
The Physics Graduate Program

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Stony Brook **University**

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Master Program

- ▶ Master of Science Program in Instrumentation: Please contact Prof. Metcalf

- ▶ Master of Arts Program
 - ★ No Thesis Option: 598 and 599 (Graduate Seminar)
Passing 28 credits of graduate courses
Passing the Comprehensive Exam at the Master level

 - ★ Thesis option: 598 and 599 (Graduate Seminar)
Graduate courses approved by the GPD
A Master Thesis (with 10-25 research credits (580))

To be admitted to a PhD program, here or elsewhere, you have to do well in the courses and/or research.

Typical Course of a Master Degree

Accelerated Program

Year 1 Take courses and do Master thesis research

First Summer Do research and write and defend the Master thesis

A Master degree can be obtained in one year and one Summer, but this is only possible if you are well-prepared.

Typical Program

Year 1 Take courses and do Master thesis research

Year 2 Work on Master thesis and do additional courses.

It is also possible to graduate from the Master program in three semesters.

Options for MA Degree

- ▶ Option that prepares you for employment outside academia

F1	S1	F2
514 (Instruments) 562 (Lasers) 515 (Graduate Lab) 598 (Graduate Seminar) Electives	518 (Synchrotron Radiation) 565 (AMO) 595 (6 credits) 599 (Graduate Seminar)	595 (9 credits)

For the accelerated program, during the Summer of the First year, complete your Master Thesis. You also may be able to transfer up to 6 credits.

Computational Option for MA Degree

- ▶ Option that prepares you for employment in Data Science

F1	S1	F2
558 (Physical Biology)	504 (Comp Methods I)	604 (Comp Methods II)
503 (Mathematical Physics)	559 (Biological Dynamics)	595 (6 credits)
515 (Graduate Lab)	595 (5 credits)	
598 (Graduate Seminar)	599 (Graduate Seminar)	
Electives	546 (Python)	

Thesis research (595) should be on a computational project, for example in astrophysics, condensed matter, lattice QCD or in data analysis. For the accelerated program, during the Summer of the First year, complete your Master Thesis. You also may be able to transfer up to 6 credits.

Options for MA Degree

Option that prepares for transfer to a PhD program without earning a Master degree

- ▶ To be admitted to a PhD program you need strong recommendation letters. They cannot be written by a course instructor because they do not know you well enough. Since the letter is already needed in December, it is hard to get a letter that makes a difference if you already apply to a PhD program then. To get such a letter you have to work closely with a faculty member starting from the beginning of the semester. Do not neglect the special studies because that will be the basis of the recommendation letter.
- ▶ To have a good chance to be admitted to a PhD program you need to have mostly if not all A grades (A or A-) in the courses. Therefore do not overload yourself.

Options for MA Degree

Course sequence for transfer to a PhD program without earning a Master degree

F1	S1
511 (QM)	512 (QM)
503 (MM)	515 (Lab)
580 (Special Studies)	595 (Thesis research)
598 (Graduate Seminar)	599 (Graduate Seminar)
Electives	Electives

Try to work with a research group during the Summer. Then you can sign up for a total of 18 credits during the Spring semester so that you have sufficient credits for a Master degree. With one or two B grades in graduate courses you will not be admitted in a top 50 PhD program.

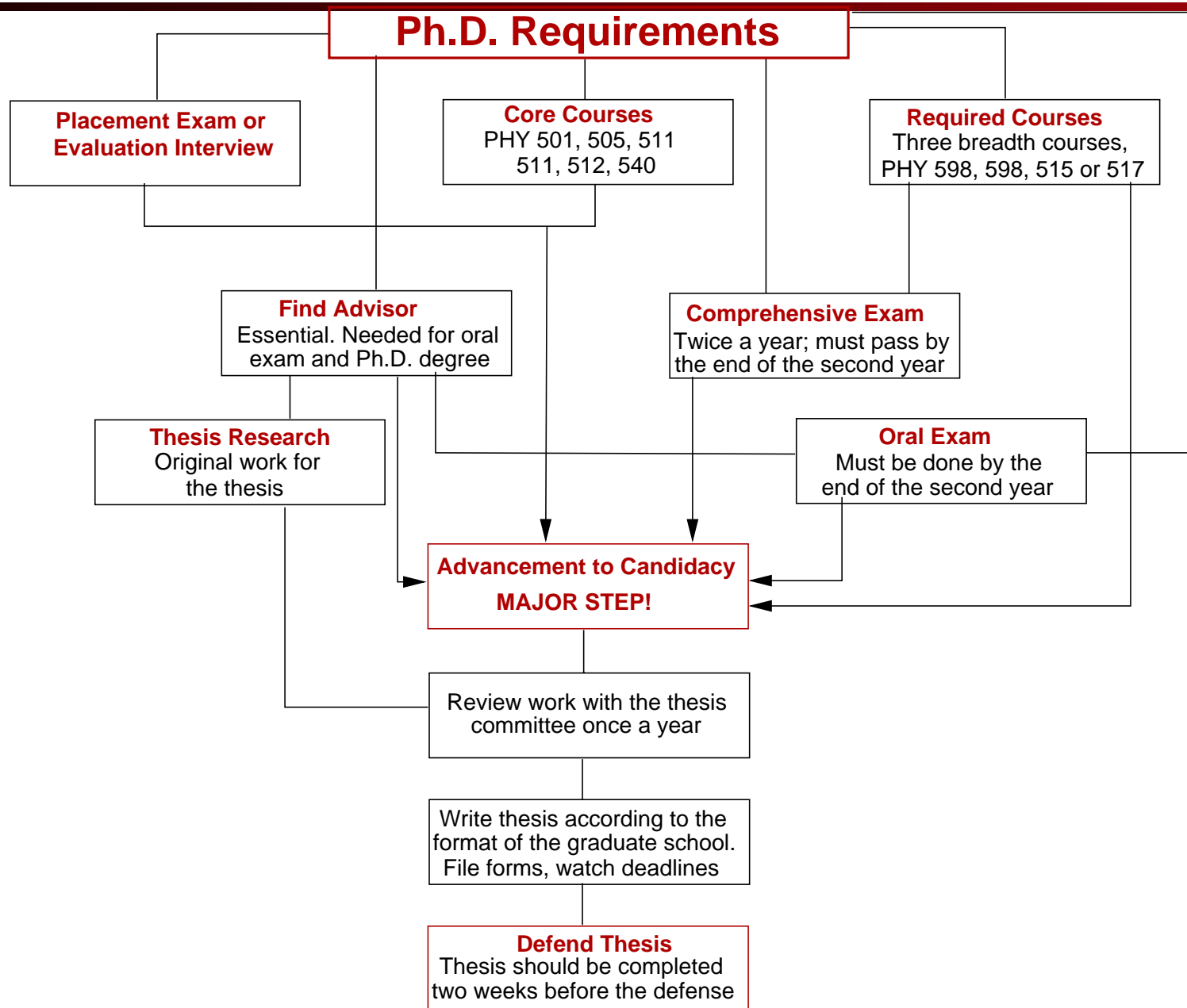
Option for Advanced MA Degree

Option for advanced students. These are Master students who already did the core graduate courses and quantum field theory.

F1	S1
501 (CM)	611 (QFT2)
540 (Statistical Mechanics)	623 (String Theory)
622 (String Theory)	620 (General Relativity)
680 (Gravity and Fields)	680 (Quantum Computing)
598 (Graduate Seminar)	599 (Graduate Seminar)
Electives	Electives

Do research during the Summer

The PhD Program



Typical Course of PhD Degree

- Year 1 Take courses and TA.
First Summer Work in a Research Lab
- Year 2 Start Research, Take courses in your specialty and TA.
At the end of the second year all students should have an advisor.
- Year 3 Spend all your time on research.
- Year 4 Spend all your time on research. Most students author their first paper during this year.
- Year 5 Start thinking about your dissertation. Many theory students get their PhD degree at the end of the fifth year.
- Year 6 Most experimental students get their PhD degree during this year.

Evaluation Committee

From the Guide:

If a student already successfully passed similar courses elsewhere a student fulfill the course requirements of one or more of these core courses by taking advanced graduate courses (subject to approval by an Advising Committee appointed by the Graduate Program Director). If that is not the case you can still skip these courses by a sufficiently good performance in the corresponding parts of a placement examination given at the beginning of each fall semester (2nd year students and beyond need permission from the Graduate Program Director).

The evaluations take place on Wednesday.

Tonight is the last section of the placement exam.

Most students take the cores course during their first year.

Tracks in the PhD program

In the Department of Physics and Astronomy we have four tracks:

Physics Track

Concentration in Astronomy

Concentration in Physical Biology

Concentration in Chemical Physics

The Physics Track is the default track. If you complete a Ph.D. in other tracks it will appear on your diploma.

Students in the Astronomy track have to take three astronomy courses instead of 3 physics breadth courses.

For Physical Biology the course sequence is quite different whereas for the Chemical Physics track the course requirements are the same as for Physics.

Main Difference Between Tracks

However, the main difference between tracks is the affiliation of your advisor. For the Astronomy track, he belong to the Astronomy Group. For the Track in Physical Biology, your advisor is affiliated with the Laufer Center, the Department of Physiology and Biophysics or Pharmacological Sciences. For the Chemical physics Track, she has the Department of Chemistry as her main affiliation.

Core Courses

Core Courses, these are required course unless you have passed the Placement exam in the subject

PHY 501: Classical Mechanics

PHY 505: Electricity and Magnetism (with recitation)

PHY 511/512: Quantum Mechanics

PHY 540: Statistical Mechanics

Other Required Courses

Breadth: Three advance courses in different fields

PHY 515: Graduate Laboratory – should be taken before the end of the second year, taking it in the third or second semester is recommended

Can be substituted by PHY 517 (Astronomy Lab Course)

PHY 598-9: Graduate Seminar

PHY 600: Two semesters of teaching

PHY 521-4: Students in the Astronomy Track should take three of the four Astronomy Courses

Breadth Requirement

Three advanced courses, in three different areas of physics, chosen from a list of courses and areas approved for this purpose. No more than one course from the 680 or 690 series can be used to fulfill this requirement. Courses between brackets may be moved to a different area.

Areas and Courses:

Astronomy:	521, 522, 523, 524, (683, 688)
Atomic Physics:	565, 566, (690)
Accelerator Physics:	554, 543, 564
Solid State Physics:	555, 556, (681)
Nuclear Physics:	551, 552, (684)
Particle Physics:	557, 612, 613, (686)
Physical Biology:	558, 559, (687)
Theoretical Physics:	541, 610, 611, 620, 621, (680, 681, 685)
Computational Methods:	504, 604 w

Default Course Plan

Default

First Semester	Second Semester
PHY 501 (Classical Mechanics)	PHY 505 (Electrodynamics)
PHY 503 (Mathematical Methods)	PHY 515 (Graduate Lab)
PHY 511 (Quantum Mechanics I)	PHY 512 (Quantum Mechanics II)
PHY 598/9 (Graduate Seminar)	PHY 598/9 (Graduate Seminar)
PHY 600 (Teaching)	PHY 600 (Teaching)
PHY 698 (Colloquium)	PHY 698 (Colloquium)

PHY 540 (Statical Mechanics) can be taken in first (for well-prepared students) or in the third semester.

Course Plan for Astronomy Track

First Semester	Second Semester	Third Semester	Fourth Semester
PHY 521 (Stars)	PHY 523 (Galaxies)	PHY 524 (Cosmology)	PHY 522 (Interstellar Medium)
PHY 503 (MM)	PHY 505 (EM)	PHY 511 (QM I)	PHY 512 (QM II)
PHY 505 (EM)	Elective	PHY 540 (SM)	
PHY 598/9 (Seminar)	PHY 598/9 (Seminar)		
PHY 600 (Teaching)	PHY 600 (Teaching)		
PHY 698 (Colloquium)	PHY 698 (Colloquium)	PHY 698 (Colloquium)	PHY 698(Colloquium)

Other Plans for Core Courses

Postponing Statistical Mechanics

F1	S1	F2	S2
501 (CM)	505 (EM)	540 (SM)	
503 (MM)	515 (Lab)		
511 (QM)	512 (QM)		

If you did not have a proper undergraduate QM course, take our undergraduate QM course first (PHY 578 – renumbered as graduate course). This course does not count as credit towards your Ph.D.. If you need to take an undergraduate courses in CM, EM or SM, then you can take are renumbered undergraduate courses PHY 573, PHY 571 and PHY 578, respectively.

Taking the Core Courses at a slower pace

F1	S1	F2	S2
501 (CM)	505 (EM)	511 (QM)	512 (QM)
503 (MM)	515 (Lab)	540 (SM)	

F1	S1	F2	S2
501 (CM)	505 (EM)	511 (QM)	512 (QM)
503 (MM)	515 (Lab)	540 (SM)	
	578 (QM)		

Course Plan for Advanced Students

F1	S1	F2	S2
501 (CM) 540 (SM) 515 (Grad Lab) 612 (Particle Physics) 598 (Graduate Seminar) 600 (TA)	610 (QFT1) 620 (Gen Rel) 613 (Advanced Particle Physics) 680 (Quantum Computing) 599 (Graduate Seminar) 600 (TA)		

Doing the required courses as soon as possible

F1	S1	F2	S2
540 (SM) 515 (Graduate Lab) 612 (Particle Theory) 558 (Physical Biology) 598 (Graduate Seminar) 600 (TA)	556 (Solid State II) 620 (Gen Rel) 610 (QFT1) 551 (Nuclear Physics 1) 599 (Graduate Seminar) 600 (TA)		

Course Requirements for Physical Biology

Physics Track	Physical Biology
PHY 505 (Electrodynamics)	PHY 505
PHY 511 (Quantum Mechanics)	PHY 511
PHY 540 (Statistical Mechanics)	PHY 540
PHY 600 (Teaching Practicum), two semesters	PHY 600, two semesters
PHY 501 (Classical Mechanics)	PHY 501 or PHY 512
PHY 512 (Quantum Mechanics)	
PHY 515 (Methods of Experimental Physics)	Two semesters of PHY 584 (Lab Rotations)
PHY 598/599 (Graduate Seminar)	PHY 665 (Journal Club), 2 semesters
Two advanced courses	Two life science courses from an approved list
	PHY 558 (Physical Biology)
	PHY 559 (Biological Dynamics and Networks)
	PHY 561 (Biology for Physical Scientists)

Course Plan for the Physical Biology Track

First Semester	Second Semester	Third Semester	Fourth Semester
PHY 501 (CM) PHY 511 (QM I) PHY 558 (Physical Biology) PHY 600 (Teaching) PHY 698 (Colloquium)	PHY 512 (QM II) PHY 505 (EM) PHY 559 (Bio-Dynamics) PHY 600 (Teaching) PHY 561 (Bio-Intro) PHY 698	PHY 540 (SM) Life Science PHY 665 (Journal Club) PHY 584 (Lab Rotation) Elective PHY 698	Life Science PHY 665 PHY 584 Elective Elective PHY 698

Course Evaluations

- ▶ Since 2011 course evaluations are electronic
- ▶ Please complete course evaluations. This helps faculty to improve their course and helps students to select courses
- ▶ If you teach please encourage your students to complete the evaluations, for the same reasons
- ▶ To see course evaluations go to
<https://it.stonybrook.edu/services/it-guides>

Setting up a Proxy Server

- ▶ `ssh -l yourstonybrookaccount -D 9501 graduat.physics.sunysb.edu`
- ▶ Will ask for a password
- ▶ On your home computer open preferences of Firefox
- ▶ Go to Connection Setting
- ▶ Select Manual Proxy Configuration
- ▶ for SOCKS Host type in 127.0.0.1
- ▶ For portnumber type 9501 (same as above)
- ▶ Choose Socks v5
- ▶ Click ok

Exams

Comprehensive Exam: This exam is offered twice a year. Most students take it in their second or third semester, but you can also take it next week. It covers the core courses and astrophysics. Each subject can be passed separately. A good source for the material of this exam is

<http://mysbfiles.stonybrook.edu/~klikharev/EGP/>

Placement Exam: This is the same exam as the comprehensive exam but student have to pass all three problems in a given subject while the passing level is higher.

Oral Exam: The oral exam consists of a presentation of some approved and interesting topic in physics or astronomy to a committee of three faculty members and should be prepared with the guidance of one of them. Usually that person is going to be your advisor.

What If You Fail the Exam

Placement Exam: No problem, just take the course(s)

Fail the Course (less than a B): Repeat the course. Note that you have to submit a retake form which has to be signed by the instructor and the GPD. A course can be retaken only once.

Fail the Course for a second time: You are no longer in good standing, and unless there are exceptional circumstances, you will have to leave the graduate program. Petition for an oral exam or to do the placement exam. This requires approval of the Graduate Program Director.

The Comprehensive Exam: Take it again.

The Comprehensive Exam at the beginning of the fifth semester: Make sure you have an advisor; She may argue your case before the faculty to set up a special oral exam.

Research

Experimental/Observational

Astronomy (exoplanets, neutron stars, cosmology)

Atomic, molecular and optical physics (cold atoms, ultrafast lasers)

Condensed matter experiment (graphene, electromagnetic materials)

High energy experiment (CERN-Atlas, Fermilab, neutrino)

Relativistic Heavy Ion Physics (RHIC)

Theoretical

Astrophysics (computational, neutron stars, cosmology)

Atomic physics (Bose Einstein condensation)

Condensed matter (computational, strongly correlated electrons)

Nuclear theory (QCD, quark gluon plasma, random matrix theory)

YITP (particle theory, statistical mechanics, string theory)

Simons Institute (mathematical physics, string theory)

Laufer Center (physical biology, protein structure)

Research Outside the Department

Research at Brookhaven National Laboratory

Accelerator and beam physics
NSLS-II – may work before you finish
Lattice QCD / nuclear theory
Condensed matter theory

Marine Sciences

Climate Studies
Atmospheric Physics

Cold Spring Harbor Laboratory

Neuro Science

How to Find an Advisor, Financial Support

Start early. Try to get a summer job after the first year

Talk to professors of the courses you are taking

Watch email / bulletin board postings about research opportunities

Go to Friday afternoon seminars

Get good grades in particular in the subject you are interested in

If possible, get into a research group by the end of the first year

If you have more than one option for advisor consider the following:

- The career path of former graduates of the group

- How long does it take to get a degree

- What is the stipend

Course Registration

Most of you will register for the following courses:

PHY 501, Classical Mechanics (3 credits)

PHY 503, Mathematical Methods (3 credits)

PHY 511, Quantum Mechanics (3 credits)

PHY 598/599, Graduate Seminar (1 credit)

PHY 600, Teaching Practicum (1 credit) (this is your TA assignment and is not a real class)

PHY 698, Colloquium (1 credit) (you are strongly urged to come to the colloquium each week).

Exceptions:

Astronomers: take PHY 521 (Stars)

Biophysicists: take PHY 558 (Physical Biology)

Those who passed the placement exam or got waivers from the evaluation committee are not required to take the core courses

Other Courses This Semester

PHY 514: Research Instruments

PHY 515: Methods of Experimental Research (aka Graduate Lab)

PHY 517: Astronomical Techniques

PHY 521: Stars (breadth)

PHY 555: Solid State I (breadth)

PHY 558: Physical Biology (breadth)

PHY 564: Advanced Accelerator Physics (breadth)

PHY 566: Quantum Electronics II (breadth)

PHY 604: Computational Physics II (breadth)

PHY 611: Quantum Field Theory II (breadth)

PHY 612: Theoretical Particle Physics (breadth)

PHY 622: String Theory

PHY 655: Advanced Graduate Seminar

PHY 680: Geometry and Field Theory of Gravity (breadth)

PHY 688: Star and Planet Formation (breadth)

Remedial Courses

PHY 571, PHY 573, PHY 576, PHY 578 are renumbered undergraduate courses and do not count as credit for an Master or Ph.D. degree. You may want to take these courses if you did not have an undergraduate course in these subjects. They count as credit, though, for an MAT (Master of Arts in Teaching) degree.

G-Status

The university classifies graduate students according to their G-status

- G1:** First year graduate student with less than 24 graduate credit hours, who is enrolled in a Master's degree program.
- G2:** Advanced graduate student with more than 24 graduate credits, who is enrolled in Master's degree program
- G3:** First year graduate student with less than 24 graduate credits, who is enrolled in a Ph.D. program.
- G4:** Advanced graduate student with more than 24 graduate credits, who is enrolled in a Ph.D. degree program
- G5:** Advanced graduate student in a Ph.D. program who is advanced to candidacy by the first day of classes of a semester

The conversion from G1 to G2 is automatic after completion of more than 24 graduate credits at Stony Brook. Same for the conversion from G3 to G4. Conversion from G4 to G5 is done by the graduate school after recommendation from us.

Advancement to Candidacy

A student is advanced to candidacy if all graduate school and departmental requirements other than the dissertation are completed. The Graduate Program Director sends a written notice to the Dean of the Graduate School to recommend advancement to candidacy which is then granted by the Dean of the Graduate School. Students must advance to candidacy at least one year before defending their thesis.

Summary and Credits

Status	Credit earned	Degree sought	Credits
G1	< 24	Master	12-18
G2	≥ 24	Master	9
G3	< 24	Ph.D.	12-18
G4	≥ 24	Ph.D.	9
G5	all reqs	Ph.D.	9

Many courses are offered with variable credits (see graduate bulletin).
By adjusting credits, you can get the right total number of credits.

Swapping courses: change registration between courses with an equal number of credits.

Courses with Zero Credits

If a course is offered for 0-3 credits, the workload is independent of the number of credits: Zero credit does not mean zero work.

By taking courses with zero credit, the department knows that you have fulfilled the requirement.

Examples

Status							Total
G1	501: 3	505: 3	511: 3	599: 1	600: 1	698: 1	12
G3	501: 3	505: 3	511: 3	599: 1	620: 3	698: 1	14
G4	501: 3	505: 3	511: 3		600: 0		9
G5	676: 1	698: 1	699: 7				9

- ▶ If you take courses outside the department, you need permission from the graduate program director
- ▶ After having advanced to candidacy you should register for 9 credits in PHY 699 (research). Explicit permission to register for others courses requires permission by the graduate program director.

Deadlines

- August 27:** You must have registered for at least one credit by midnight of this date – otherwise it will cost you real money.
- August 28:** First day of classes.
- September 4-5:** Labor Day Holiday.
- September 12 (4pm):** Last day to add, drop or swap classes

See:

http://www.stonybrook.edu/commcms/registrar/calendars/academic_calendar
for a complete academic calendar.

What Does it Take to Become a First Class Physicist or Astronomer?

- ▶ Think independently
- ▶ Step back to analyze the big picture
- ▶ Don't accept any 'truth' from any authority unless you have verified it yourself
- ▶ Question everything
- ▶ Work on hard problems