The Comprehensive Exam:

Presented by Derek Teaney (chair of exam committee)

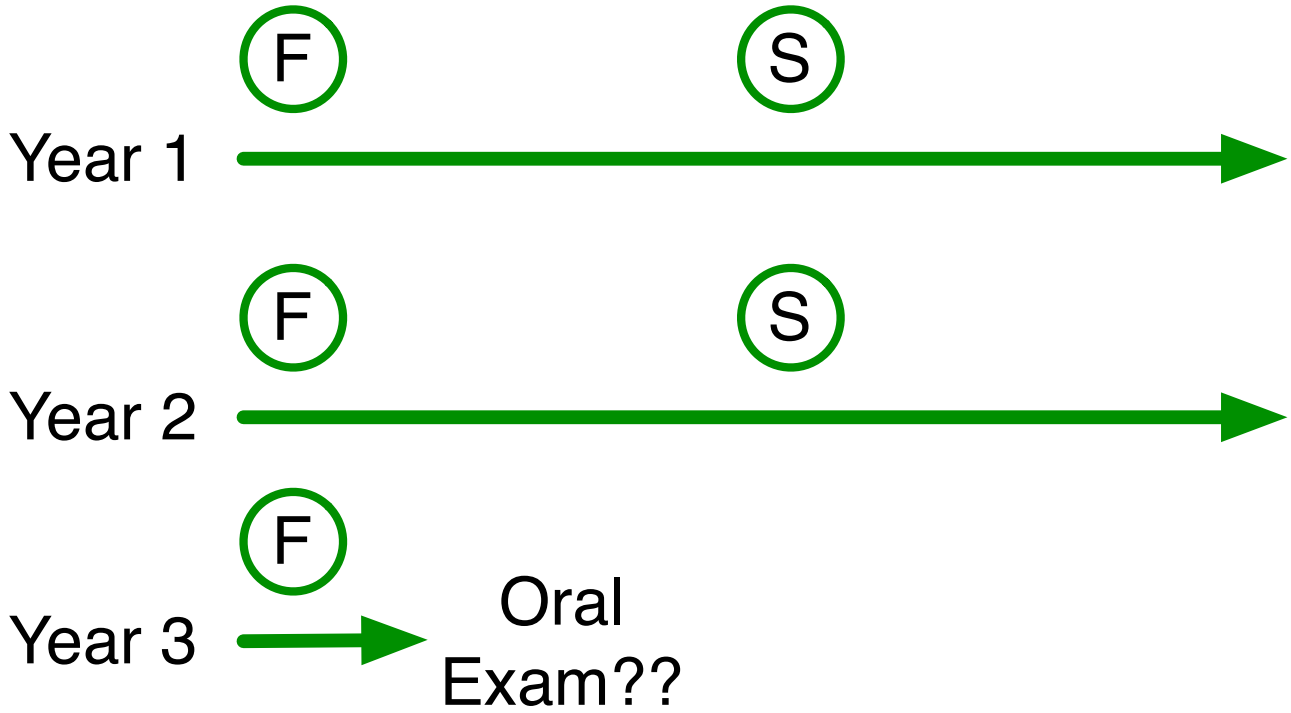
The committee:

1. Dominik Schneble (AMO Experiment)
2. Xu Du (Condensed Matter Experiment)
3. Konstantin Likharev (CM Theory/Experiment, all core graduate courses)
4. Sergey Syritsyn (Nuclear Theory, Statistical Mechanics)
5. Marilena lo Verde (YITP, General Relativity)
6. Derek Teaney (Nuclear Theory, EM, CM)

Best source of information: the department web page

(just google stony brook physics comprehensive exam)

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?
   - You *may* be given an oral exam
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 (slightly) lower level.
   - Masters: instead of (or in addition to!) a Master's thesis,
     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!

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 weeks exams:

- Tuesday, 9:00 am – 1:00 pm: Quantum Mech. *Harriman 112*
- Wednesday, 9:00 am – 1:00 pm: Classical Mechanics. S240
- Saturday, 9:00 am – 1:00 pm: Electrodynamics. S240
- Sunday, 9:00 am – 1:00 pm: Statistical Mechanics. S240

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

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