CHEMICAL PHYSICS - DOCTOR OF PHILOSOPHY (PHD)

Chemical physics is a discipline at the interface between chemistry and physics. Chemical physics applies physical methods and theory to study molecular and collective properties of matter. The focus is on understanding complex phenomena from gas phase molecular dynamics, to nanoscale, mesoscale and biological phenomena, through model systems and fundamental physical principles.

The chemical physics program allows students to strike a balance between core courses and courses that are better suited to address the student’s specific research goals and interests. Students must consult with the chemical physics graduate advisors in their parent departments, either chemistry and biochemistry or physics, to plan their formal coursework.

This program is administered by an interdepartmental committee. For more information, contact the graduate program manager in either the Department of Chemistry and Biochemistry (chemgrad@colorado.edu) or the Department of Physics (Jeanne.nijhowne@colorado.edu).

Requirements

Program Admissions

Graduate students in good standing in either the chemistry or physics department are formally admitted when they pass the preliminary examination. Students are formally admitted to the PhD program in chemical physics. After filling in the form, indicating graduate courses and their chemical physics graduate advisor for advice on initial course selection. Advanced students must be in good standing in their home department and able to complete the chemical physics PhD within the time limit set by the Graduate School in order to declare their intent to work toward the chemical physics PhD. Once they have been accepted by the Graduate Advisor in chemical physics to enroll for candidacy in the PhD program in chemical physics, the graduate advisor will notify the graduate secretary in their home department to have their major code changed to CPHY.

Once a student has declared their intent to work toward a PhD in chemical physics, the preliminary examination shall be conducted by the chemical physics graduate advisor. The exam shall review all completed courses, undergraduate and graduate, related to chemical physics. The student must also earn grades of B+ or better in at least six credit hours of University of Colorado graduate courses that have been approved for the PhD in chemical physics by the graduate advisor. Students must pass the preliminary examination within two semesters of declaring their intent to work toward a PhD in chemical physics. Students are formally admitted to the chemical physics PhD program when they pass the preliminary examination.

Courses

General Requirements

Students must complete a program of formal courses (see "Selection of Formal Courses" below) approved by their PhD thesis advisor and the Committee on Chemical Physics. Students must file an approved degree plan of courses already taken, in progress and planned for future semesters with the Graduate School by the end of their fourth semester. The 30 doctoral dissertation credit hours required by the Graduate School may be completed in either CHEM 8991 or PHYS 8990.

A minimum grade of B+ is required in all courses counted for the PhD degree. Students must maintain both a cumulative grade point average of 3.0 in their program of formal courses and an overall grade point average of 3.0.

Selection of Formal Courses

The chemical physics program makes the distinction between formal and graduate level courses. All students will be required to complete an approved program of formal courses that contains at least 6 credit hours of formal coursework. Formal courses are graded based on individual coursework. Many graduate level courses are not considered formal courses in the context of the chemical physics PhD requirements, but may be counted toward Graduate School course requirements.

Each student’s degree plan for coursework must be approved by the student’s PhD thesis advisor and a chemical physics graduate advisor. The formal courses shall be chosen to develop the student’s competency in classical mechanics, quantum mechanics, thermodynamics and statistical mechanics, electricity and magnetism, chemical kinetics, and in their area of thesis research.

Transfer of Credit

Up to 10 credit hours of graduate level, formal coursework may be transferred from another school, subject to demonstrated proficiency in the subject(s), approval by the Chair of the Committee on Chemical Physics, and approval by the Graduate School. Forms for this purpose can be obtained from the graduate program manager.

Formal Application for Admission to Candidacy for the PhD Degree

All students must make formal application for admission to candidacy for the PhD degree by the fourth semester. The required forms can be obtained from the graduate program manager. This Graduate School requirement should be fulfilled even if the student has not completed all the courses required by their degree plan. To satisfy Graduate School requirements, the degree plan may include graduate-level courses that are not approved as formal courses in chemical physics, but the degree plan must include the student’s approved program of formal courses in chemical physics. After filling in the form, indicating graduate courses taken and to be taken, it should be approved and signed by the student’s PhD thesis advisor and then by the Chair of the Committee on Chemical Physics.

Examination Requirements

Each student is required to pass a preliminary examination before admission to the program. Each student in the program is required to pass a comprehensive examination to advance to candidacy. After completing all graduate school and course requirements, the candidate must then submit a dissertation and pass a final dissertation defense to be awarded the PhD in chemical physics.

Language Requirements

Foreign Language Requirement

The program does not require proficiency in a foreign language for the PhD degree.
English Language Proficiency
The English language proficiency required for an advanced degree by
the Graduate School will be assessed for each student through written
coursework and in the oral portion of the comprehensive examination.

Advancement to Candidacy
Advancement to candidacy for the PhD in chemical physics requires that
the student select a PhD thesis advisor, complete a program of courses
approved by the PhD thesis advisor and the Committee on Chemical
Physics, write a proposal describing their proposed PhD thesis research,
and pass a comprehensive examination covering chemical physics and
the proposed thesis research. The oral examination should normally be
completed by the end of the second year.

The comprehensive examination shall be conducted by a five member
Comprehensive Exam Committee (CEC), according to the rules of the
Graduate School. The CEC shall consist of graduate faculty from the
Department of Chemistry and Biochemistry and the Department of
Physics; there must be at least one member from each department. One
member of the CEC shall be the student's thesis advisor. The membership
of the CEC shall be selected by the student, but must be approved by the
PhD thesis advisor, the graduate advisor and the Graduate School.

In order to attempt the oral examination, the student must demonstrate
satisfactory progress toward completing their approved program of
courses and submit an application for candidacy to the Graduate School
at least two weeks in advance of the scheduled oral examination.
Students are responsible for arranging the examination date, time and
place with their CEC and should notify the chemical physics program
chair and their departmental graduate secretary at least two weeks prior
to the scheduled date. The candidate must schedule the exam so that all
members of the board are available for a full two hours.

One week in advance of the oral examination, the student should
submit a written proposal to their CEC that demonstrates suitability
of the project for a PhD thesis, adequate background knowledge of
chemical physics, the field of research and the relevant literature.
The oral examination will assess the student's competence in the
core areas of chemical physics: elementary physics and chemistry,
quantum mechanics, chemical kinetics, thermodynamics and statistical
mechanics, electricity and magnetism, as well as the student's research
plans. The research advisor is strongly encouraged to attend the oral
examination, but is recused from final discussion and voting on the
outcome. Three (out of four) passing votes are needed for the CEC to
approve the written proposal and the oral examination. A pass may be
conditional or unconditional.

If the student does not pass the oral examination, the committee
may recommend additions to the approved program of courses in
chemical physics or that the student complete the MS or PhD program
in their home department (note that there is no MS degree program
in chemical physics). A student who does not pass has the right to
attempt the examination once more after a period of time set by the CEC.
Advancement to candidacy occurs when all examination requirements
and conditions have been met.

Annual Progress Review
Students in chemical physics must complete the annual progress review
required in the third year and beyond.

Dissertation Defense
This examination is primarily a defense of the candidate's thesis. The
examining committee consists of the student's PhD thesis advisor as
chair and four other faculty members, at least three of whom must be
from the Department of Chemistry and Biochemistry and the Department
of Physics, with at least one from each department. These committee
members are selected by the program chair upon request by and after
consultation with the student and must be approved by the Graduate
School two weeks in advance.

The student must arrange for one of these other committee members
to be the "second reader" of the thesis. The second reader will carefully
review the thesis with the candidate. The student is responsible for
arranging the date, time and location for the defense, notifying their home
department's graduate program manager in time for the appropriate
approvals by the Graduate School, and distributing copies of the
dissertation to the committee members at least two weeks before the
defense.

Failure to meet this latter deadline is a legitimate reason for any thesis
committee member to postpone the dissertation defense. A passing
defense requires an affirmative vote from at least four out of five
committee members. A student who does not pass has the right to
attempt to defend the dissertation once more after a period of time set by
the examining committee.

Dissertation Requirements
A doctoral student writes a dissertation based upon their own original
investigation. The dissertation must demonstrate mature scholarship,
critical judgment and a familiarity with the tools and methods of
research.

- Every dissertation presented in partial fulfillment of the requirements
  for an advanced degree must represent the equivalent of at least 30
  credit hours of work.
- The student is responsible for notifying the Graduate School of the
  exact title of the dissertation on or before the posted deadlines during
  the semester in which the doctoral degree is to be conferred.
- The dissertation must comply in mechanical features with the
  specifications for theses and dissertations available in the Graduate
  School.
- The dissertation must be submitted electronically before the posted
deadline in order to graduate in a given semester. It should be
submitted to http://www.etdadmin.com/colorado. A signature page
with at least two original signatures must also be turned in to the
Graduate School office by the end of the business day on or before
the dissertation deadline.
- The final grade is withheld until the dissertation is completed. In
  progress (IP) grades are assigned during each semester until the
  defense is successfully completed. The final copy of the dissertation
  is accepted by the examination committee, at which time the final
  grade for all dissertation hours is submitted to the Graduate School
  on a final grade card.