A Century of Physics at Arkansas

By
Raj Gupta

This lecture was transcribed by Donna Johnson

Greetings:

Good morning everyone. A very warm welcome to everyone and special greetings to our alumni, emeritus faculty, and former faculty. I am delighted that so many of you have decided to join us on this occasion. It is a pleasure beyond words.

Acknowledgments

- The Late Paul Sharrah
- David Lachut
- Ever Cavender
- Usha Gupta

I would like to acknowledge those who have helped me with this talk. First of all, the late Professor Paul Sharrah, because much of the material for my talk is derived from his book, *Physics in Arkansas, 1872-1995*. David Lachut, one of our physics majors, who has helped me with this presentation. Ever Cavender, who did research in the Special Collections Department of the library. Also, Usha Gupta, our Physics Librarian, who collected historical information for this talk. In the spirit of full disclosure, I should mention that Usha also doubles as my wife.

Outline

- Pre-1907
- 1907
- Buildings and Locations
- Research
- Degrees
- 1927-28 Snapshot
- 1938-39 Snapshot
- 1963-64 Snapshot

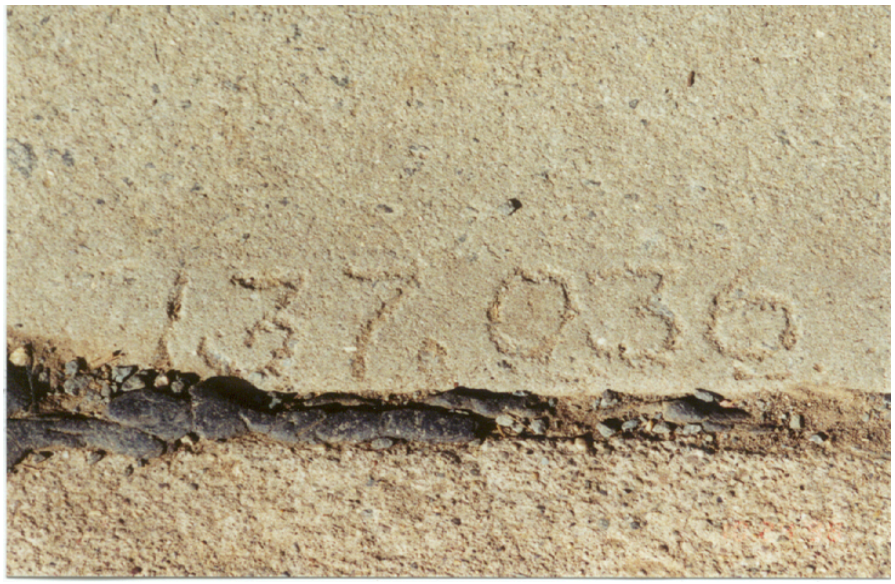
My presentation will follow a straight line from the beginning to the present because time is short and I want to emphasize the early part of this talk, which is what fascinates me. The last 3 items on the outline are snapshots of the department in three particular years. I have chosen these years because in 1928 the first physics major received his degree. In 1939 the first Masters degree in Physics was awarded. In 1964 the first Ph.D. in physics was awarded.

So, let's start at the beginning.

Pre-1907 University

The University was founded as
Arkansas Industrial University
$(\alpha)^{-1}$ years ago
where α is the fine-structure constant

The university was started $(\alpha)^{-1}$ years ago, where α is the fine structure constant. I apologize, but I couldn't resist putting this in. I promise that this will be the only physics in my talk. The fine structure constant is a very important constant in physics. It is used to define the strength of electromagnetic interaction. It is a combination of fundamental constants, and it is dimensionless. Therefore, it has a fixed numerical value. So, I started looking for its numerical value. Well, I found it.

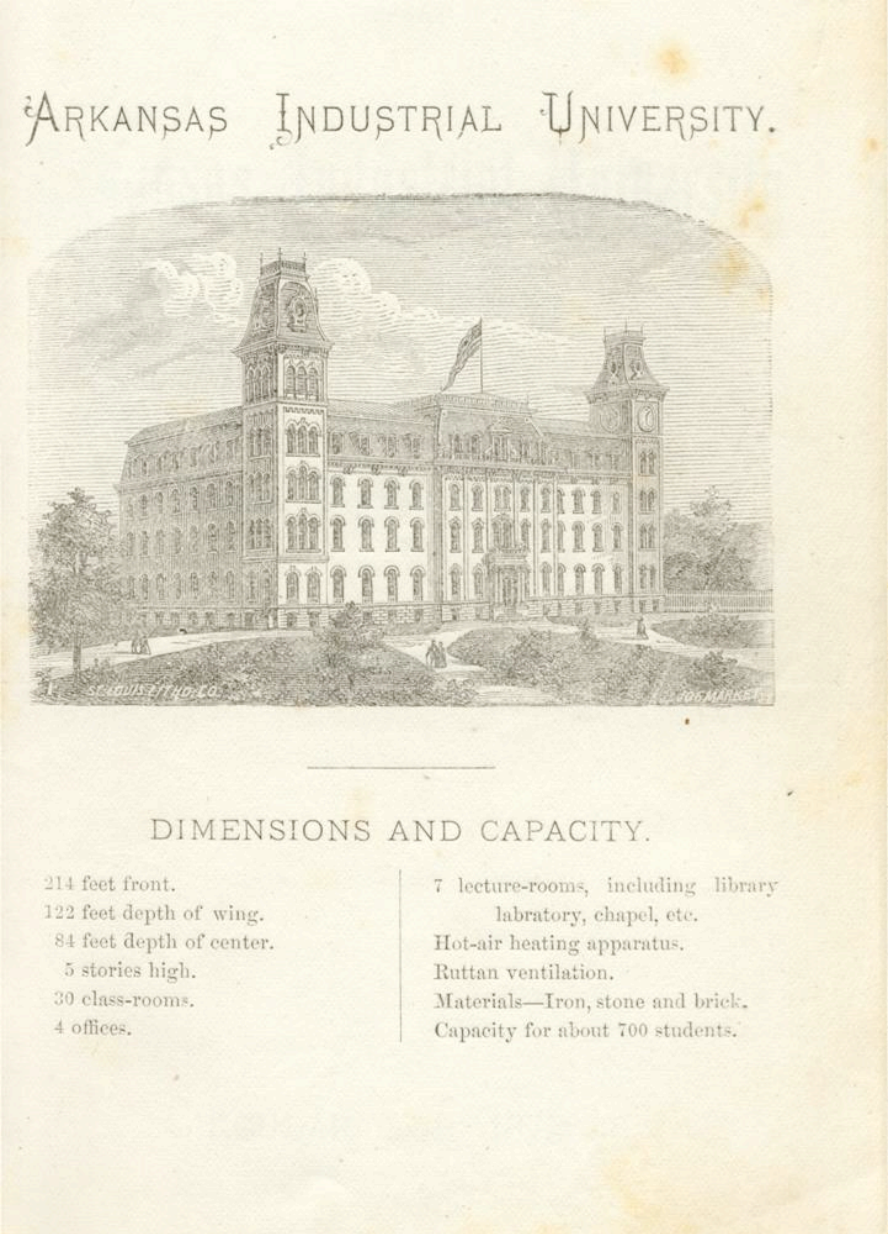


I found it etched in concrete on a sidewalk near Princeton University Physics Department. Some crazy physicist couldn't resist the temptation of wet concrete. Well, it turns out that the crazy physicist was none other than John Wheeler, a distinguished Princeton physicist.

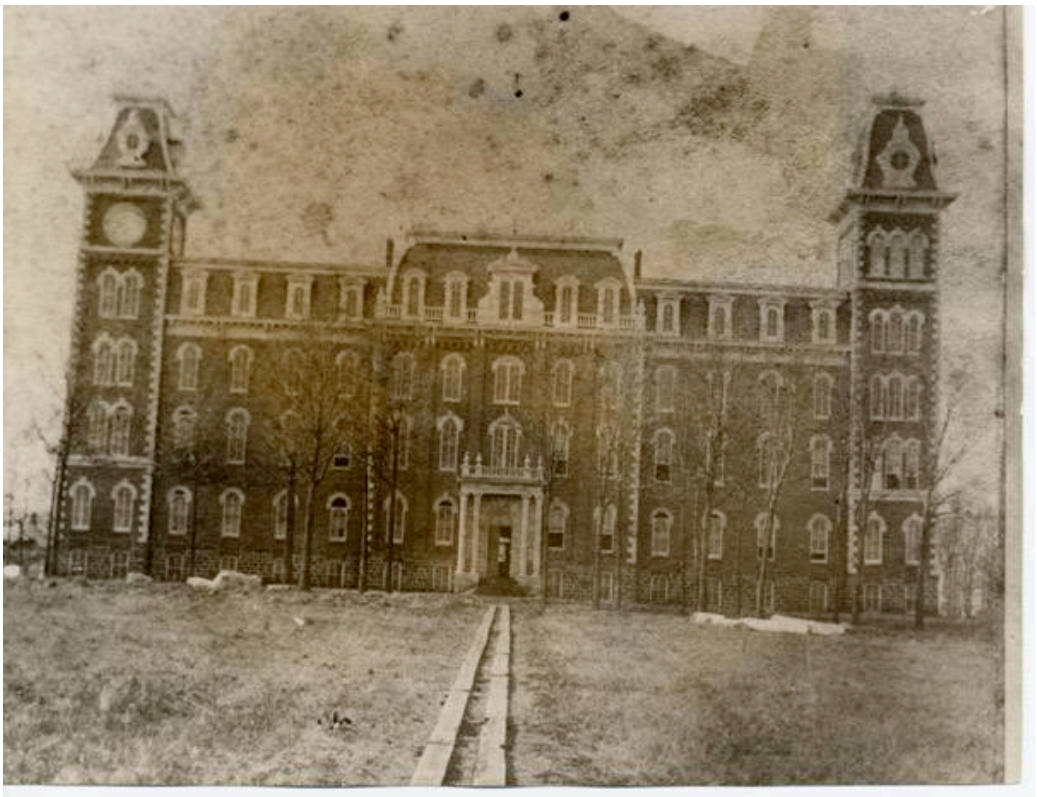
A mere hope in the woods

So that puts the start of the university at 137 years ago, that is, in 1871. Much has been written about the university's beginning, so I will simply say a few words and then focus on Physics. The Federal Land Grant Act, known as the Morrill Act was passed in 1862 to provide federal aid to states to establish universities. It was amended in 1866 to give "reconstructed" states more time.

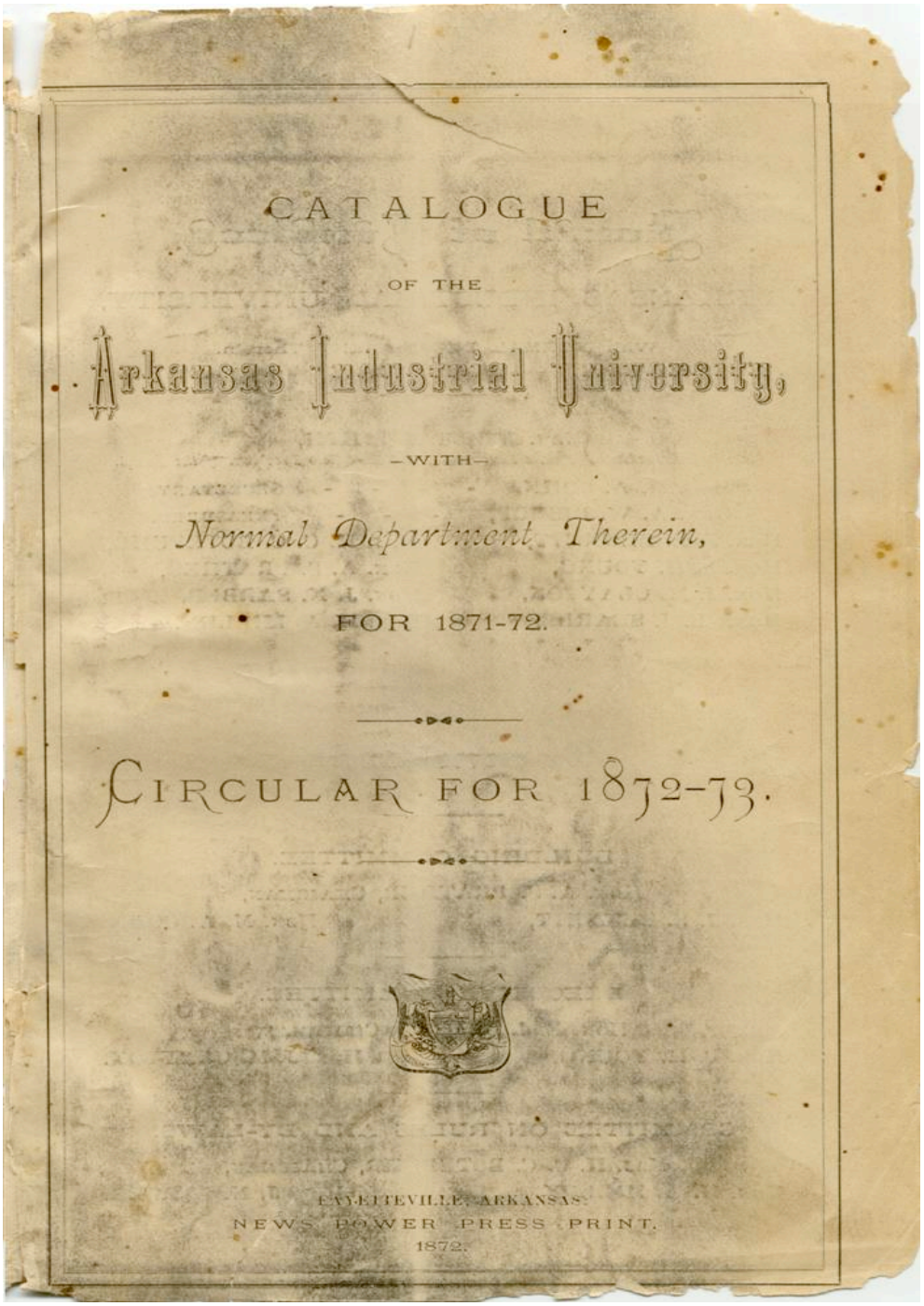
In order to receive aid, they had to be in operations by Feb 12, 1872. The university started classes Jan 22, 1872, just 3 weeks before the deadline. The picture you see is where the university classes started in 1872. This was the whole university! Transportation was a huge problem. Fayetteville was an isolated rural town, and there was nothing here. It took 10 hours by stagecoach from the nearest railroad station, which was somewhere near Ft. Smith. Now you probably see why the title of my slide is "A Mere Hope in the Woods." The committee that was working on establishing the university had appointed an interim president, Noah Gates, but was having enormous problems attracting a person of scholarship and administrative abilities to take over as president. John Reynolds, in his early history of university of Arkansas says it was not easy to secure a person of this caliber to come to the "woods and take control of a mere hope." However, 137 years later that mere hope has been transformed into a sprawling major public institution. Arkansas is a poor state and has always been short of resources. It is really the dedicated efforts of the early faculty who built this university on just mere hope.



While the university started in wooden shacks, there were plans to build a grand building. What you see here is a lithograph of Old Main reproduced from the original copy of the 1871-72 catalogue, the first catalogue printed just a few months after the first classes started.



And a grand building it is! This is an early photograph of Old Main, probably taken shortly after its construction.



CATALOGUE

OF THE

Arkansas Industrial University,

—WITH—

Normal Department Therein,

FOR 1871-72.

CIRCULAR FOR 1872-73.

FAYETTEVILLE, ARKANSAS:
NEWS POWER PRESS PRINT.
1872.

This is the title page of the first university catalogue for 1871-72. It was printed just a few months after the start of the classes.

So let's look at the curriculum in the 1871-72 catalogue. There was only one course of study, and we note in it that it had two terms of natural philosophy, which presumably included physics.

General Course.

First or Freshman Year.

FIRST TERM.

Regular Studies.	Optional Studies.
Algebra.	Harkness' First Greek Book.
Physical Geography—Elemt'ry.	French.
Cæsar's Commentaries and Harkness' Introduction to Latin Composition.	
Practical Agriculture and Pomology—Lectures.	
English Diction and Elocution.	
Natural Philosophy.	

SECOND TERM.

Algebra.	Harkness' First Greek Book continued and Xenophon's Anabasis commenced.
Natural Philosophy.	
English Diction and Elocution.	
Practical Agricult'e—Lectures.	French.
Cicero's Orations and Latin Composition.	

THIRD TERM.

Geometry.	Xenophon's Anabasis and Harkness' Greek.
Cicero's Orations and Latin Composition.	Composition.
Botany.	French.
Physiology.	
Practical Agriculture and Horticulture—Lectures.	

Second or Sophomore Year.

FIRST TERM.

Geometry.	Homer, with written exercises.
Chemistry.	French.
Virgil's Æneid.	German.
Botany. History.	

SECOND TERM.

Chemistry. History.
Livy.
Plane Trigonometry.
Euripides (Iphigenia in Taurus)
German.
French.

THIRD TERM.

Mineralogy.
Surveying and Spherical Trigonometry.
Horace. Rhetoric.
Aristophanes (Birds).
Chemistry.
German.

Third or Junior Year.

FIRST TERM.

Astronomy.
Geology.
Tacitus (Germania and Agricola).
Conic Sections and Analytical Geometry.
Thucydides (Selections).
German,
Civil Engineering.

SECOND TERM.

Geology.
English Literature.
Juvenal.
Sophocles (Œdipus Tyrannus).
German.
Civil Engineering.

THIRD TERM.

Logic.
Physical Geography.
English Literature.
Tacitus (Histories).
Demosthenes (Olynthiacs and Philippics).
German.
Civil Engineering.

Fourth or Senior Year.

FIRST TERM.

Mental Philosophy.
Political Economy.
Elements of Criticism.
Science of Education.
Latin.
Greek.

SECOND TERM.

Moral Philosophy.
History of Civilization.
Civil Polity.
Constitution of United States.
Greek.
Latin.
Evidences of Christianity.

THIRD TERM.

History of Philosophy.
Modern Philology.
Constitutional Law.
History of Inductive Sciences.
Social Science.
Latin.
Greek.

CATALOGUE

OF THE

Arkansas Industrial University

WITH A

Normal Department Therein,

FOR 1872-73.

CIRCULAR FOR 1873-74.

In the next year's catalogue for 1872-73, we note that now there are two courses of study, a classical course (which would be like a liberal arts course),

COURSES OF STUDY.

CLASSICAL COURSE.

FIRST OR FRESHMAN YEAR.

FIRST TERM.

Algebra.
Physical Geography (Elementary).
Cæsar's Commentaries and Harkness' Introduction to Latin Composition.
English Diction and Elocution.
Physiology.
Harkness' First Greek Book.
French.

SECOND TERM.

Algebra.
Natural Philosophy.
English Diction and Elocution.
Cicero's Orations and Latin Composition.
Harkness' First Greek Book continued and Xenophon's Anabasis commenced.
French.

THIRD TERM.

Geometry.
Cicero's Orations and Latin Composition.
Botany.
Philosophy.
Xenophon's Anabasis and Harkness' Greek.
Composition.
French.

SECOND OR SOPHOMORE YEAR.

FIRST TERM.

Geometry.
Chemistry.
Virgil's Æneid.
Botany.
History.

Homer, with written exercises.
French.
German.

SECOND TERM.

Chemistry.
Livy.
Plane Trigonometry.
History.

Euripides (Iphigenia in Taurus).
German.
French.

THIRD TERM.

Mineralogy.
Surveying and Spherical Trigonometry.
Horace.
Rhetoric.

Aristophanes (Bird's).
Chemistry.
German.

THIRD OR JUNIOR YEAR.

FIRST TERM.

Astronomy.
Zoology.
Tacitus (Germania and Agricola).
Conic Sections and Analytical Geometry.

Thucydides (Selections).
German.
Civil Engineering.

SECOND TERM.

Geology.
English Literature.
Juvenal.
Bookkeeping.

Sophocles (Œdipus Tyrannus).
German.
Civil Engineering.

THIRD TERM.

Logic.
Physical Geography.
English Literature.
Tacitus (Histories).

Demosthenes (Olynthiacs and Philippics).
German.
Civil Engineering.

which includes one term of natural philosophy and one term of astronomy, and

a course in engineering.

COURSE IN ENGINEERING.

FIRST YEAR.

FIRST TERM.

Algebra.
Physical Geography.
Drawing.
English Diction and Elocution.
Physiology.

SECOND TERM.

Algebra.
Geometry.
English Diction and Elocution.
Drawing.
Natural Philosophy.

THIRD TERM.

Geometry.
Natural Philosophy.
Botany.
Drawing.

SECOND YEAR.

FIRST TERM.

Plane and Spherical Trigonometry.
Chemistry.
General History.
Conic Sections.

SECOND TERM.

Chemistry.
General History.
Analytical Geometry, Linear Perspective, Shades and Shadows.

THIRD TERM.

Mineralogy—Crystallography.
Rhetoric.
Drawing Designs.
Calculus.

This course has not only two terms of natural philosophy…

THIRD YEAR.

FIRST TERM.

Astronomy.	Theoretical Mechanics.
Zoology.	Physics.

SECOND TERM.

Geology.	Applied Mechanics.
Physics.	Bookkeeping.
Metallurgy.	

THIRD TERM.

Logic.	Meteorology.
English Literature.	Shading and Tinting.

FOURTH YEAR.

FIRST TERM.

Mental Philosophy.	Strength of Materials.
Political Economy.	Architecture.

SECOND TERM.

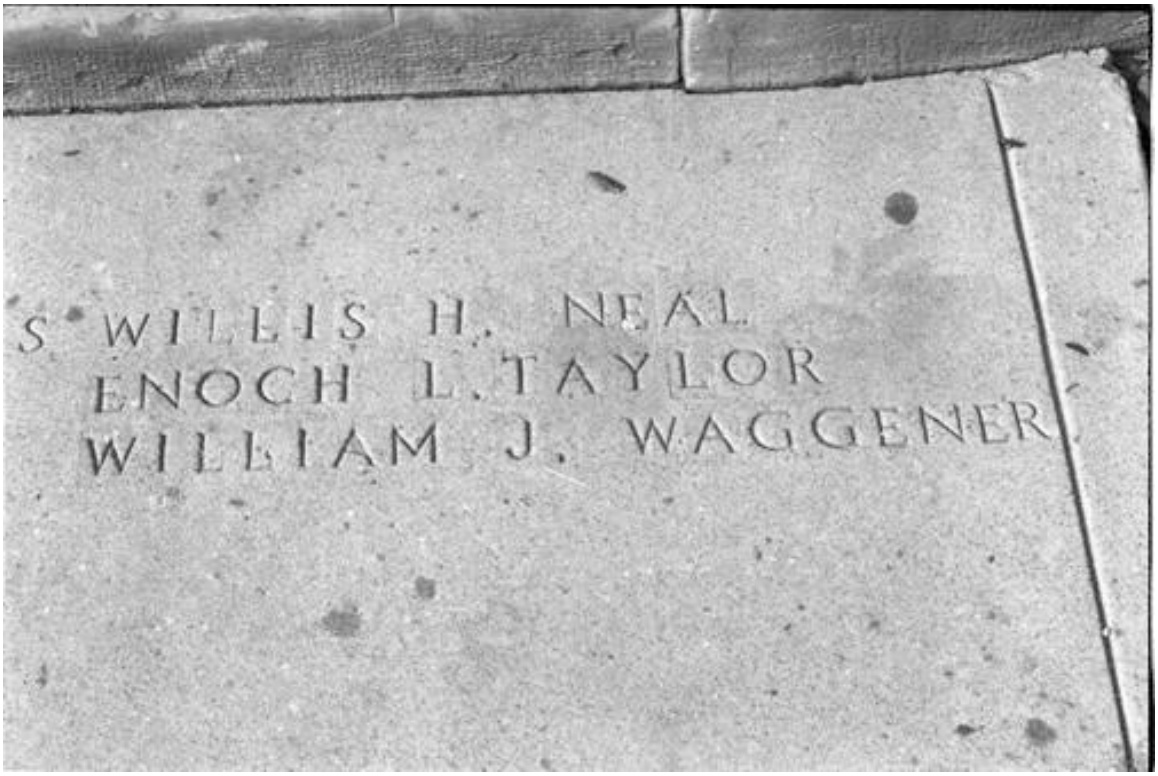
Moral Philosophy.	Theory of Mechanics.
History of Civilization.	Machine Drawing.
Constitutional Law.	

THIRD TERM.

Theory of Motors.	Designs and Estimates.
Millwork and Machines.	Railway Surveys and Bridge Building.

but also has a course in physics, a course in theoretical mechanics, and a course on applied mechanics! From here on, there is a checkered history. By 1875-76, the engineering college was getting organized, and then physics is dropped altogether and has given way to courses such as bridges and roofs, heat and ventilation, construction and management of railroads, steam engines, hydraulic motors, etc.

One of the first graduates



Even though the physics major was not established until 1907, the first university graduating class in 1875 did produce a physicist, and that was William Waggener. Waggener went on to establish the Department of Physics at the University of Colorado. While on leave of absence from Colorado, he went for further study to Frederick-Wilhelms University in Berlin, Prussia. We are very proud of his accomplishments. Colorado's Department of Physics is one of the most exciting places for research in atomic physics today. Several of the recent Nobel prizes have gone to that department.

Pre-1907 Physics in Arkansas

- 1871-80 Presumably taught by engineering teachers
- 1880-85 Physics was placed with Chemistry
- 1885 Taught by a Professor of Applied Mathematics
- 1887 Physics was transferred to Department of Biology and Geology
- 1888 Physics was transferred to Department of Mechanic Arts and Engineering
- 1890-1904 Physics was again placed with Chemistry
- 1904 Physics became Department of Electrical Engineering and Physics

This slide illustrates the homes physics occupied between 1871 and 1907 before it was granted a department status. It appears that physics was an orphan. It was taught as a second, and sometimes even as a third subject, by teachers whose primary area was engineering, chemistry, math and even biology or geology. Toward the latter part of this period, physics spent about fourteen years as part of the Chemistry Department. Finally in 1904 it was placed with Electrical Engineering.

1907: Start of a new era in physics in the State of Arkansas

Let's try to imagine what it was like in 1907. Theodore Roosevelt was president of the United States. The population was a little under 90 million. The state had a population of about 1.5 million. The population of Fayetteville was about four thousand five hundred. What you see in this picture is the Fayetteville town square at that time with some event about to take place.

The first train came to the Fayetteville on June 8, 1881. This by and large solved Fayetteville's transportation problems. It was no longer an isolated place. The picture above shows the train depot that existed in 1907.

What else was happening in 1907-08?

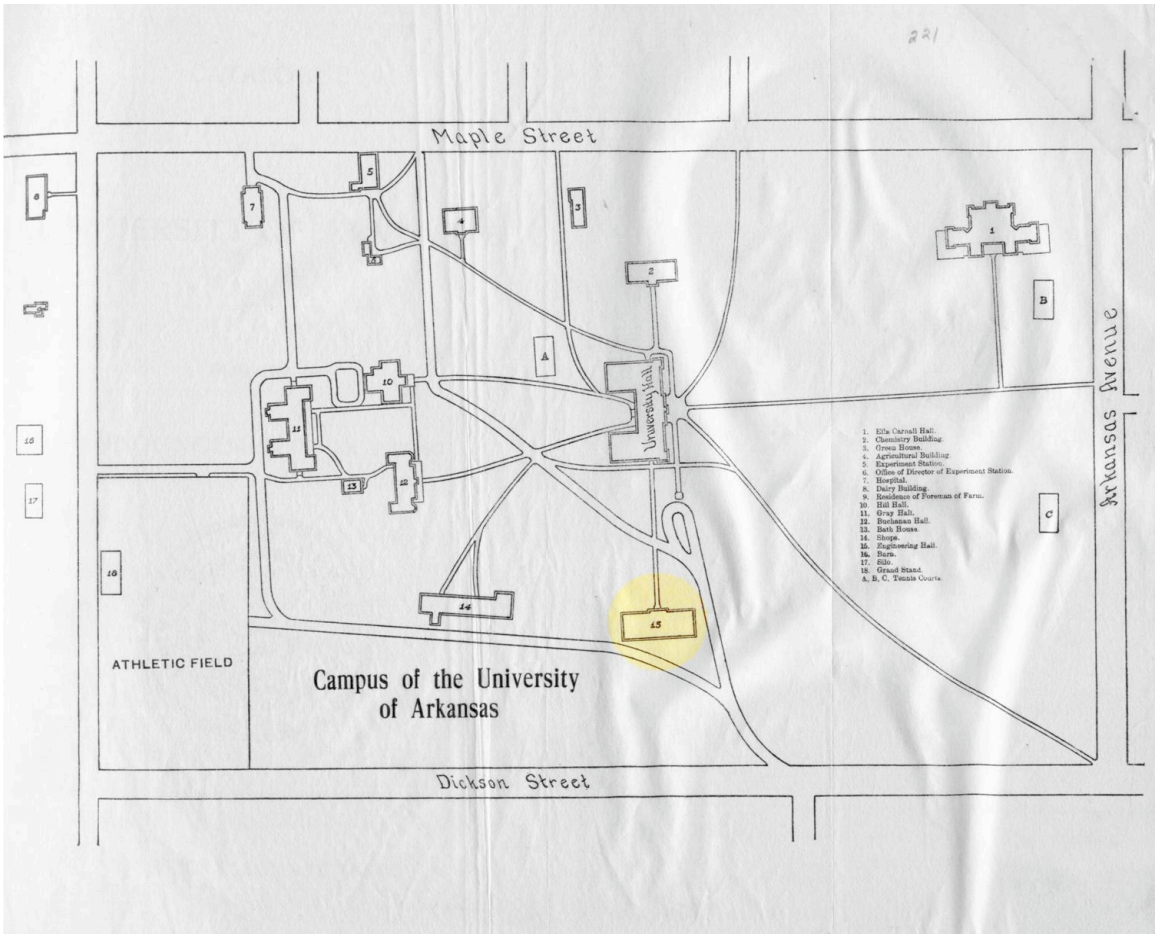
Transportation:

The model-T went into production in 1908. This was the first mass produced car and sold for $850. Its impact on transportation cannot be overstated.

Technology:

What was happening in technology? The vacuum tube was patented around this same time. The vacuum diode was invented in 1904 and the triode in 1906. This development made possible radio and wireless communication. This was the start of the electronics era and had a huge impact on technology.

The University:

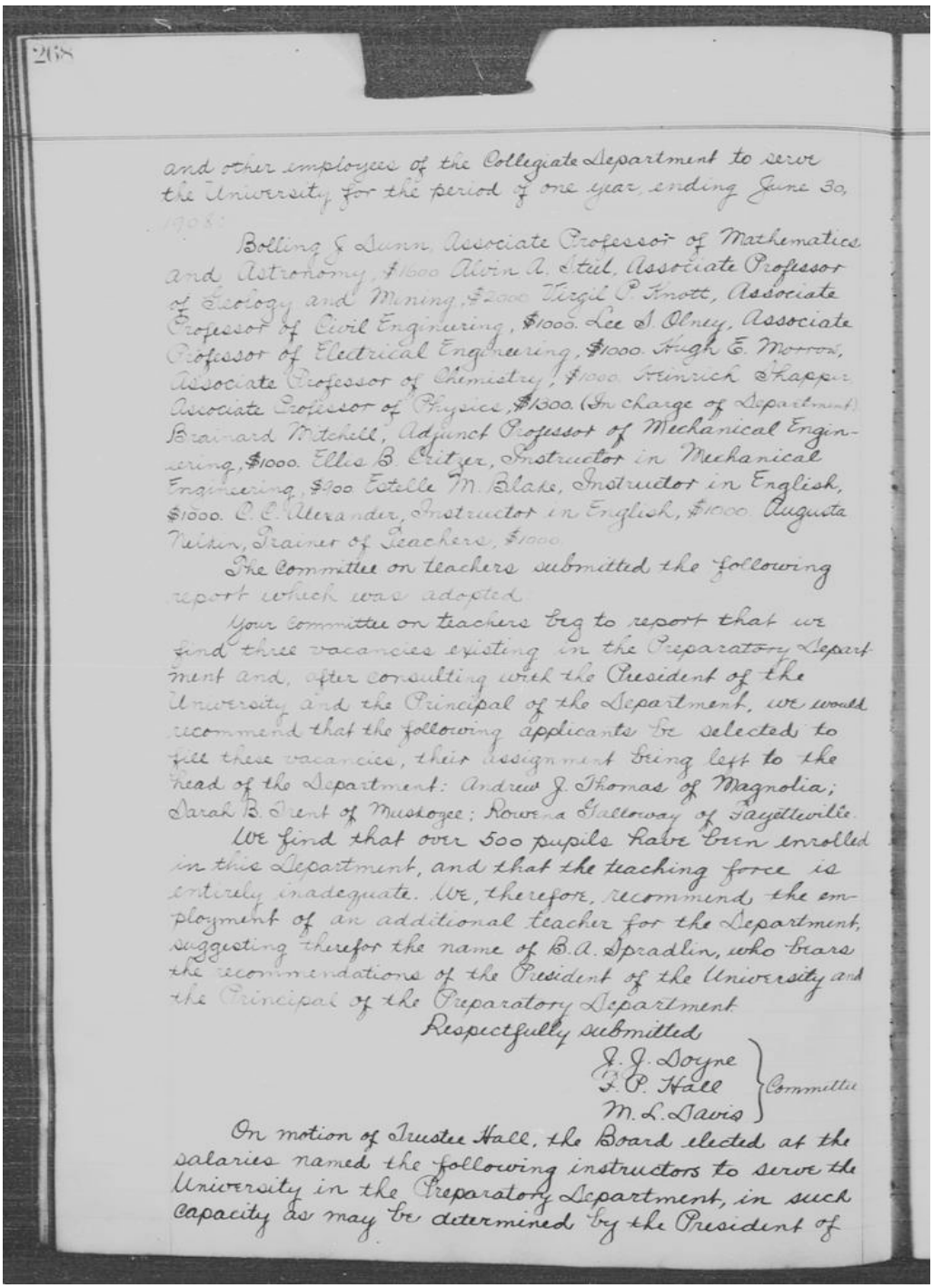


What was the university like in 1907? As can be seen from the campus map above, several buildings in addition to Old Main had been constructed by that time. Physics was located in the Old Engineering Hall, which is highlighted here. Arts and Sciences and Engineering were together as one College. This college had a faculty of 21 and 11 adjuncts, assistants and instructors. Enrollment of the entire university was between 550-600.

Athletics:

No talk about the UA would be complete without a mention of athletics. This slide shows the football field around 1907.

The Resolution:



268

and other employees of the Collegiate Department to serve the University for the period of one year ending June 30, 1908:

Bolling S. Dunn, Associate Professor of Mathematics and Astronomy, $1000. Alvin A. Stil, Associate Professor of Geology and Mining, $2000. Virgil P. Knott, Associate Professor of Civil Engineering, $1000. Lee S. Olney, Associate Professor of Electrical Engineering, $1000. Hugh E. Morrow, Associate Professor of Chemistry, $1000. Heinrich Schapper Associate Professor of Physics, $1300. (In charge of Department) Brainard Mitchell, Adjunct Professor of Mechanical Engineering, $1000. Ellis B. Critzer, Instructor in Mechanical Engineering, $900. Estelle M. Blake, Instructor in English, $1000. C. C. Alexander, Instructor in English, $1000. Augusta Neikin, Trainer of Teachers, $1000.

The Committee on teachers submitted the following report which was adopted.

Your Committee on teachers beg to report that we find three vacancies existing in the Preparatory Department and, after consulting with the President of the University and the Principal of the Department, we would recommend that the following applicants be selected to fill these vacancies, their assignment being left to the head of the Department: Andrew J. Thomas of Magnolia; Sarah B. Trent of Muskogee; Rowena Galloway of Fayetteville.

We find that over 500 pupils have been enrolled in this Department, and that the teaching force is entirely inadequate. We, therefore, recommend the employment of an additional teacher for the Department, suggesting therefor the name of B. A. Spradlin, who bears the recommendations of the President of the University and the Principal of the Preparatory Department.

Respectfully submitted

J. J. Doyne
F. P. Hall } Committee
M. L. Davis

On motion of Trustee Hall, the Board elected at the salaries named the following instructors to serve the University in the Preparatory Department, in such capacity as may be determined by the President of

As mentioned previously, prior to 1907, physics was taught by teachers whose primary area was other than physics. In a meeting on June 11, 1907, the Board of Trustees authorized to appoint one person in charge of the “department.” Professor Heinrich Schapper was placed “in charge of the department” at a salary of $1,300, which in today’s dollars would be about $35,000.

The B.S. Degree in Physics:

COURSE FOR THE DEGREE OF B. S. IN PHYSICS.*

FRESHMAN YEAR.	Hrs. per week.	SOPHOMORE YEAR	Hrs. per week.
Mathematics 1*c*, 2*c*	6	Mathematics 4*a*, 4*b*	5
Physics 1	3	Physics 2, 2*a*	5
Chemistry 1	3	Chemistry 2, 3, 5	5
English 1	3	French 1	3
German 1	3		

JUNIOR YEAR	Hrs. per week.	SENIOR YEAR.	Hrs. per week.
Mathematics 6*b*, 9*a*, *b*, 16	7	Mathematics 18	3
Physics 6, 7, 9	4	Physics 3, 4, 5, 8, 9	10
Chemistry 8	$1\frac{1}{2}$	Chemistry 12	$1\frac{1}{2}$
E. E. 5, 12	$3\frac{1}{2}$	E. E. 6, 8	$3\frac{1}{2}$
C. E. 1	1	Thesis	
Scientific German and French	1	Journal Meeting	
Journal Meeting			

*This course begins in September, 1908; only the first two years can be offered at present.

The 1907-08 catalogue defined, for the first time, a major in physics as it is shown here.

The Course Descriptions:

PHYSICS.

H. SCHAPPER, *Associate Professor, in charge.*
MESSRS. WHITE, GRAHAM, and MCCLAIN, *Assistants.*

PREPARATORY PHYSICS (3).—Recitations three hours a week throughout the year.

1. GENERAL PHYSICS (3).—Two hours a week throughout the year are devoted to class-work, and two hours a week throughout the year to work in the laboratory. To be taken parallel with freshman mathematics. *Prerequisite: Preparatory Physics.* M. W. 3; Tu. F. 4; W. Th. F. 6, 7.

1*a*. PRECISION OF MEASUREMENTS (½).—Recitations one hour a week during the second term. Elective.

2. ADVANCED PHYSICS (3).—Lectures and recitations three hours a week throughout the year. Some of the more important dynamical principles are given; the theory of potential is discussed at more length; the subject of Electrical Measurements is treated rather fully; the notion of an Electron is introduced. To be taken parallel with sophomore mathematics. *Prerequisite: Physics* 1. M. T. W. 1.

2*a*. LABORATORY WORK (2).—Four hours a week throughout the year taken parallel with Physics 2. F. 5-8.

3. THEORETICAL ELECTRICITY (2).—Vector Analysis; Maxwell's theory; Lorentz's theory; The Mechanics of the Electron.

4. KINETIC THEORY OF GASES (1).—Two hours a week first term.

5. THERMODYNAMICS (1).—Two hours a week second term.

6. HEAT (1).—Two hours a week for one term, mostly laboratory work.

7. LIGHT (1).—Two hours a week for one term, mostly laboratory work.

8. GENERAL THEORY OF LIGHT (2).—The theory of light is considered more fully, special attention being given to the Electromagnetic theory of light.

9. MATHEMATICAL PHYSICS (4).—Four hours a week for a year.

10. ELEMENTARY ACOUSTICS (1).—A course of two hours a week for one term, intended primarily for students of music. The scientific basis of harmony is explained and fully illustrated.

11. JOURNAL MEETING.—Together with the department of chemistry, the instructors and students of the Department of Physics meet once a week, on Thursday, for report and informal discussion of articles in the current physical and chemical journals, and of such researches as may be carried on in the departments. Attendance is required of all students in the advanced classes.

This slide, reproduced from the 1907-08 catalogue, gives the course descriptions for the physics courses.

Required Math courses:

21 hours including:

- Differential and Integral Calculus
- Analytical 3-D Geometry
- Differential Equations
- Partial Differential Equations
- Descriptive Astronomy

In this slide, you note the math courses that were required for a major in physics, which includes up to a partial differential equations course. Astronomy, at that time, was part of the Math Department.

Required physics courses:

22 hours, including

- Precision of Measurement
- Theoretical Electricity
- Kinetic Theory of Gases
- Thermodynamics
- Heat
- Light
- General Theory of Light (includes EM theory of light)
- Mathematical Physics
- Acoustics
- Journal Club
- Thesis

This slide shows the required physics courses. In addition, 11 hours of chemistry and 7 hours of electrical engineering were required. Students took 18 hrs per week of courses, in addition to journal club and thesis; in other words, 76 hours in 4 years.

Physics enrollment in 1908-09 was 149, although no physics degree was awarded until 1928. Now, let's look at this curriculum in a little bit more detail. This curriculum was, perhaps, not out of line with the standard physics curriculum of the time. Remember that Einstein introduced his Theory of Relativity only two years earlier and quantum theory was in its infancy. The Bohr Model did not come until 1913. Electrons, X-rays, and radioactivity had been discovered but perhaps had not become part of the standard physics curriculum. The course of electromagnetism does mention "The Mechanics of the Electron". Keep in mind, also, that "physics department" had only one faculty member at that time. My suspicion is that this curriculum was found to be unsustainable because when we look at the curriculum in later years, we find that it has been considerably curtailed.

Space:

The Physics Department was housed in the Old Engineering building, which no longer exists. Physics was part of Electrical Engineering just before it was given the status of a separate department, so it naturally stayed in the same building. However, it had just a few rooms for its use. Therefore, the Board authorized construction of a temporary 50ft x 40ft wooden structure at a cost of $1000 to house the physics laboratories. The building was, however, very short lived. It went up in smoke in 1909, along with all the physics apparatus that the department had collected over the years, without a cent of insurance!

The First Physics Department Head:


Giles Emmet Ripley.

Giles Emmet Ripley, the first head of the Physics Department, was appointed in 1908. (Professor Schapper apparently left the university at that time.) Professor Ripley had received his BS and MS degrees from Purdue University in Indiana. He remained head of the department until 1940, when he retired. He was also Dean of Men from 1923 to 1937. He has many patents to his credit, and some of them are on display in the Physics Library.

Buildings Timeline

- 1871-1875 The original building
- 1875-1893 University Hall (Old Main)
- 1893-1904 Science Hall (Chemistry &Physics)
- 1904-1918 (Old) Engineering Building

(1907-1909 Physical Laboratory)

- 1918-1936 Physics Hall
- 1936-1952 University Hall (Old Main)
- 1952- Physics Building

(1994 Renovation & Expansion)

Physics has always had a problem with not having suitable space. This slide shows the timeline of various buildings that physics has occupied. I will not dwell on this slide but go ahead and show you the pictures of each one of these buildings.

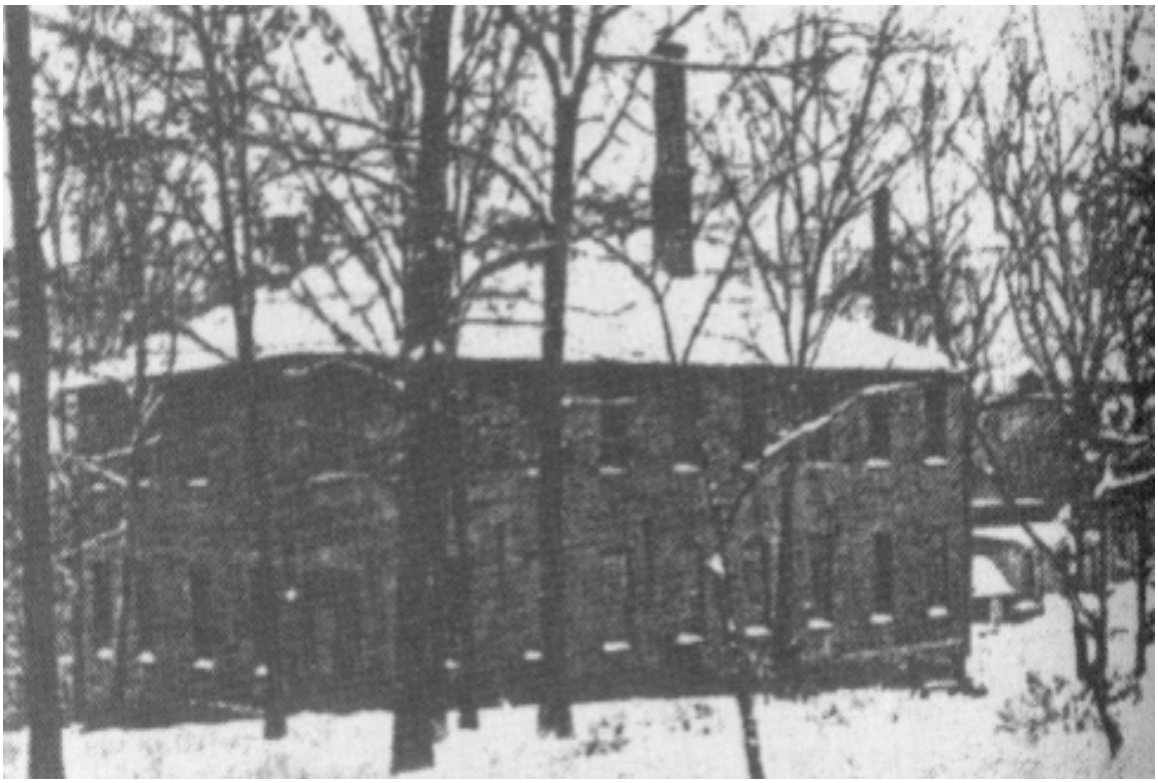
The First Building (1871-75)

This is the original university building where physics was taught before Old Main was completed.

University Hall (Old Main)

Physics was taught in Old Main from 1875-1893.

Physical Sciences Building (1893-1904)



In 1893 Physics was moved to the Physical Sciences Building, which was primarily occupied by the Chemistry Department. Physics was part of Chemistry at that time.

(Old) Engineering Hall (1904-1918)

In 1904 Physics was made part of Electrical Engineering and was placed in Old Engineering hall. Even after becoming a separate department, it continued to occupy space in that building until 1918 when the first bldg for physics was built. The temporary wooden building which was built in 1907 at a cost of $1000 (about $22,000 in today's dollars) to house the physics laboratories was temporary indeed! It was destroyed by fire in 1909. We have not been able to find a picture of that building.

Physics Hall – The First Building Dedicated to Physics (1918-36)

This was the first physics building. It was a two-story wooden structure with ten rooms for offices, classrooms, laboratories, etc. No pictures of the interior are available. However, the building was wholly inadequate for Physics both in quantity and quality of space. George Harvey who received his bachelors in 1938 and masters in 1940, wrote about the building to Paul Sharrah, and I quote: “Old 2-story building, perhaps a shed, … was a disgrace to the campus.”

Professor Ripley, in the 1927-28 annual report, had this to say:

“Our most urgent need at present is much more space, and a building free from vibration. There is only one place in the present building where sensitive galvanometers can be used, such as are required for the course in Electrical Measurements, the course in High Temperatures, and much other advanced laboratory work.

“There is a need for a large lecture room, seating 200-300 students, well equipped with demonstration apparatus, for use in the elementary course.”

Those words are still echoing 80 years later. We still have the same needs: more space and space suitable for state-of-the-art research. And we are still waiting for a large lecture room equipped with demonstration apparatus!

The Chemistry Building

My colleagues like to compare us with the Chemistry Department. So, I thought that I would tell you a little bit about the chemistry space. Chemistry got their first brick building in 1905, two years before Physics even got its $1000 temporary wooden shack! This building still exists on the northeast side of campus, and houses School of Social Work.

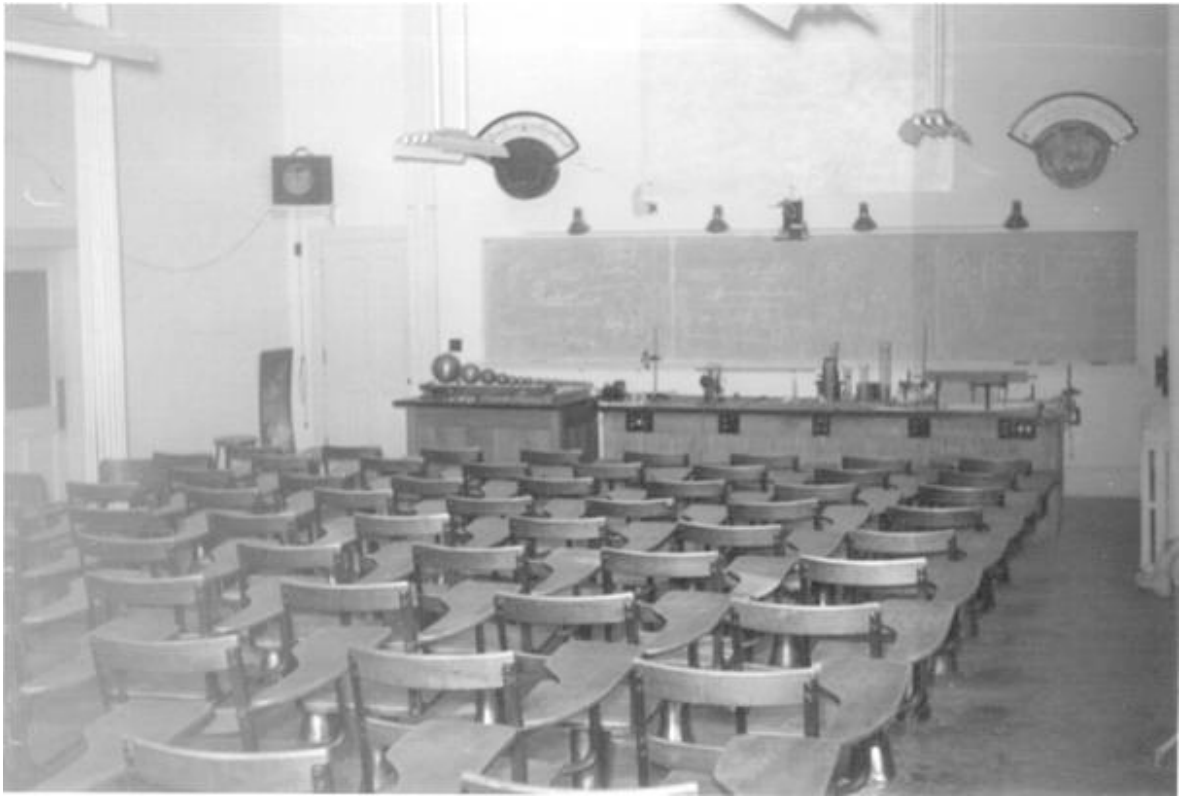
Old Main, the Second Time (1936-52)

Physics was moved back to Old Main in 1936, and it stayed there until 1952 when it relocated to our present quarters. Fortunately, we have some pictures of the interior of Old Main from that period available, and they are shown in the next few slides.

Giffels Auditorium

This is Giffels Auditorium during the period when Physics was located in Old Main, and that is the room in which you are currently sitting in. (It was not known as Giffels Auditorium at that time).

The Physics Lecture Room

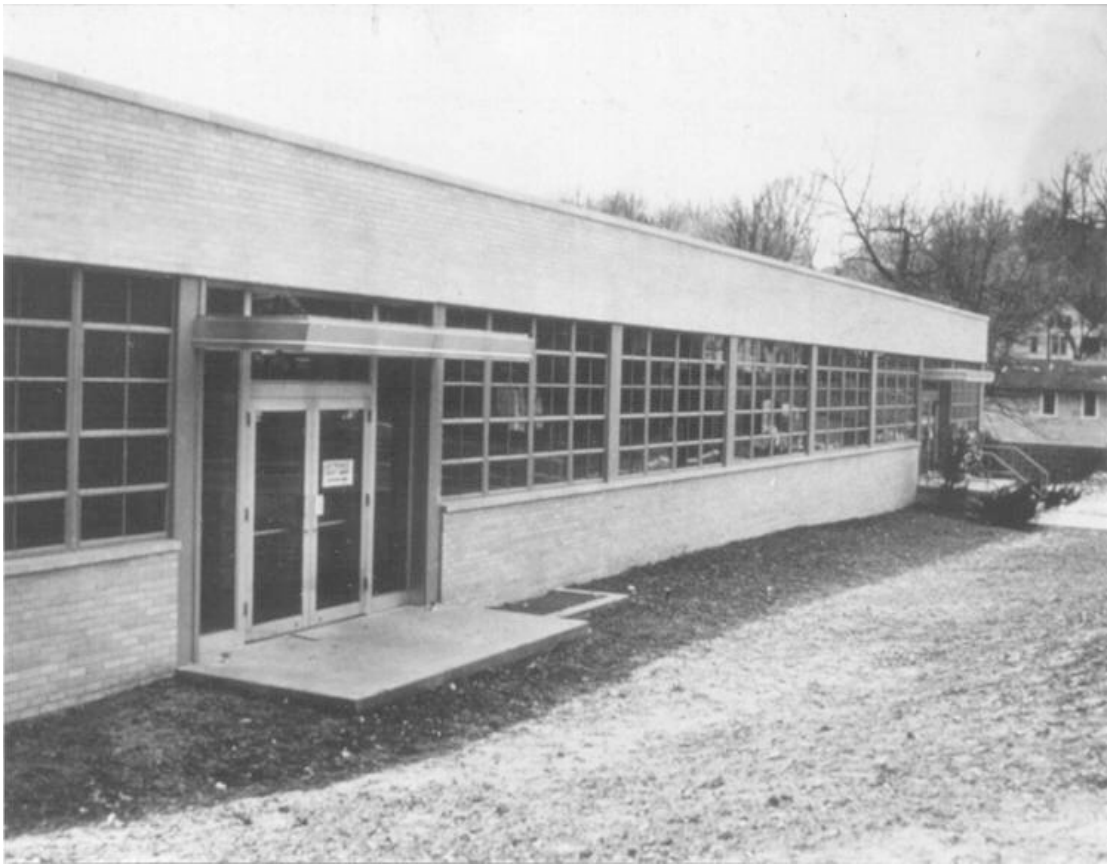


This was the physics lecture room in Old Main. Note the large meters mounted on the wall for electricity demonstrations and these were standard in any physics lecture room in that period. Note also the physics demonstrations that are set up on the bench.

The Physics Library

The Physics Library consisted of two book cases in a faculty office, first occupied by Professor Sharrah and later by Professor Schwartz.

Physics Building – The First Brick Building (1952- to date)



In 1952 Physics moved into its first brick building. It appears that this picture was taken shortly after its construction. There were plans to build a building for the Physical Plant when the Engineering School had a review and the Physics space was determined to be inadequate and unsuitable. The building was constructed for the Physical Plant, but the construction plans were modified so that Physics could be moved into it “temporarily”.

Physics was assigned only a part of the space in this building. Even then it was considered an improvement over space occupied in Old Main. Most of the windows were painted blue, factory like. The interior of the building had unpainted cinder blocks, ceiling extending to the fiber-glass insulation in the roof, concrete floors, and no air-conditioning.

This is the Physics Library. The unpainted cinder-blocks are visible here.

Here, Mr. Lingelbach assists a student in the Physics Library.

This building was renovated in 1994. The department had gone through a rapid growth in the 1950's and 60's. It had run out of the space completely. By the early 1980's Physics had the complete control of all the space. Still the space was woefully inadequate. New experimentalist faculty were hired without laboratory space for them! Moreover, the space lacked the basic infrastructure (adequate power, cooling water, environmental control, etc.) for state-of-the art research.

In 1990, the department wrote an infrastructures improvement proposal to the NSF. It was awarded $500,000 for the renovation of the *research* space. The department used this grant as a leverage to obtain additional $3.5M from the University to renovate the entire building and to build a small addition to the building. The renovation/construction was completed in 1994. You will have a chance to visit the building this afternoon.

The Renovated Building

Here is the front of the building now and…

This is the small addition in the back . The entrance to that part is shown here.
This was part (Phase I) of a larger building that was promised to the department. The Phase II never materialized.

In the next few slides, I will show you how some parts of the building interior looked like just before and after the renovation.

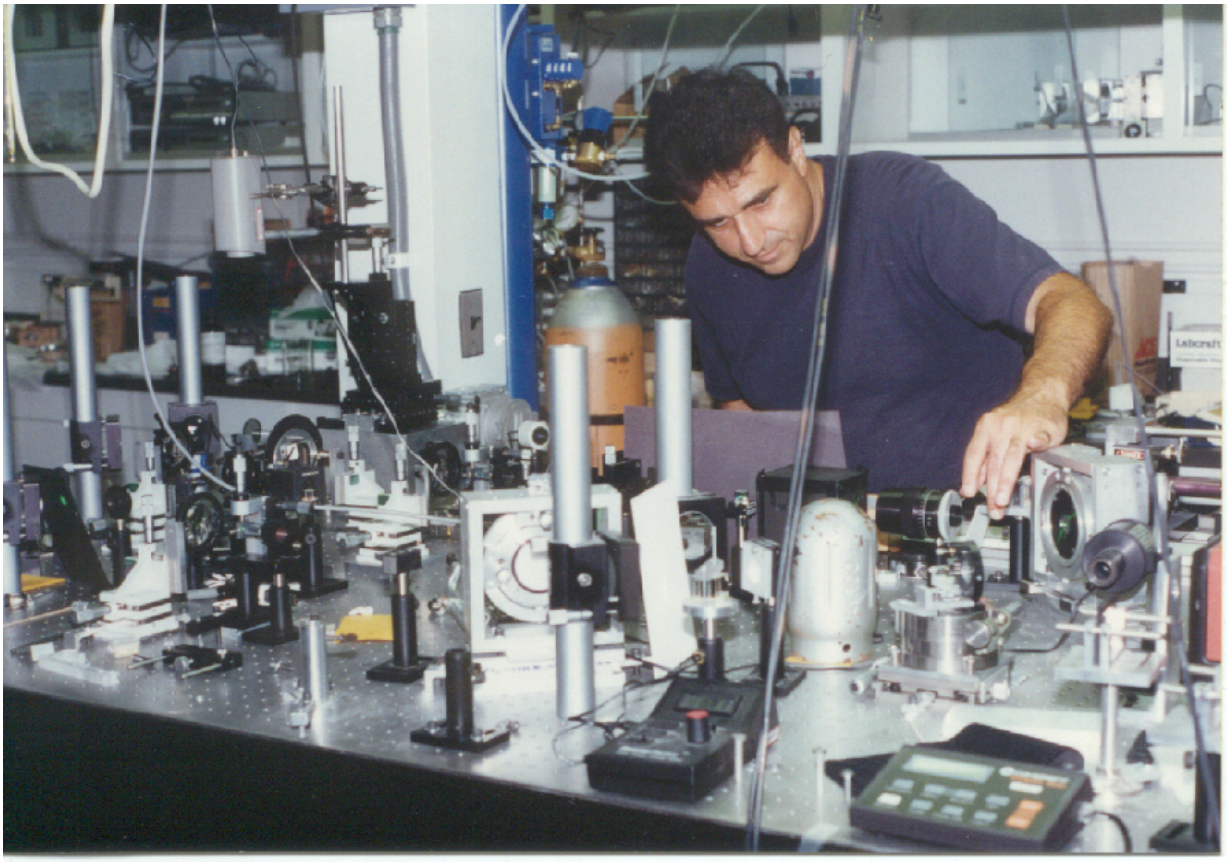
The Physics Library

The Physics Library had way outgrown the space available to it. Books were stacked to the ceiling. Some were still in boxes on the floors. There was practically no seating space.

This is what the library looked like after the renovation. You will see the library this afternoon, except now most of the shelves of journals have been removed to make room for computers.

Research Labs

This was Professor Richardson’s lab. It had a concrete floor, a fan coil AC unit had been added and it is seen here hanging from the ceiling.



After the renovation, this is one of the labs. Here you see Professor Salamo.

The Basement Hallway

I don’t want to overdo this, but I would like to show you a couple more pictures. On the left, you see one of the hallways in the basement of the building. Somebody commented that it looked like a submarine. Over the years, some infrastructure improvements had been made to accommodate the department’s research: more power, water in labs, etc. Some of these were strung out on overhead trays. On the right, you see the same hallway after the renovation.

The Physics Lecture Room

Many of you probably remember Room 119, the physics lecture room, where many of you had your physics classes: broken windows, lights hanging by chains, wooden seats, etc.

The new Lecture Room

This is what the current lecture room looks like. As I pointed out earlier, Phase II of the building never materialized. Physics is again woefully short of space. Even if it had materialized as planned, Physics would be out of space by now due to its rapid growth.

Research

JUNE, 1926 *PHYSICAL REVIEW* *VOLUME 27*

HEAT TRANSFER IN THE ANNULAR SPACE BETWEEN TWO COAXIAL CYLINDERS*

By S. R. Parsons

Abstract

Two brass tubes are mounted with a common axis, one inside of the other, and are warmed by driving hot air, in turbulent flow, through the annular space between them. The rates of transfer of heat to the two tubes are compared by means of a coefficient representing heat transmitted per unit time per unit area of metal surface per unit difference of temperature between metal and air. Lees has shown that in streamline flow there would be a difference in the surface friction per unit area for the two tubes, and if that were true in turbulent flow, there would be a corresponding difference in the coefficients of heat transfer. The experimental results show that if there is such a difference in turbulent flow, it is not of the magnitude to be expected from Lees' equations, and fail to show with certainty that any difference exists.

MAY, 1926 *PHYSICAL REVIEW* *VOLUME 27*

THE L ABSORPTION LIMITS OF TUNGSTEN: PHOTOMETRIC MEASUREMENTS

By C. B. Crofutt

Abstract

In a previous paper both the absorption and emission spectra of tungsten were photographed simultaneously on the same plate. It has since seemed advisable to make a photometric analysis of the original plates showing the L absorption bands. The results give for L_1, 1.2117A, and for L_3, 1.0708A, as compared with the former eye measurements of 1.2122A and 1.0716A, though the last are regarded by the author as more reliable. The mean variation in the measurements is less than .0002A. L_1 is clearly between β_8 and β_{10} and L_2 between γ_6 and γ_2, indeed between γ_6 and a new line, 1.0699A.

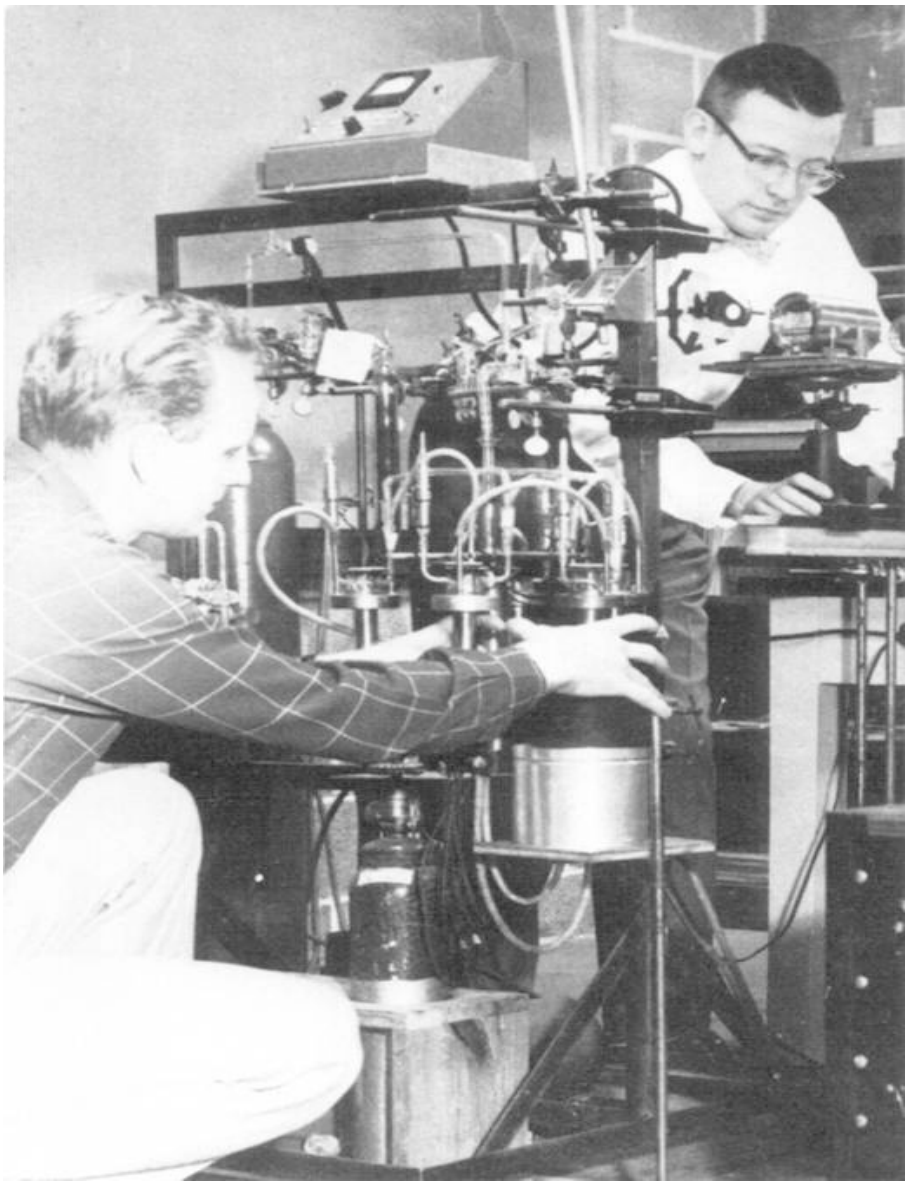
Now I would like to talk a little bit about research. The two earliest faculty publications in national journals appeared in 1926 and were by Professors Parsons and Crofutt. Keep in mind that there was no university research mandate at that time. This research was done in spite of the fact that the faculty had almost no time for research and the building had no space for research. Faculty were teaching 15 hours, and they still managed to conduct publishable research! I read for you from the 1927-28 annual report for the department: "At present, research is possible only in the summer vacation, because of both lack of time and space. It is restricted to a very limited range of kinds of work for lack of equipment. If time and laboratory space could be made available, a fairly extensive program of research could be laid out…."

In the 1930s and 40s, research consisted of primarily Dr. Hamm's work in acoustics and Dr. Roberds' work in X-rays. Here you see Professor Hamm. Some of the X-ray tubes used by Professor Roberds are on display in the Physics Department, and you will have an opportunity to view them this afternoon.

To promote research in the 1950's, the university purchased two instruments for research in the physical sciences, a Phillips X-ray machine and a Littrow Spectrograph, both shared between Physics and Chemistry. Here you see a picture of Jean Camus, a visiting French spectroscopist with the Littrow Spectrograph.

In 1948 the university started an Institute of Science and Technology to promote research. Dr. Griegorieff, a man successful with getting grants, was appointed as director. Several members of this institute were also in physics. The institute was phased out in 1953.

Professor Sharrah came to the university in 1942 and, after the war, established a research program in X-ray diffraction. Here you see Dr. Sharrah's X-ray research laboratory.



In 1948, Dr. Herman Schwartz was hired to conduct research in relativity. Dr. Hughes was hired in 1954. He started research in atomic physics and developed a very highly successful program in atomic physics. He received the department's first research grant in 1956 from the Air Force Office of Scientific Research. He was instrumental in establishing the department's Ph.D. program in 1959.

The first Ph.D. in physics was awarded under his direction in 1964. The establishment of the doctoral program gave a considerable boost to research in the department. It was now possible to have graduate assistants. This period was the post Sputnik era, which was a double-edged sword. On the one hand, it was relatively easy to get research grants but, at the same time, it was difficult to recruit faculty.

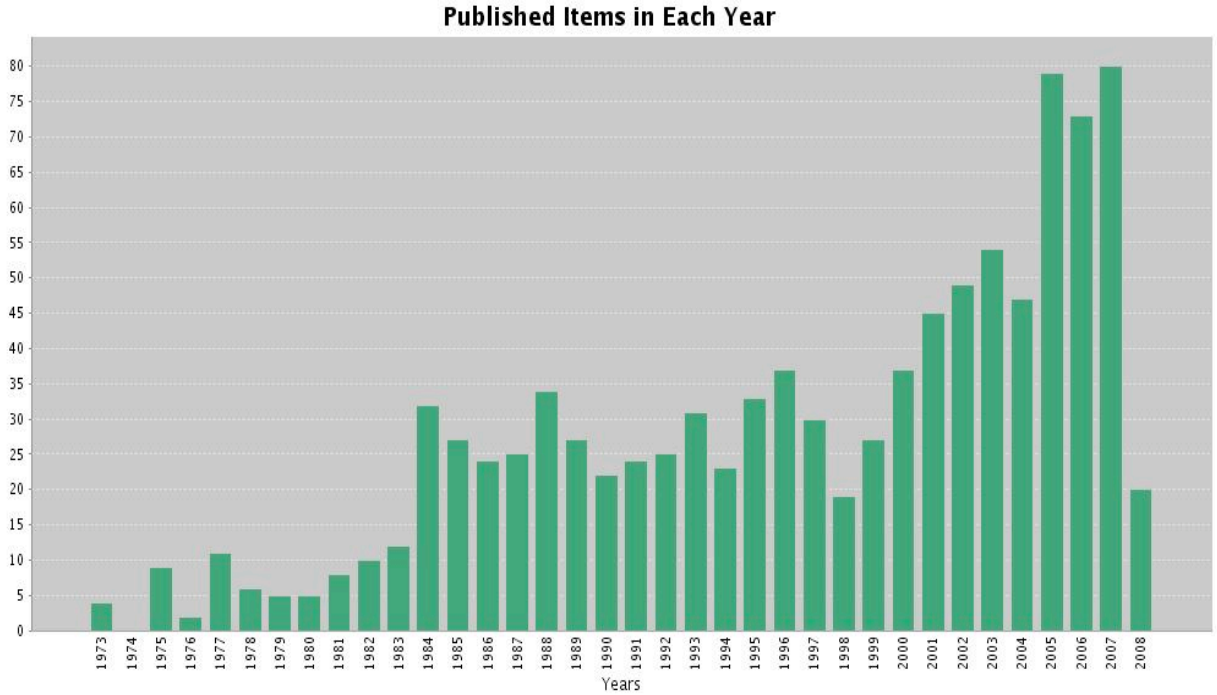
New research started in the 1960's and 1970's

- 1959: Bud Zinke – plasma physics
- 1961: Steve Day – NMR
- 1962: Charles Jones – molecular spectroscopy
- 1964: Art Hobson – statistical mechanics
- 1966: Charles Richardson – atomic physics
- 1966: Rich Anderson – atomic physics
- 1969: FT Chan – atomic scattering theory
- 1970: Michael Lieber- theoretical and mathematical physics
- 1972: Carol Web – first astronomer
- 1972: Don Pederson – elastic properties of solids
- 1975: Greg Salamo – quantum optics

This slide covers the faculty members who were hired between 1959 and 1975. It appears to me that the department had not decided to focus its research in a particular area or areas. In 1975, largely due to the efforts of Greg Salamo, the department decided to build a program in quantum optics and laser physics. Several new faculty members were hired in this area, and the department built quite a reputation. In the 1990s the department started to broaden into the area of condensed matter physics and then subsequently now in nanoscience. I will not say much about the research efforts that are currently in progress in the department because you will hear talks about them a little later this morning.

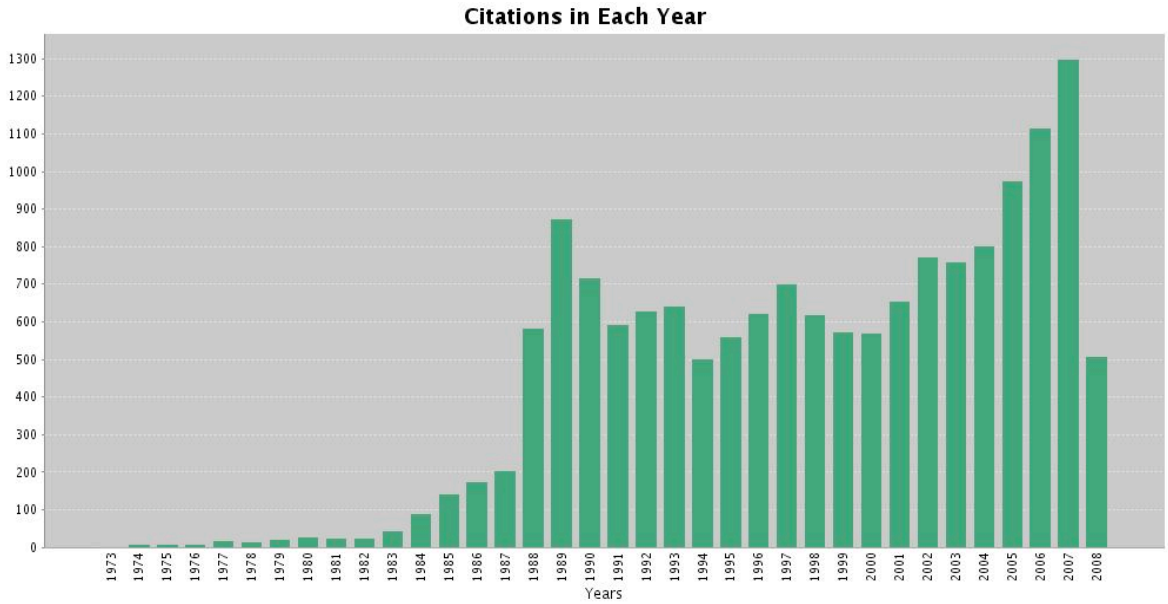
I would like to conclude with a few histograms.

Department's Research Publications



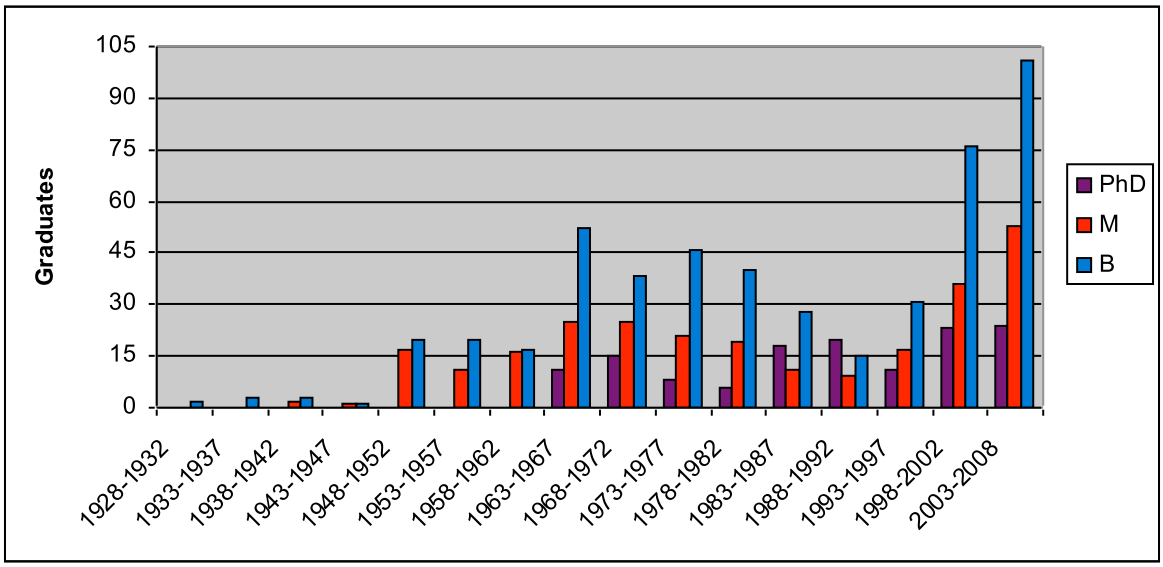
This slide shows a number of publications by physics faculty and staff every year since 1973 until now. The slide speaks for itself. During the last 3 years, physics faculty members have published approximately 75 papers per year.

Citations to Publications by the Faculty



This slide shows citations to the publications by our physics faculty, again starting in 1973 and continuing to the present. In the last 3 years, work by physics faculty has been cited approximately 3000 times.

Physics Degrees



Finally, I would like to make just a brief mention of out instructional program. This is a huge subject and would require a separate talk. Therefore, Professor Oliver will talk about our current instructional program in some detail a little later this morning.

Here I will just show you a histogram of our degree production. Approximately 900 degrees have been awarded: 136 Ph.D.s, 260 masters, and 500 bachelors. B designates both BS and BA degrees and M designates MA and MS degrees.

I have run out of time so I will not have time to get to the last three topics shown on my outline slide. I would like to conclude here. I thank you very much for your attention.