The Comprehensive Exam:

Presented by Derek Teaney (chair of exam committee)

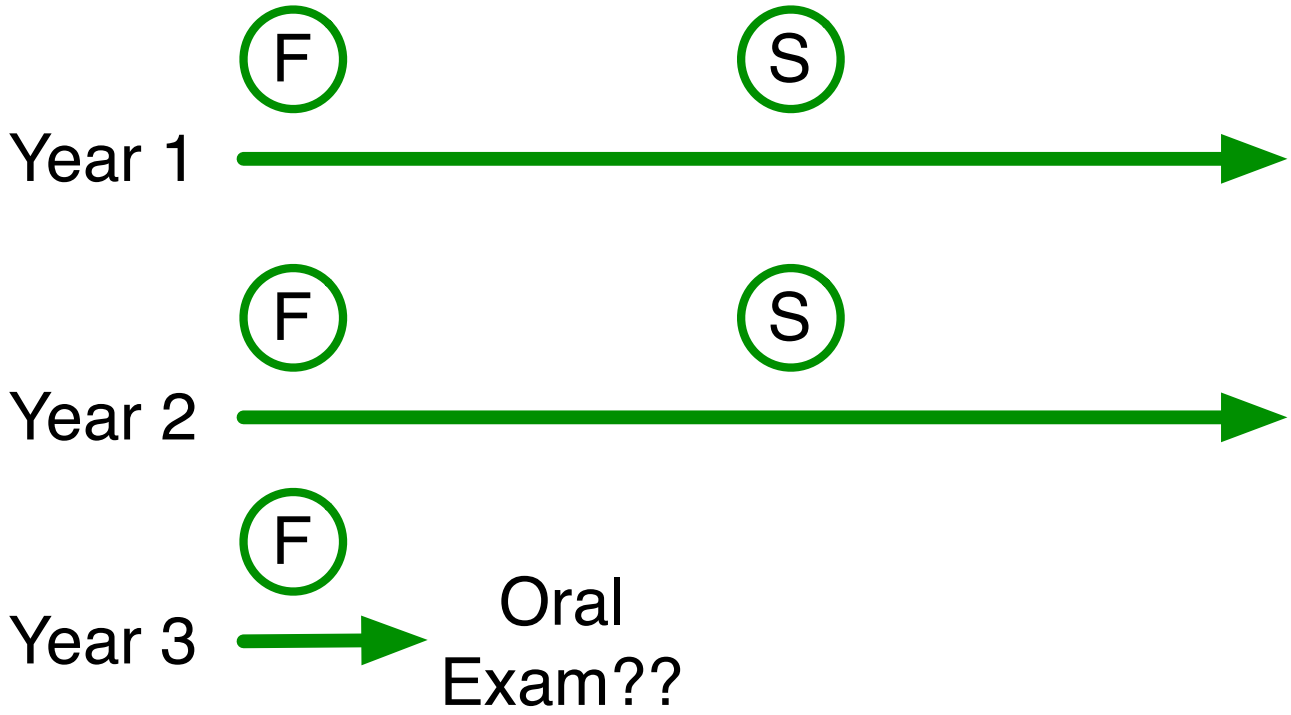
The committee:

1. Xu Du (Condensed Matter Experiment)
2. Dmitri Averin (CM Theory, all core graduate courses)
3. Sergey Syritsyn (Nuclear Theory, Statistical Mechanics)
4. Jennifer Cano (CM Theory, Solid State I)
5. Jesus Perez Rios (AMO Theory, Undergraduate QM)
6. Derek Teaney (Nuclear Theory, EM, CM)

Best source of information: the department web page

(just google stony brook physics comprehensive exam)

Incoming PhD students: pass the comps by start of the third year!



1. What if you do not pass by the start of the 3rd year?
   - A committee will be formed to take a holistic look at your progress
2. The ideal is to finish at the start of the second year

Passing the four parts to the exam: CM, EM, QM, SM

1. PhD: must pass at least 3.5 exams – this means:
   - Three exams at the Ph.D. level and one at the Master's level.
2. You can pass each part separately – the ideal is:
   - CM and EM after your first semester,
     QM and SM after your second semester
3. You can also pass at the Master's level, which is a lower level.
   - Masters: instead of doing a Master's thesis, theory Master students can pass all four parts at Master's level
4. You can skip core graduate if you pass at the placement level
   - But this is hard! Also can skip courses by approval of Matt

The (ideal) exams reflects the content of the core graduate courses!

Each part: three questions, take best two questions

- Ph.D. pass level is $\sim 50\%$ on two questions
- Placement level is $\sim 75\%$ on three questions

12 pnts for everyone

8 pnts for teaching

A bead on a hoop

A bead of mass m is constrained to move (without friction) on a hoop of radius R. The hoop rotates with constant angular velocity ω around the vertical axis. The bead is subjected to the force of gravity at the surface of the Earth.

a) Write down the Lagrangian for the system and the Lagrangian equations of motion. [4pts]

b) Find any constants of motion that may exist. Construct the Hamiltonian. Is it equal to the energy in the fixed (i.e. non-rotating) frame? Is the fixed-frame energy conserved? [2pts]

c) Find the critical angular velocity Ω below which the bottom of the hoop is a position of *stable* equilibrium. Find the stable equilibrium positions for both $\omega < \Omega$ and $\omega > \Omega$. [7pts]

d) Calculate the frequencies of small oscillations around the positions of stable equilibrium. [7pts]

The best way to study is to look at old exams and finals of core courses on department web page, and phys. grad. student web page.

(just google: Stony Brook Physics Comprehensive Exam)

This year's exams:

- Thursday 8/24, 9:00 am – 1:00 pm: Classical Mechanics.
  - Given in the E4330 (and E4320 overflow) in Library
- Friday 8/25, 9:00 am – 1:00 pm: Electrodynamics. E4330
- Saturday 8/26, 9:00 am – 1:00 pm: Quantum Mechanics. E4330
- Sunday 8/27, 9:00 am – 1:00 pm: Statistical Mechanics. E4330

Bring a one page, *hand written*, formula sheet.

Take the exam for practice, or to place out of a core course