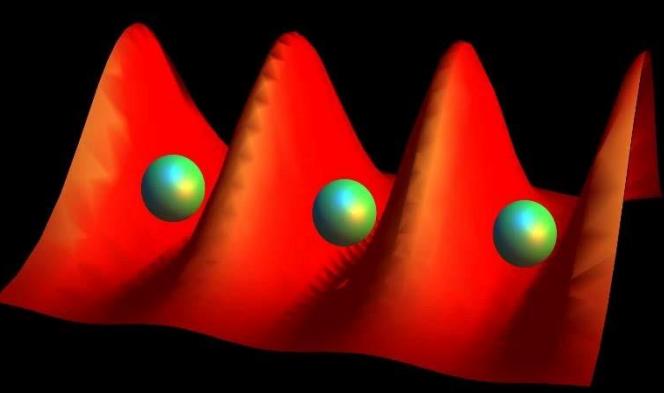
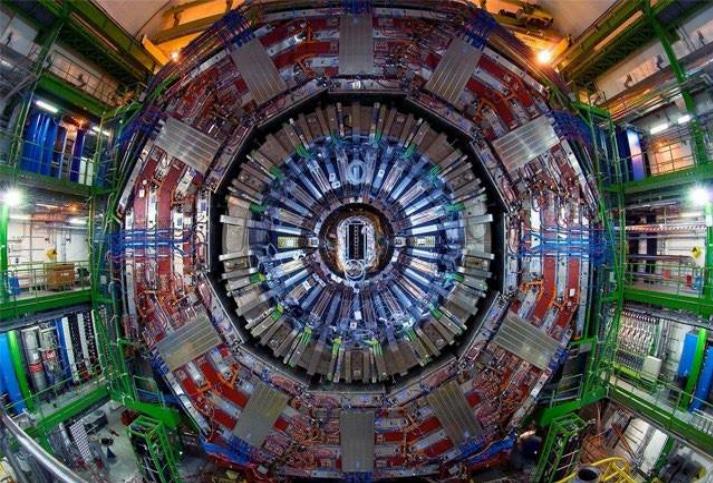


# Master of Science in Physics



Northwestern University  
Department of Physics & Astronomy  
Program Handbook  
Academic Year 2021-2022



# Welcome to the Department of Physics and Astronomy

We are delighted to have you join us here in the Department of Physics and Astronomy, and we are looking forward to seeing you mature and grow as a scientist. We expect you to work hard, to master fundamental topics, to learn key research skills, to help your classmates improve in their own research and to make the Department a place of high-quality scientific activity. We wish you all the best for your time here and are ready to help you in any way possible.

The Department, like all of the world, is dealing with COVID-19. We carefully and mindfully follow the guidelines from Northwestern Administration to keep all members of the department safe. Please do your part by following the guidelines and bringing your concerns to our attention. Learning and research are important, but people's safety is more important.

We strive to maintain an inclusive atmosphere in the Department of Physics & Astronomy that is welcoming to all. We expect that all members of our department will uphold these principles in their interactions with each other. The departmental website has additional information about our equity and inclusion initiatives, as well as resources for students seeking help or guidance

This document should answer most questions that you will have throughout your time here.

A handwritten signature in black ink that reads "Michael Schmitt". The signature is fluid and cursive, with the first name starting with a capital 'M' and the last name with a capital 'S'.

Professor Michael Schmitt  
Chair, Department of Physics and Astronomy [Northwestern University](#)

The Physics Master's Handbook supplements The Graduate School's (TGS) policies and procedures. The following pages contain information about program-specific policies, procedures, and regulations. Students are subject to the regulations in effect at the time of matriculation. It is your responsibility as a student to be aware of these and The Graduate School's regulations.

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# Pandemic-related Changes for 2021-2022

## **Wildcat Wellness**

Students are expected to follow all Northwestern guidance related to Wildcat Wellness:  
(<https://www.northwestern.edu/coronavirus-covid-19-updates/health/wildcat-wellness/index.html>).

## **Current Policy on Remote Learning**

Previously, in the Fall 2020, Winter 2021, and Spring 2021 quarters, courses were mostly held remotely over Zoom to stem the spread of corona virus. Northwestern University has moved back to in-person instruction, with no courses being offered remotely. Similarly, all Qualifying Exams, Dissertation Proposals (known commonly as “Prospectus”), and Dissertation defenses will be conducted in-person.

## Degree Paths

There are two paths to the Master’s degree that students may follow: The Standard Path and the Elective Path. The Graduate School requires a minimum of nine (9) letter-graded (ABC) courses in each path.

### **The Standard/Thesis Path**

The Standard Path requires that students take the five core courses and four elective courses. This path also requires that students write a thesis.

Year One	Typical Registration	Milestones to be Achieved	Forms to be Completed
Q1 - Fall	3-4 units of coursework	(before) Q1- Select an <u>Advisor</u>	
Q2 - Winter	3-4 units of coursework		On <u>GSTS</u> : Master’s Completion Form
Q3 - Spring	3-4 units of coursework or Physics/Astro 499		
Q4 - Summer	TGS 512	Q4- Thesis Defense	

Some students have chosen to stay in the Fall of Year 2 in order to complete their theses.

## The Broad Path

The Broad Path requires that students take the five [core courses](#) and seven [elective courses](#).

Year One	Typical Registration	Milestones to be Achieved	Forms to be Completed
Q1 - Fall	3 units of coursework		
Q2 - Winter	3 units of coursework		
Q3 - Spring	3 units of coursework or Physics/Astro 499		
Q4 - Summer	TGS 512		
Year Two	Typical Registration	Milestones to be Achieved	Forms to be Completed
Q5 - Fall	3 units of coursework or Physics/Astro 499		On <a href="#">GSTS</a> : Master's Completion Form

## Courses

It is strongly recommended that students discuss course choices with their advisor or the Director of the Master's Program, Andrew Geraci ([andrew.geraci@northwestern.edu](mailto:andrew.geraci@northwestern.edu)).

### Core Courses

- Physics 411-0: Classical Mechanics (fall)
- Physics 412-1: Quantum Mechanics I (fall)
- Physics 412-2: Quantum Mechanics II (winter)
- Physics 414-1: Electrodynamics I (winter)
- Physics 416-0: Introduction to Statistical Mechanics (winter)

### Electives

This is a list of electives from Physics and Astronomy. It may be possible to take courses outside of the Department, but they must be approved by the Director of the Master's Program. Students have taken courses in Electrical Engineering and Computer Science, Materials Science, Neurobiology, Applied Mathematics and others.

- Physics 411-1: Methods of Theoretical Physics (fall)
- Physics 412-3: Quantum Mechanics III
- Physics 414-2: Electrodynamics II
- Physics 420-0: Statistical Physics
- Physics 422-1,2,3: Condensed Matter Physics
- Physics 423-0: Nuclear Physics
- Physics 424-1,2: Particle Physics
- Physics 426-0: Nonlinear Physics (EECS 406-0)
- Physics 430-0: Physics of Continuous Media

- Physics 432-1,2: Many-body Theory
- Physics 434-0: Quantum Fluids, Solids and Gases
- Physics 435-0: Soft Matter Physics
- Physics 436-0: Mesoscopic and Nanometer Scale Physics
- Physics 471-0: Molecular Biophysics
- Physics 478-0: Fundamentals of Macromolecular Crystallography
- Physics 479-0: Biophysical Methods for Macromolecular Analysis
- Astronomy 421-0: Observational Astrophysics
- Astronomy 425-0: Stellar Astrophysics
- Astronomy 429-0: Extragalactic Astrophysics and Cosmology
- Astronomy 443-0: Stellar Structure and Evolution
- Astronomy 445-1,2: General Relativity and Applications
- Astronomy 448-0: Interstellar Gas and Radiation Pressure
- Astronomy 449-0: Stellar Dynamics

## **Physics/Astro 499**

This course allows students to work on a specific topic not covered by any lecture courses under the guidance of a faculty member of the Department of Physics and Astronomy. The student receives a letter grade (not P/NP) based on an evaluation conducted by the faculty member. This course carries the same credit as a lecture course. At most half of the courses taken by a first-year student can be 499. This course is only rarely used by students in this department.

## **TGS 512**

This option allows students to maintain full-time status in the event that they lose funding. It can also be used by advanced student who need to temporarily step away from any research or teaching responsibilities. Students registered for this course can continue to use university facilities. When registered for TGS 512 students are able to purchase the Northwestern Student Health Insurance plan. Students taking this course cannot be registered for any other TGS course. This course carries a \$100 per quarter fee.

International students will register for this course in the Summer of their first year as part of their visa requirements.

## **Advising**

### **Identifying an Advisor**

Selecting a research advisor is the one of the most important choices a Master's student makes. Students should look for an advisor before their first quarter at the University. Please note that many professors may not have one-year projects for those following the Standard Path. Please consult with several different professors to ensure that they have a project available.

## **Thesis Committee**

Students identify their thesis committees with the help of their advisor. The thesis committee consists of the advisor and, at minimum, one professor with a budgetary appointment at the University.

Any change in committee members must be approved by the advisor.

## Graduation

First, log on to [GSTS](#).

(Main Menu > TGS Forms > Navigate to Application for a Degree Form)

Then, fill out the Master's Completion Form, also in [GSTS](#).

(Main Menu> TGS Forms> TGS Master's Completion Form)

The PA prints out a copy of this once it is completed and attaches it to the folder that the Advisor picks up on the day of the Defense. This form must be signed by all Committee members. The Advisor then returns it to the PA who enters the information into the system.

### **Submitting the Thesis Draft**

A complete copy of the thesis must be submitted to the committee no less than 7 days before the scheduled defense date (and therefore at least 14 days before TGS or other external deadlines). At the time the schedule is originally established, committee members can notify the candidate that they will require more than 7 days, for example in order to accommodate travel constraints or particularly intensive review styles.

The submitted draft must be a polished and complete version that could credibly stand as a final thesis as submitted.

### **Booking a Room**

Please contact the Academic Office (F165) and book a room.

### **Successful Defense and Editing**

Assuming the Defense is successful, the student must finish all the edits requested by the committee. The advisor must approve the final version of the thesis before the Graduate Program Assistant enters in the completion of the degree. The student will receive an email from TGS stating that the degree form has been approved.

### **Submission of the Thesis to the Department**

The student must complete all required editing before the final submission of the Final Exam Form takes place. It is advised that all editing is completed as quickly as possible.

Once the editing is complete and the Advisor has approved the thesis, the student submits his/her Dissertation to the Graduate Program Assistant via email.

### **Grade Changes**

Any Y or K grades must be changed before a degree may be conferred.

## **Graduation**

Commencement takes place once a year in mid-June. Students are invited to the ceremonies in June, without regard to the quarter of completion, as there are no other ceremonies throughout the year.

## Admission to the PhD Program

Many students have been admitted to PhD programs here and to other physics and astronomy programs in America and Canada. However, there is no guarantee that you will be accepted into the Department's PhD program. Students are encouraged not only to apply to the Department's program but to other universities as well. The Director of the Master's Program and advisors may help to narrow down the best schools for students.

## Satisfactory Academic Progress

### GPA Requirement

The Department follows The Graduate School's minimum GPA requirement of a 3.0.

### Academic Probation

Should a student's GPA fall below 3.0, he/she will be placed on Academic Probation and given two quarters to raise his/her GPA above the minimum. Students who are placed on probation by TGS (<http://www.tgs.northwestern.edu/about/policies/satisfactory-academic-progress.html>) and who are unable to attain remediation during the probationary period will be dismissed from the program.

### Extending Academic Probation

The TGS policy regarding petitions for extensions of Academic Probation is straightforward. The student must submit a [petition](#). The following criteria must be met:

- The specific length of the extension including the exact date by which the requirement will be met: the extension time frame should be realistic.
- A detailed rationale for the extension
- A detailed timeline for meeting the new deadline including what work remains to be completed and the specific timeline, with proposed deadlines by which that work will be completed within the extension period
- A detailed letter of support for the extension from the Director of Graduate Study
- A detailed letter of support for the extension from the student's academic/research advisor

### Academic Progress Reports

Each student's academic progress must be reported annually by the student's program to the student and to TGS. Each quarter, grades will be checked for substandard performance. Students must ensure that they are maintaining their grades and finishing their work in a timely manner. If they are having trouble doing so, they must work with their advisor and the Director of the Master's Program to resolve issues preventing inadequate performance.

Students can find their Academic Progress Reports in [GSTS](#). This is also where students are expected to tell the Department about their progress. Advisors also report on progress in GSTS and students can find his/her thoughts there. It is vital that students report this, as this gives a good idea of where they are and how they will get to the next step.

### Dismissal Process

The Director of the Master's Program and the Chair have the responsibility to decide whether a student is to be dismissed. Their decision is final.

## Leaves of Absence

Leaves of absence must be approved by your advisor, the DGS and TGS. Leaves of absence are permitted in the following circumstances.

- Medical Leave of Absence: For students who must temporarily interrupt progress toward degree due to a physical or mental health condition.
- Family Leave of Absence: For students who must temporarily interrupt progress toward degree to care for a child or other family member, or to extend absence following a parental accommodation. This is separate from and may be taken in addition to a parental accommodation.
- Parental Accommodation Leave: For students who become new parents (whether by childbirth or adoption).
- General Leave of Absence: For students who elect to temporarily interrupt their progress toward degree for a non-medical/non-family care reason.

Please see TGS' Leaves of Absence policy page for further details and requirements.

## Submitting a Leave of Absence Request

Family, Parental and General leave of absence requests are submitted via [GSTS](#). GSTS > TGS Forms > Petition for Absence

The process for a student to request a medical leave of absence is outlined on the [Dean of Students, Medical Leave of Absence website](#).

## Tuition and Other Fees

### Tuition

Tuition information can be found here: <https://www.northwestern.edu/sfs/tuition/graduate/the-graduate-school.html>

### Insurance

All Northwestern students are required to maintain health insurance coverage. Master's students are eligible to receive a discounted yearly premium through the Graduate School. [Information on the Health Insurance Plan](#).

### Student Activity Fee

This fee covers special services, including discounted CTA rides, gym membership and programs for students, among other things. It is required for all full-time enrolled Graduate School students, except for those enrolled in TGS 512, 513, 514, 506, 507 or 508.

More information about the [Fee](#).

### Funding Opportunities

More information about all types of fellowships and grants can be found [here](#).

## Department Staff Members

### Director of the Master's Program

Director- Professor Andy Geraci | Tech F135

### Academic Office (Tech F165)

Department Chair

Director of Operations and Outreach/Assistant Chair

Faculty Program Assistants

Graduate Program Assistant

Undergraduate Program/Dearborn Assistant

### Business Office (Tech F155)

Business Administrator

Research Administrator

Accounting Specialist

Financial Assistants

The people filling the roles listed above may change. Please check the Department [website](#) for the most current staff members.

Any questions about the Department can be directed to the [Graduate Program Assistant](#).

## Calendars

The most up-to-date Northwestern academic calendar can be found [here](#).

The Graduate School has a calendar [here](#) as well.

The holiday schedule can be found [here](#).

[Plan It Purple](#) is Northwestern's calendar for all things educational, social and fun.

## Department Activities

Students are expected to attend all colloquia, all seminars in their research area, and all Brown Bag Lunches. These events serve to broaden students' knowledge in a range of fields, demonstrate effective scientific communication, and aid in networking within and outside the department.

Every week, a bulletin will be posted and sent to the graduate email list that says when and where each event takes place.

## Colloquia

On Friday, an invited speaker of renown gives an hour-long colloquium. After the presentation and the question-and-answer session, snacks and refreshments are served in F160.

## Brown Bag Lunches

The Brown Bag Seminar is a bi-weekly seminar series held on Wednesdays during the lunch hour (12:00pm-1:00pm) with pizza available on a first-come-first-served basis. The seminars feature two speakers from the department, each giving talks that last 20-25 minutes with 5-10 minutes available for questions. The speakers are drawn from a combination of professors, post-docs, and graduate students and the level of the talks is aimed at a first-year graduate student.

## Seminars

Regular and special seminars are offered in various sub-fields of physics and astronomy. These are announced each week in the departmental email bulletin.

## Heilborn Lectures

The department of Physics and Astronomy is grateful to George Heilborn (1935-2015), a graduate of Northwestern's physics program, and his family, for their generous support of the Heilborn Lectures at Northwestern University. We have benefited greatly from this program over the years. George Heilborn created the Heilborn endowment in memory of his parents, Walter and Christine Heilborn, in 2000 in order to strengthen the Physics and Astronomy program at Northwestern for the benefit of faculty, students, and other departments in the Chicago area.

There are several talks, lectures and chances to meet the speaker. Past speakers include Nobel Laureates, Professors, Physicists and Astronomers from the top laboratories in the world.

*Link: [Past Heilborn Lectures](#)*

## Graduate Student Council

### Mission

The goal of the Physics & Astronomy Graduate Student Council (PAGSC) is to address important issues pertaining to Physics & Astronomy graduate students at Northwestern University. The Council provides a structure to organize student efforts, to receive input from the student body, and to work with the Physics & Astronomy department.

### Activities

The main activity organized by the Council is the weekly Grad Student Coffee Hour (Mondays at 12:00PM in F160). Other activities include quarterly town-hall meetings, barbecues, game nights, pizza nights and other ad hoc get-togethers.

Please contact the President of the Council for more information: [PAGSC\\_President@u.northwestern.edu](mailto:PAGSC_President@u.northwestern.edu)

## International Students

The Department has many students hailing from countries all over the world. The [International Office](#) is available by appointment for advising services and support programs.

## **Course Requirements During COVID Pandemic (Updated Policy Fall 2021)**

Northwestern University has transitioned back to fulltime in-person instruction. As such, no courses may be taken remotely at this time. The university continues to monitor the situation and will adapt accordingly.

## **Visa Regulations**

International students who are not permanent residents are given an F-1 or J-1 Student Visa. This visa gives the right to study here in the United States and only confers limited working rights. Please check with the International Office for up-to-date regulations.

The University helps apply for the visa and sends the Form I-20 papers. Bring the Form I-20 papers upon arrival in the United States. Students may arrive up to 30 days before the start date listed on the Form I-20.

## **English-language Skills**

International students are expected to have taken the TOEFL test or a suitable alternative

Students may also enroll in [English Language Programs](#). Please email [elp@northwestern.edu](mailto:elp@northwestern.edu) for more information.

## **Course Registration**

Foreign students on an F-1/J-1 visa must be registered for a minimum of three (3) credits.

Foreign students who are not registered for other courses are required to register for TGS 512 in order to maintain their F-1/J-1 status, usually during the summer or during any leave taken. A minimum cumulative GPA of 3.0 is required to qualify for TGS 512.

## **Fellowships for International Students**

Information on fellowships for International Students can be found [here](#).

## **International Office**

<http://www.northwestern.edu/international/>

# Nondiscrimination Statement, Conflict Resolution, and Counseling

The Department and TGS are committed to maintaining an environment that fosters student education and training and have established the following guidelines for dealing with any type of conflict that might arise.

## **Nondiscrimination Statement**

Northwestern University does not discriminate or permit discrimination by any member of its community against any individual on the basis of race, color, religion, national origin, sex, pregnancy, sexual orientation, gender identity, gender expression, parental status, marital status, age, disability, citizenship status, veteran status, genetic information, reproductive health decision making, or any other classification protected by law in matters of admissions, employment, housing, or services or in the educational programs or activities it operates. Harassment, whether verbal, physical, or visual, that is based on any of these characteristics is a form of discrimination. Further prohibited by law is discrimination against any employee and/or job applicant who chooses to inquire about, discuss, or disclose their own compensation or the compensation of another employee or applicant.

Northwestern University complies with federal and state laws that prohibit discrimination based on the protected categories listed above, including Title IX of the Education Amendments of 1972. Title IX requires educational institutions, such as Northwestern, to prohibit discrimination based on sex (including sexual harassment) in the University's educational programs and activities, including in matters of employment and admissions. In addition, Northwestern provides reasonable accommodations to qualified applicants, students, and employees with disabilities and to individuals who are pregnant.

Any alleged violations of this policy or questions with respect to nondiscrimination or reasonable accommodations should be directed to Northwestern's Office of Equity, 1800 Sherman Avenue, Suite 4-500, Evanston, Illinois 60208, 847-467-6165, [equity@northwestern.edu](mailto:equity@northwestern.edu).

Questions specific to sex discrimination (including sexual misconduct and sexual harassment) should be directed to Northwestern's Title IX Coordinator in the Office of Equity, 1800 Sherman Avenue, Suite 4-500, Evanston, Illinois 60208, 847-467-6165, [TitleIXCoordinator@northwestern.edu](mailto:TitleIXCoordinator@northwestern.edu).

A person may also file a complaint with the Department of Education's Office for Civil Rights regarding an alleged violation of Title IX by visiting <https://www2.ed.gov/about/offices/list/ocr/complaintintro.html> or calling 800-421-3481. Inquiries about the application of Title IX to Northwestern may be referred to Northwestern's Title IX Coordinator, the United States Department of Education's Assistant Secretary for Civil Rights, or both.

## **Conflicts Involving Discrimination and Harassment**

Harassment, whether verbal, physical, or visual, that is based on race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, parental status, marital status, age, disability, citizenship, or veteran status is a form of discrimination. Discrimination and harassment complaints should be referred to the Office of Equal Opportunity and Access. Information regarding Sexual Harassment is found below.

Office of Equal Opportunity and Access: <http://www.northwestern.edu/hr/eeo/>

## **Sexual Harassment**

It is the policy of Northwestern University that no member of the Northwestern community- students, faculty, administrators, staff, vendors, contractors, or third parties - may sexually harass any other member of the community. For information or assistance regarding a sexual harassment complaint, please visit the [University's Sexual Harassment Prevention Office](#).

## **Conflicts Not Involving Discrimination, Harassment, or Sexual Harassment**

When a conflict arises, whether with a student's advisor, a fellow student, or someone else in the University, TGS recommends that students first talk to their DGS. One function of the DGS is to address student concerns and grievances and to be available when students are experiencing academic difficulty. If a student is unsure who his or her DGS is, please contact the department office (847-4913685) or TGS (847-491-5279).

If the DGS has a conflict of interest, the Chair of the student's department is the next resource. In the case that a student cannot or does not want to speak with anyone in the program or department, the next resource is TGS. In TGS, the Associate Dean for Student Affairs, William J. Karpus ([wkarpus@northwestern.edu](mailto:wkarpus@northwestern.edu)), handles student conflict issues and works directly with the academic school Associate Deans and faculty, as needed.

DGSs, department chairs, TGS staff, and TGS Deans can treat students' concerns confidentially unless the concerns involve sexual harassment, discrimination, or a safety issue, in which case they are obligated to report the issue to the appropriate University office.

## **Counseling and Psychological Services**

More information on [Counseling and Psychological Services](#) (CAPS).