

Computational Physics

Department of Computer Science and Engineering

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Department of Physics

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Overview

This degree program, offered jointly by the Department of Physics and the Department of Computer Science and Engineering, makes it possible to pursue a number of career options. Graduates can pursue a research career in the traditional areas of physics such as condensed matter physics or particle physics, with a strong emphasis on computation. Graduates who pursue careers in physics education find that they are well prepared to use computers in the classroom and the teaching laboratory, and to develop educational software. Graduates can also play an important role in the development of virtual universities and the technology needed to facilitate distance learning, or pursue employment in firms that develop scientific software, as well as computer games. Even Wall Street employers are interested in people with a background in computational physics.

About our Degrees

Acceptance Criteria - B.S.

Minimum GPA of 2.5 in [CSE 115-CSE 116](#), [MTH 141-MTH 142](#), and [PHY 107-PHY 108](#) (or [PHI 117- PHY 118](#), preferred) and [PHY 158](#).

Acceptance Criteria - B.S./M.S.

Minimum GPA of 3.0 in [CSE 115-CSE 116](#), [CSE 191/MTH 191](#), [MTH 141-MTH 142](#), [MTH 241](#), [PHY 107-PHY 108/PHY 158](#), [PHY 207](#), [PHY 257](#).

Acceptance Information

In order to be admitted to any of the undergraduate degree programs, students should contact the Undergraduate Director of the Department of Physics, Professor Bernard Weinstein at phyugadv@buffalo.edu; 645-6730 or 645-3645; or 209 Fronczak Hall. There are no application deadlines. At present there are about five majors in the computational physics programs.

Degree Requirements

Please see [Degrees and Policies](#).

About our Courses

The computational physics program offers lecture courses, lecture/lab courses, and lab courses. The physics courses taken only by majors typically have 10 to 20 students in them; the computer science courses are somewhat larger. TAs are only used as recitation or lab instructors in the introductory courses. Students interested in pursuing a degree in computational physics should begin by taking [CSE 115-CSE 116](#), [MTH](#)

Computational Physics

[141-MTH 142](#) and [PHY 107-PHY 108](#) (or [PHY 117-PHY 118](#), preferred) and [PHY 158](#), or equivalent honors courses.

For computer science course descriptions, please see [Courses](#).

For physics course descriptions, please see [Courses](#).

About our Faculty

The physics faculty is comprised of approximately equal number of theorists and experimentalists. Faculty are involved in all areas of physics including condensed matter physics, biophysics, high energy physics, and astrophysics/cosmology.

Five physics faculty members have received the SUNY Chancellor's Award for Excellence in Teaching, and eight are Fellows of the American Physical Society.

The Director of Undergraduate Studies is Professor Bernard Weinstein who can be contacted at phyugadv@buffalo.edu; 716-645-6730 or 645-3645, or 209 Fronczak Hall.

Transfer Policy

Transfer students from accredited institutions are accepted into the BS program if they have completed, with a minimum GPA of 2.5, courses equivalent to [CSE 115-CSE 116](#), [MTH 141-MTH 142](#), and [PHY 107-PHY 108/PHY 158](#).

Extracurricular Activities

Undergraduate Physics Club

This organization is an active group open to all students. It sponsors special speakers and workshops, and organizes open houses and social activities. For more information, call 716-645-2017. Students in the club also belong to the [Society of Physics Students](#) (SPS), which is affiliated with the American Physical Society, and within SPS students with a GPA above 3.5 are eligible for election to the Sigma Pi Sigma National Physics Honor Society.

See the [UB Student Association](#).

Practical Experience and Special Academic Opportunities

Undergraduate Research and Practical Experience

Undergraduate computational physics majors regularly become involved in the research activities of the Department of Physics. This can involve independent study, part-time employment, and/or full-time employment during the summer.

Honors, Awards, and Scholarships

Departmental Honors

By completing a senior thesis and obtaining satisfactory grades, it is possible to graduate from the B.S. program with Departmental Honors.

Outstanding Senior Award

Each year the Department of Physics chooses an outstanding senior. This student receives a certificate and a monetary award from the department, and also receives a College of Arts and Sciences Dean's Outstanding Senior Award.

Sekula Scholarship

Each year the Department of Physics awards up to seven scholarships to undergraduate majors pursuing one of its programs. This award is based on merit, as well as financial need.

Career Information and Further Study

With this program, a graduate can pursue a research career in the traditional areas of physics (for example, in condensed matter physics or particle physics), but with a strong emphasis on computation. Graduates can pursue teaching careers in physics, and they are well prepared to use computers in the classroom and the teaching laboratory, and to develop physics educational software. Graduates can also play an

Computational Physics

important role in the development of virtual universities and the technology needed to facilitate distance learning. This degree also makes it possible to pursue employment in firms that develop scientific software, as well as computer games. Even Wall Street employers are interested in people with a background in computational physics.

Approximately 90% of our students go on to graduate school, mostly in physics, but a significant number go into other areas such as law, medicine, biophysics, and medical physics. Our students regularly are admitted to outstanding graduate schools such as Princeton, Cornell, University of Chicago, MIT, and UB.

Degrees Offered

Undergraduate: BS

Combined Degree: BS (Computational Physics)/MS (Physics)

Links to Further Information About this Program

- [Undergraduate Catalog](#)
- [Undergraduate Admissions](#)
- [Graduate Admissions](#)
- [Department of Computer Science and Engineering](#)
- [Department of Physics](#)
- [College of Arts and Sciences](#)
- [Undergraduate Studies in Physics](#)

Computational Physics - B.S.

Acceptance Criteria

Minimum GPA of 2.5 in the prerequisite courses.

Prerequisite Courses

[CSE 115](#) Introduction to Computer Science for Majors I
[CSE 116](#) Introduction to Computer Science for Majors II
[MTH 141](#) College Calculus I
[MTH 142](#) College Calculus II
[PHY 107](#) General Physics I or [PHY 117](#) Honors Physics I (preferred)
[PHY 108](#) General Physics II or [PHY 118](#) Honors Physics II (preferred)
[PHY 158](#) General Physics II Lab

Required Courses

[CSE 191/MTH 191](#) Introduction to Discrete Mathematics
[CSE 250](#) Algorithms and Data Structures
[CSE 305](#) Introduction to Programming Languages
[CSE 437/MTH 437](#) Introduction to Numerical Analysis I or [PHY 410](#) Computational Physics I
[CSE 438/MTH 438](#) Introduction to Numerical Analysis II or [PHY 411](#) Computational Physics II
[CSE 442](#) Software Engineering
[MTH 241](#) College Calculus III
[MTH 306](#) Introduction to Differential Equations
[MTH 309](#) Introductory Linear Algebra
[PHY 207](#) General Physics III or [PHY 217](#) Honors Physics III
[PHY 208](#) General Physics IV
[PHY 257](#) General Physics III Lab
[PHY 301](#) Intermediate Mechanics I
[PHY 307](#) Modern Physics Lab
[PHY 401](#) Modern Physics I
[PHY 403](#) Electricity and Magnetism I
[PHY 405](#) Thermal and Statistical Physics I
[PHY 407](#) Advanced Laboratory or [PHY 408](#) Advanced Laboratory
One calculus-based probability/statistics course elective (e.g., [EAS 305](#) Applied Probability or [MTH 411](#) Probability Theory)

Summary

Computational Physics

Total required credit hours for the major...87-90

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [CSE 115](#), [MTH 141](#), [PHY 107](#) or [PHY 117](#) (preferred)
Spring [CSE 116](#), [MTH 142](#), [PHY 108](#) or [PHY 118](#) (preferred), [PHY 158](#)

SECOND YEAR

Fall [CSE 191/MTH 191](#), [MTH 241](#), [MTH 306](#); [PHY 208](#)
Spring [CSE 250](#); [PHY 207](#) or [PHY 217](#); [PHY 257](#)

THIRD YEAR

Fall [CSE 305](#), [CSE 442](#); [PHY 301](#), [PHY 401](#)
Spring [PHY 307](#), [MTH 309](#), one calculus-based probability/statistics elective (e.g., [EAS 305](#) or [MTH 411](#))

FOURTH YEAR

Fall [PHY 403](#), [PHY 405](#), [CSE 437/MTH 437](#) or [PHY 410](#), [PHY 407](#) (if [PHY 408](#) is not taken)
Spring [CSE 438/MTH 438](#) or [PHY 411](#), [PHY 408](#) (if [PHY 407](#) is not taken)

Computational Physics/Physics - B.S./M.S.

Acceptance Criteria

Minimum GPA of 3.0 in the prerequisite courses.

Prerequisite Courses

[CSE 115](#) Introduction to Computer Science for Majors I
[CSE 116](#) Introduction to Computer Science for Majors II
[CSE 191/MTH 191](#) Introduction to Discrete Mathematics
[MTH 141](#) College Calculus I
[MTH 142](#) College Calculus II
[MTH 241](#) College Calculus III
[PHY 107](#) General Physics I or [PHY 117](#) Honors Physics I
[PHY 108](#) General Physics II or [PHY 118](#) Honors Physics II
[PHY 158](#) General Physics II Lab
[PHY 207](#) General Physics III or [PHY 217](#) Honors Physics III
[PHY 257](#) General Physics III Lab

Required Courses

[CSE 250](#) Algorithms and Data Structures
[CSE 305](#) Introduction to Programming Languages
[CSE 442](#) Software Engineering
[MTH 306](#) Introduction to Differential Equations
[MTH 309](#) Introductory Linear Algebra
[PHY 208](#) General Physics IV
[PHY 301](#) Intermediate Mechanics I
[PHY 307](#) Modern Physics Lab
[PHY 401](#) Modern Physics I
[PHY 403](#) Electricity and Magnetism I
[PHY 405](#) Thermal and Statistical Physics I
[PHY 505](#) Computational Physics I
[PHY 506](#) Computational Physics II
[PHY 515](#) High Performance Scientific Computing I
[PHY 516](#) High Performance Scientific Computing II
[PHY 551](#) or [PHY 552](#) Graduate Lab
One calculus-based probability/statistics course elective (e.g., [EAS 305](#) Applied Probability or [MTH 411](#) Probability Theory)
15 credit hours of [PHY 500](#) (electives and M.S. thesis)

Summary

Total required credit hours for the undergraduate portion...78

Computational Physics

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Refer to the graduate school's policies and procedures manual for requirements for master's candidates.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [CSE 115](#), [MTH 141](#), [PHY 107](#) or [PHY 117](#) (preferred)

Spring [CSE 116](#), [MTH 142](#), [PHY 108](#) or [PHY 118](#) (preferred); [PHY 158](#)

SECOND YEAR

Fall [CSE 191/MTH 191](#), [MTH 241](#), [MTH 306](#), [PHY 208](#)

Spring [CSE 250](#), [PHY 207](#) or [PHY 217](#), [PHY 257](#)

THIRD YEAR

Fall [CSE 305](#), [PHY 301](#), [PHY 401](#)

Spring [PHY 307](#), [MTH 309](#), one calculus-based probability/statistics elective (e.g., [EAS 305](#) or [MTH 411](#))

FOURTH YEAR

Fall [CSE 442](#), [PHY 403](#), [PHY 405](#), [PHY 505](#)

Spring [PHY 506](#), [PHY 552](#) (if [PHY 551](#) not taken)

FIFTH YEAR

Fall [PHY 515](#), two 500-level PHY electives

Spring [PHY 516](#), two 500-level PHY electives