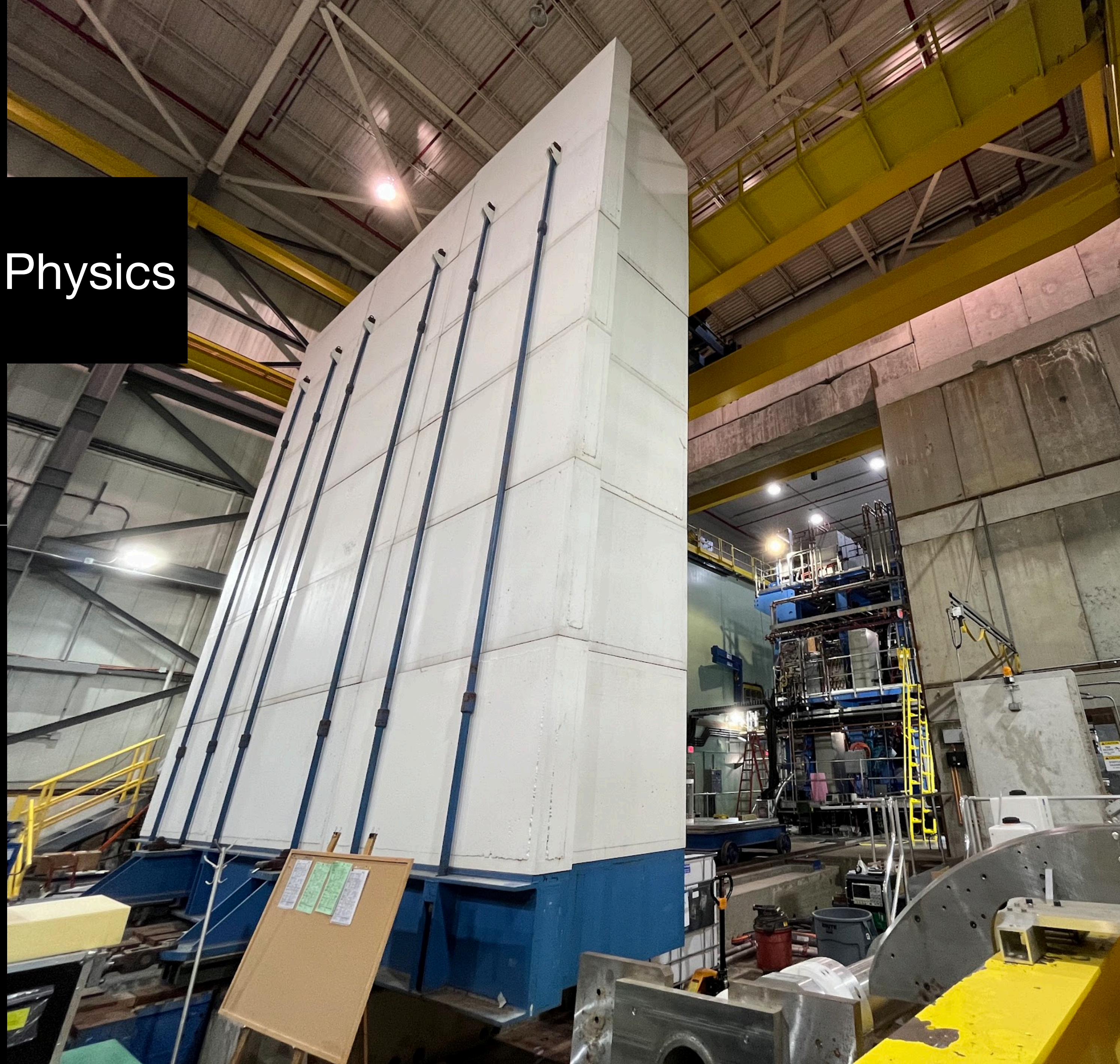


Welcome to Nuclear and Particle Experimental Physics at MIT

Gunther Roland (Division Head)
for the NUPAX division

April 2 2025



Physics Department “Divisions”

- LNS is our home in terms of research
- Department and its four divisions take care of the academic side
 - Atomic, Biophysics and Condensed Matter Physics
 - Astrophysics
 - Theoretical Nuclear and Particle Physics
 - Experimental Nuclear and Particle Physics

Academics in the Physics Department

- We want all students to be proficient in the foundations to all our work:
 - Classical Mechanics
 - Electricity and Magnetism
 - Quantum Mechanics
 - Statistical Mechanics
- For each area, students can pass the graduate level course OR pass a written exam
- In addition to the foundational classes, we also require classes in the student's speciality (e.g., nuclear and particle physics) and two breadth courses

NUPAX Speciality and Breadth Courses

- All NUPAX students take the 8.701 (Intro to Nuclear and Particle Physics), 8.711 (Nuclear Physics) and 8.811 (Particle Physics) specialty classes
- In addition, every student takes 2 breadth classes outside of NUPAX, e.g., astrophysics, condensed matter, biophysics,...
- A full matrix of possible breadth classes can be found on the department webpage, <https://physics.mit.edu/academic-programs/graduate-students/doctoral-guidelines/>
- While core requirements need to be taken in the first two years, and speciality classes should be taken as early as possible, breadth requirements can (and usually are) taken later in grad student career
- Balance of course load and early integration into research groups

Breadth Subject Requirements

(As of Fall 2023)

To enrich knowledge about physics outside of one’s own research field, students must complete two breadth requirement subjects. At least one of these must be from the list below. Both must be passed with a grade of B- or better.

There are four category of courses:

- * At least one course marked by 1 (true breadth) must be taken; *no exceptions granted*.
- * One of the courses marked by 2 (technique) should be taken; *in legitimate circumstances a substitution can be requested*. (This is similar to the current substitution procedure.)
- * Courses marked by X are not acceptable as breadth for students in the area; *no exceptions granted*.
- * Courses marked by X*, not normlly accepted for breadth in a parriclular area, can be appealed to as substitution in rare circumstances.
- * Only one course from any row can be taken.

The following table is a first attempt at designating the courses, but should be further refined by relevant faculty in each area:

Subject #	Subject name	Atomic	Bio	CMX	CMT	Plasma	Astro	Nuclear-ParticleX	Nuclear-ParticleT	QI
8.323 8.324/8.325 or Harvard equivalent	Relativistic QFT	1	1	1	X	1	1	1	X	2
		2	2	2	X	2	2	2	X	2
8.370 8.371/8.372	Quantum Computation	2	1	1	1	1	1	1	1	X
		2	2	2	2	2	2	2	2	X
8.421/8.422	AMO	X	2	2	2	2	1	1	1	X*
8.511 8.512/8.513/8.514	Theory of Solids	2	2	X	X	2	1	1	1	1
		2	2	X	X	2	2	2	2	2

8.591 8.592	Quantitative Biology Stat Phys in Biology	1 1	X X	1 1	1 1	1 1	1 1	1 1	1 1	1 1
8.613J 8.614	Plasma Physics	1 2	1 2	1 2	1 2	X X	1 2	1 2	1 2	1 2
8.701/8.711/8.11 8.712	Nuclear & Particle Physics	1 2	1 2	1 2	1 2	1 2	1 2	X X	2 2	1 2
8.821	String Theory	1	1	1	1	1	1	1	X	1
8.901 8.902	Astrophysics	1 2	1 2	1 2	1 2	1 2	X X	1 2	1 2	1 2
8.942	Cosmology	1	1	1	1	1	X	1	1	1
8.962	General Relativity	2	2	2	2	2	X*	2	X	2
8.316 SDSS cross-List courses	Data Science Machine learning	2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2

Oral exam

- Focusses on the tools of the trade for a nuclear and particle physics experimentalist
- Topics such as experimental techniques and foundations of nuclear and particle physics covered in the speciality courses
- Marks readiness to embark on thesis research in the specialty area
- Taken in the second or third year
- Offered each term
- Many resources available; cohort for each semester usually forms study group

Thesis

- Work done in one of the NUPAX research groups (see presentations this afternoon and tomorrow)
- “Apprenticeship” with experienced physicists in your group
- Thesis topic agreed between you and research advisor 1-2 years in advance of thesis
 - formation of thesis committee
- Average duration in the department is 5.8 years (summer of 2031...)

Summary

- Congratulations, again and welcome to MIT!
- Looking forward to talking to you in the next days and for years to come...
- Extraordinary place for research
- Any questions, please reach out to rolandg@mit.edu

One more thing...

- Dinner at ~6:30PM this evening - Chez Roland
- 4 White Pine Lane, Lexington MA
- (617) 505 9089
- ~30 min ride with Uber (courtesy of NUPAX)
- Any dietary preferences?