University purchase and install a Spitz-A1 Planetarium.

In 1971 the temporary World War II building housing the planetarium was to be torn down. There was little apparent interest or leadership

relative to the planetarium so the physics department had the physical plant haul the Planetarium projector to the physics building where it could be stored. Dr. Glen T. Clayton, physics major John Fitzgerald and Dr. Paul Sharrah went along with the truck on that day. Then Dr. Sharrah went off to the University of Arizona on sabbatical and the Spitz instrument sat unattended except for some much needed repairs performed by Fitzgerald.

Thus from the earliest times and up to 1972 there had been at least nine part-time astronomy teachers (Appendix III).

Meanwhile, Dr. S. M. Day and Dr. C. B. Richard-son called Dr. Sharrah in Arizona in the Fall of 1971 and asked if he still believed that the department should teach as-tronomy and hire a full-time person to do so. We all agreed that we should do this and Carol Webb from the Univer-sity of Texas was hired in 1972.

An astronomy teaching laboratory was established on the roof of Kimple Hall. Charles B. Richardson prepared an astronomy laboratory manual. Carol Webb and later Claud H. Lacy prepared laboratory teaching materials.

When Ms. Webb left the department in 1980, Dr. Claud H. Lacy from the University of Texas was employed to teach the astronomy classes and initiate astronomy research activities. The course offerings have been expanded both at the introductory level and at the advanced level so that physics majors can have a strong minor in astronomy. Dr. Claud Lacy's "memo" in Chapter 8 gives more information about this program.

Sixteen-inch telescope in the Droke Observatory, astronomer Claud H.Lacy at the controls.

The Droke Observatory, built in 1978.

The planetarium dome and instrument were installed in excellent refurbished space in the physics building during the summer of 1972 and was ready for use by August of that year. (Room 117) Beginning late in the summer and in the fall of 1972, newspaper and other announcements described the public demonstrations and invited school and youth groups to make appointments. The programs were initially given principally by four members of the physics faculty; Michael Lieber, Charles Richardson, Carol Webb and Paul C. Sharrah. Claud Lacy later gave programs and operated night viewing sessions with the Droke telescope. (See below.)

Sharrah was active in the regional and national planetarium organizations and attended a training session at Spitz in Chadds Ford, Pennsylvania. He served as president of the Great Plains Planetarium Association one year and directed a meeting of the group in Fayetteville. He was made a Fellow of the International Planetarium Society at its meeting in Richmond, Va., in 1978.

John Fitzgerald assisted with the repair and made improvements on the already aged planetarium projector when it was reactivated in 1971-72. Two students, Lisa Lovett, and Eliot Neel were faithful demonstrators. Eliot also gave much help with maintenance and devel-

oped a good audio system. Ms. Lovett gave many of the demonstrations to the school groups and gave many of the star talks at the public shows. Dianne McGuffy and Mrs. James Watson also were of much help as demonstrators and script writers. Some of these activities were a part of the planetarium course and part was done on hourly pay.

Professionally produced programs were used, frequently with considerable modification and reduction in length. The little planetarium became a pleasant and effective audio-visual medium. The professionally produced programs chosen were always educational and entertaining but we were determined that each and every program would spend a few minutes devoted to the "starry sky tonight"! The students enrolled in a course in planetarium operation usually gave these live star talks, and they were well received by all age groups. The students enrolled in the planetarium course were required to have had at least one semester of astronomy before entering the course.

Many of these planetarium programs were followed by a viewing session in the astronomy laboratory located on the roof of Kimple Hall. One or two telescopes and a pair of binoculars were used and "naked eye" viewing was emphasized.

The total number of visitors, including the general public, school groups, and university students was as large as 3,000 or more per year and it estimated that over 40,000 persons have attended planetarium programs over a 41 year period starting in 1951.

Physics Librarian/Secretary Mary Chaffin typed the first draft of this history in a short version in 1991.

Several students received additional astronomy teaching experience and college credit running the planetarium for school groups and public shows. The Spitz A-1 was shut down in 1992.

Planetarium Appreciated by Public

The short letter which follows is only one of many received from teachers and children throughout the years thanking all of us for our work in the planetarium.

9-22-76

Dr. Sharrah,

Thank you for spending your time with our Third Graders on their field trip.

They loved the Planetarium and the slides on Mars. Our unit on Planets was much more enjoy - able after time spent with you.

Sincerely yours,

(Signed by three teachers.)

Observatory Constructed, Donated

The forty acre Windcrest Estate atop an Ozark Ridge about 12 miles southeast of Fayetteville was donated to the University of Arkansas Foundation by James W. and Kaye Barrett Droke in 1976. The estate was donated in memory of Dean George Wesley Droke. Since Dean Droke was a Professor of Mathematics, Logic and Astron-omy, and his grandson was an avid amateur as-tronomer, it was fitting that the Droke family provided the location and funding to build the James Wesley Droke Ob-servatory in 1978 to house the sixteen inch reflecting telescope funded by the National Science Foundation. The proposal to fund the telescope was written by astronomer Carol Webb. Dr. Claud Lacy replaced Carol Webb in the fall of 1980. Within the year he had received funding from the National Science Foundation to continue his photometric observations of variable stars at McDonald Observatory and had received funding from the Research Corporation to automate the telescope at Droke Observatory for photometric studies.

Office Management, Proposals

No history of the progress and goings on in the physics department is really complete unless one looks a little at the management of the head office and the library. For several years after physics moved into the Dickson street building in 1952 the department had only one secretary and half of her pay and responsibility was to the library. Additional part-time help would be used during the 1960's in the summer institute work and two and finally three and sometimes four secretaries were working regularly in the building by the 1990's.

At first there was a rapid turnover of help because the pay scale would only permit us to hire the wife of a married student couple. This started changing slowly in the 1960's and some office help were staying a little longer. Shirley Jean Eaton has the record now, having served already for over twenty years!

It is interesting to review the nature of the work and the procedures. For many years one mechanical typewriter was adequate for the work. Then beginning in the 1960's the electric typewriter was used and finally in the 1980's the word processor was to take over in the offices. The secretaries each have a machine and all of the professors have one in their office. The department also has two or three in a central space available to the students.

The secretary in the earlier times often took letters using shorthand. Various recording systems gradually diminished this need. Quoting from an e-mail note sent by physics secretary Sandra Johnsen in 1995, "Really sorry to be so long in responding to this message. As you can tell I do not check my e-mail all that often. As for shorthand—I do not know of any secretaries today that use shorthand. As far as being taught. . . well, in 1981-83 it was being taught at the American Business College on Locust Street. Myself, well, I was a demon at reading the stuff but was not very quick about writing. I think it's because I'm left-handed. Also, not many offices today require the old 'Miss Jones, would you come in here and take a memo' attitude. Today, especially, with the computer-internet-e-mail-on line existence of the business world, shorthand is quite probably obsolete. I rather enjoyed reading the squiggles and such when I was taking the course, but I don't miss it. I've got to run right now but if you wish I'll give it more thought."

Again in the earlier days the tests would be laboriously typed up on a mimeograph sheet and run off by editorial services. They were difficult to correct and much black ink was involved! The fluid duplicator, a successor to the hectograph, took over for much of the testing and even for informal memos. The fluid duplicators were limited in the number of copies that could be produced and were subject to fading. The inexperienced workers would have much telltale purple on their hands and face and clothing!

Some teachers would use multilith machines for more attractive tests and other materials, but these processes often took too much time.

When the word processors became popular, most of the tests were typed on one of them and the printed test can be duplicated.

Probably the most useful single office machine to come along in relatively recent times is the duplicator using graphite, "Xerox", and the many others available now. Another machine which has changed much of communication of information is the FAX machine. Letters, orders, and instructions flow quickly from machine to machine over the telephone lines.

The typing of letters and tests is only a small part of the office activity. There are purchase orders and contracts and budgets and memos and proposals etc. There are telephone messages to forward and important calls to make. There are problems to solve, often about money matters, but also much of the activity is almost like counseling!

The typing of memos and especially proposals has been radically changed by the introduction of the word processor. A correction somewhere in the beginning or body of the text does not require the whole manuscript to be retyped! The manuscript can be formatted and the spelling can be checked! It has become easier to turn out a professionally looking document. This book is being initially formatted principally

on a small portable microcomputer, Macintosh PowerBook 165. A final pre-press preparation of this history is being done in QuarkXPress software on a Macintosh LCII computer.

The digital scanner also introduces a new dimension in the handling of information and graphics. It is possible also to store pictures etc. for network customers to see and use. Most of the illustrations in this book have been scanned and have been given, along with the page text, to the printer in digital form. The fine pictures of the 1994 remodeled and expanded physics building are on the University computer and thus are available on World Wide Web on the Internet.

In recent years an entirely new term "desktop publishing" symbolizes the power of the computer and the scanner and the printer and even a binder on the same desk!

Teaching and Research

Certain aspects of teaching have been discussed already in Chapter 2. The enrollments in the large service courses was to experience phenomenal increases. There was a very large step upward in the enrollment following the Korean War. The department also took on a heavy responsibility when the third semester of physics for engineers was introduced emphasizing modern physics.

Thus by 1960 the doctoral program was underway and the physics department was on the move. The national attitude was favorable toward science and the number of students receiving degrees in physics would peak during the 1960's. (Chapter 10) A total of 177 undergraduate degrees and 128 graduate degrees would be granted during the very active twenty-year period from 1960 to 1979. As of May 1995 a total of approximately 313 undergraduate degrees, 167 master's degrees and almost 82 doctoral degrees have been granted.

The honors program and undergraduate research were to be a prominent feature of the physics program during those years.

As early as 1965 the department was beginning to teach some of the large physical science sections in SEAUD and in 1969 the one semester astronomy course had to be moved there because of large enrollment. Rooms 118, 119 127, 104 and 110 were loaded with physics classes and more than one section of each introductory course was the method of manning these teaching assignments. Then in the late 1960's and especially in the early 1970's large single sections of the introductory sections were instituted.

Thus all major elementary teaching was forced to go to other lecture halls on campus, for example SEAUD and Kimple Hall. The use of demonstrations dropped drastically. Most of the demonstration devices had been developed with a smaller classroom in mind and furthermore it was hard to transport equipment to other buildings!

Some of the faculty felt that the introduction of these large sections was a step away from our long standing commitment to quality teaching, and time has proved this to be true. We started the large sections but didn't prepare the teachers for this type of teaching.

Communicating and interacting with a large group becomes unexpectedly much more difficult. A teacher who may be reasonably good teaching ten to thirty students can utterly fail in the larger group! We didn't provide adequate training and teaching support and the use of demonstrations in the lecture halls fell by the wayside.

Someone facetiously remarked once that we gave the young inexperienced teacher a copy of the text and their class roll and said "go get em." Why are college teachers frequently so egotistical that they don't think they need to learn how better to communicate? We may have gone to extremes in "training" high school teachers how to teach at the expense of subject matter but there is some evidence that we have gone to the other extreme in college teaching!

For a time a graduate student was assigned as a classroom assistant to work with the professor. They were to attend all the lectures, take the roll and grade most of the papers. They might be expected to fill in a time or two each semester as needed. It was good for the course and the graduate student. In so far as possible, these students were selected because of expressed interest and potential in teaching and were in the second or third year of their graduate studies.

The development of the research program is discussed in Chapter 4 and Chapter 8. A real "quantum leap" was taken by the department when it moved into a doctoral program in 1959.

Teaching and research! Some professors seem to excel in teaching and some in research, but the most interesting professors are "man enough" to be good at both. But success in either requires a strong love of the subject and a genuine belief in the students with whom one works. The students may sometimes be described as diamonds in the rough. The most successful professor ultimately is the one who really puts his students first.

Excuse the philosophy but I always did get excited when the subject of teaching and students came up. Remember, I was the one who was so interested in teaching that a high official of the University ca. 1950 said that I would never amount to anything!