Dr. W. F. M. Goss
Dean of College of Engineering

Dear Sir:

I respectfully submit this, my annual report of the Department of Physics for the year 1908-9.

Courses and Attendance

The accompanying table shows the courses given with instructors and number of students enrolled in each course both this year and last year. It will be noted that there are again marked increases in our large undergraduate classes. There has been nearly 10% increase in the large classes in general physics, and an increase of over 25% in the large laboratory class in electrical measurements. The total registration in our graduate courses has also doubled. There are few universities in the country that have as large an enrollment in physics as we have now, and we should expect continued increases particularly in the number of the non-technical and the graduate students.

The undergraduate courses have moved smoothly and the results have been generally satisfactory. But continual improvements are needed for efficiency. The amount of instructional work in some of these courses is not always realized. Thus in Physics 3, the laboratory course taken by sophomore engineers, there are 300 laboratory reports to be corrected, marked and returned each week. This must be done thoroughly for otherwise the course would become a farce. But reports mean corresponding experiments, and these mean apparatus to be transferred to the laboratory, inspected and adjust-
ed, direction and data sheets to be prepared, assignments to be
made, instruction and help given in the performance of the experi-
ments, etc. The 70 students in electrical measurements require pro-
portionally even more time, as the work is expected to be of a higher
order. The work of the large courses thus requires the direction of
a considerable number of assistants, and this must be considered in
the assignment of work to directing professors. It is an increasing
question with us, as we shall have to add several assistants (most
of them at the minimum salary and hence untrained), to take care of
our increased numbers in general physics and electrical measurements.
We have been discussing the establishment of a regularly scheduled
course in general physics of graduate grade for assistants, follow-
ing week by week the topics of our sophomore physics. Another task
that falls on our directing professors is the preparation of the
direction sheets. We shall have to revise these in two of our
courses the coming year. This amounts, in fact, to the preparation
of a laboratory manual to meet the requirements and methods of our
laboratory. The assistant professors, Doctors Knipp, Watson and
Schulz, have worked faithfully and efficiently, and the success of
our work is largely due to their thought and efforts.

Graduate Work and Investigations

We have given during this year the following courses taken
by graduates:

104 - Electrical & magnetical measurements, through the year
120a - A course of recitations & lectures on light, 1 semester
121 - A lecture course of one hour weekly, both semesters, on
recent advances in physical science
124 - A course of recitations & lectures on conductivity of electricity in gases and radio-activity - both semesters

125 - A laboratory course in heat

126 - A Physics Club meeting held every Thursday evening from 6:30 to 8:00 with papers by members of the Club reporting original work mostly

131 - Investigations - not for theses

133 - Thesis investigations

Of these courses 104 and 125 have been given in connection with undergraduate work, but being laboratory courses the work for the graduate students was arranged especially for them and more work required of them than of the undergraduates. We have limited our range of work because of space and the number of instructors. We have emphasized the investigational laboratory work; farther on in this report you will find the investigations now in progress. Each investigation requires a large amount of reading of references by the instructor, so an investigation may take even more time than the giving of a course. We have 13 students registered for major work in physics, all of them taking one or more courses. We have, in addition to the above, 6 students taking graduate work in physics, these having major work in other lines.

Mr. Edward E. Stephenson is the only candidate for the degree of Doctor of Philosophy this year. Mr. Stephenson's thesis investigation is showing excellent results, but owing to the richness of the field that has been opened up by his experiments, his thesis may not be ready for acceptance before the first of June. I have advised him to complete his thesis so that it can be accepted complete by Commencement time and the results published, even if he
does not have time to take his examinations for getting his degree this year. By this means we will secure the priority of publication for some very interesting discoveries which he is making. I believe this is more important than his securing the degree a year earlier.

Six of the 15 students majoring in physics intend to push their work for a Doctor's degree as rapidly as possible, and probably take it with us. One of these, Mr. G. J. Balzer, has recently had an excellent financial offer to return to the high schools of Milwaukee. It is so very much more than he can hope to make in university work for a number of years that he may not prosecute his Doctor's degree immediately. The names of the six are:— G. J. Balzer, J. W. Hornbeak, J. G. Kemp, E. B. Stephenson, W. W. Stifler, E. H. Williams.

We have two original researches completed in the Department this year, which are in press, part or all of the proof having been examined. These are:—


"The Time Rate of Gas Reactions of CO₂", by J. K. Clement, appearing as an Engineering Experiment Station Bulletin.

Two other investigations, one by Dr. Knipp and the other by Dr. Schuls, are completed and the manuscript is being prepared.

The following are the original researches in progress in the Department:—

The Effect of Pressure and Temperature on Rectifying Cells, by G. J. Balzer. In this investigation the oscillograph was
used and new and important results obtained. The matter will 
be ready for publication by Commencement time.

Surface Tension of Liquid Air, by E. G. Converse. This 
is a new determination using improved methods, and more uniform 
values have been obtained than any published. The results will 
probably be published as a note this coming summer.

The Thermal Conductivity of Poor Conductors at High Tem-
peratures. This is an elaborate investigation being carried on 
by W. L. Egy under an Engineering Experiment Station Fellow-
ship, and will give entirely new results. It will also furnish 
a new method which can be extended to other substances. The 
manuscript will be ready by Commencement.

This will form a Master's thesis for the coming June.

Investigation of Absorption Spectra of Rare Earths, by 
W. F. Schulz and J. G. Kemp. This work is an investigation 
which will require a year or more to complete it; it is a con-
tinuation of work which Dr. Schulz carried on at Johns Hopkins 
University.

Radiometer Action of Light on Gold Leaves in a High Vacuum, 
by C. W. Sandifur. This started as a repetition of work done 
by Bottomley. The investigation is completed and has given ex-
perimental evidence showing that Bottomley's explanation was 
incomplete. The work will be published as a note in The Physi-
cal Review.

Methods of Measuring Electrical Capacity, by O. H. Smith. 
This experimental investigation is being carried on for the
Master's degree and may or may not give original results.

Magnetic and Physical Properties of Heusler Alloys, by E. B. Stephenson. This work is being carried on for the Doctor's degree. A large number of observations of various kinds have been taken and some very interesting results obtained. It will probably be the most complete investigation so far published on these lines.

Variation of Temperature and Pressure of the Mercury Arc - The Pressure Due to the Mercury Vapor, by W. W. Stifler. This investigation of some very interesting phenomena discovered by Dr. Knipp will likely lead to new ideas concerning the movements of the ions in mercury vapor. Good progress is being made, and it is hoped that this matter will be in shape for a report by the time of the meeting of the American Physical Society next November.

The Acoustics of the Auditorium with Experiments on Intensity of Sound, by F. R. Watson and Otto Stuhlmann, Jr. A great amount of time has been spent on this investigation, and even if it does not solve the problem of acoustics of architecture it will result in some very interesting and important data on the measurement of sound intensity. This will be ready for a preliminary report by the end of the college year.

Spark Discharges under Different Gas Conditions, by E. H. Williams. This is work which will require a year to complete, and Mr. Williams hopes to make use of it for his Doctor's degree.
New Building and Equipment

Since the last annual report the contract for the new Laboratory of Physics has been let and the construction begun. The building has progressed far enough to assure us that it will be one of the most attractive of our University buildings. In facilities, it will, we believe, be equal to any laboratory of physics in the country. The University was fortunate in letting the contract at a time of lower prices, so that we have enough to furnish the building satisfactorily.

Organization and Additions Needed

The new building has been planned to take care of the three lines of work which seem to be the field of the department:—first, instruction in physics for undergraduates; second, instruction and facilities for graduate students preparing either for university or for high-school work; and, third, researches independent of the instruction of particular students not only on topics suggested by pure physical theory but by physical data called for by the problems in the pure and applied sciences. Our department work has been along all of these lines as already indicated. In the undergraduate work it is a question of manning the courses as now organized. In the graduate and advanced work, our work has been along too limited lines. We have done some things well, but the work must be extended and additions made to our organization now that we have space and facilities. The additions proposed below may seem large to those who have to keep an eye on "ways and means", as well as
consider educational policies; but the subject has been studied from the standpoint of what we must do to meet the student demands which we will have. The new building with adequate organization should make us a center in physics, and it is our chance and duty to take a lead.

Recommendations

My recommendations are as follows:

First, that we add to the department a man of high scholarship and with a gift of leadership. He should be strong in general experimental physics so that he could direct investigations. We must expect to pay a commanding salary to get a mature man of standing. Rather than get an inferior man, we should take a young man of promise and support him.

Second, that we secure the early appointment of someone to the position in mathematical physics authorized over a year ago. I shall prepare in a separate letter a recommendation for a man for this place.

Third, that we increase our assistants (mostly lowest paid men), so as to meet the increased enrollment, and also to relieve our men of professorial rank from routine as far as is possible with efficient undergraduate instruction. Four such assistants are needed. These assistants should add to the investigations in physics, as they would be selected from men expecting to take higher degrees in physics.

Fourth, that we increase the force in our machine shop.

Fifth, that a clerk be added for the department office.
I have omitted names from these recommendations and also have omitted recommendations concerning the men now in the department. Doctors Knipp and Watson, the Assistant Professors who have been with us six and seven years, are both excellent men who have worked hard and well for us. They both stand well with physicists and teachers, and deserve well of the University.

In conclusion, I wish to thank the Dean and other members of the College of Engineering for the earnest support that the Department of Physics has received from them; without that support it would not have been possible to do what has been done.

Yours respectfully,

Professor of Physics
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<th>No. &amp; Character of Course</th>
<th>No. of Students</th>
<th>Work each week</th>
<th>Instructors</th>
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<tr>
<td>Physics 131, Special</td>
<td>I 5: I</td>
<td>2: Laboratory</td>
<td>A.P. Carman</td>
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<td>Investigations</td>
<td>II 3:II</td>
<td>1: hours, 6 to</td>
<td>C.T. Knipp</td>
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<td>15 weekly</td>
<td>W.F. Schulz</td>
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<td>Physics 133, Thesis</td>
<td>I 7: I</td>
<td>7: Experimental</td>
<td>A.P. Carman</td>
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<td>Physics I. Lectures &amp; recitations in General</td>
<td>I 393: I 361:2 experimental</td>
<td>A.P. Carman - lectures</td>
<td>F.R. Watson - quizzes by</td>
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<td>Physics for Engineering &amp; like students</td>
<td>II 361:II 348</td>
<td>each of 2 sections</td>
<td>W.N. Stempel questions of 16 sections</td>
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<td>W.P. Schuksz, Head Laboratory</td>
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<td>Physics 2b. Laboratory Course for Physics 2a</td>
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<td>F.R. Watson</td>
<td>Laboratory</td>
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<td>Physics Measurements for Juniors in E.E. &amp; Graduates</td>
<td>II 69:II 59:2 periods for</td>
<td>C.H. Swisher</td>
<td>each of 3 sections</td>
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<td>Physics 15. Minor Course in Electrical Measurements</td>
<td>I 13: I 15: Two three-hr.</td>
<td>E.H. Williams - periods week-</td>
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<td>II 6:II 2:12</td>
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<td>5-hr. laboratory</td>
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<td>Physics 165. Heat Metals</td>
<td>II 2:3 lectures</td>
<td>F.R. Watson</td>
<td>Laboratory periods</td>
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<td>for graduates, Physics</td>
<td>6 with additions</td>
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<td>Physics 16. Teachers' course</td>
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<td>3 three-hour</td>
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<td>I 18:</td>
<td>1 lecture</td>
<td>C.T. Knipp</td>
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<td>Physics 124. Seminary Club</td>
<td>I 18: I</td>
<td>8:30-8 Thurs.</td>
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<td>F.R. Schuksz</td>
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<td>cal Theory (4a last yr.)</td>
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<td>5:30-8 Thurs.</td>
<td>F.R. Schuksz</td>
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