STUDYING FOR THE PHYSICS AND GENERAL GRE (...and associated grad school application issues)

Thoughts and suggestions by Prof. Bob Benjamin, U of Wisconsin-Whitewater (E-mail: <u>benjamir@uww.edu</u>)

When a graduate school application committee is looking through applications, they are looking for students who are going to be "successful". Most committee members would agree that a successful student is one who becomes a knowledgeable, independent, original, and hard-working scientist. Some (and in some schools, most) committee members will narrowly define success as "becomes a research-oriented professor at a major research university that has a research graduate program." (I put "research" in there three times deliberately.) A broader view would include teaching physics/astronomy positions at smaller universities, jobs at national labs, observatories or government agencies, and positions in private industry. The broadest possible view would be having a happy life while making the maximum contribution to society. But why should a grad school take you just for that?

How does the committee judge your chances of becoming successful? The major component of the application are

- College transcript. If your GPA is below 3.0, you have some explaining to do if you want to get into grad school, e.g., bad semester for personal reasons, change of major, etc. Between 3 and 3.9-ish is a grey area, where details of individual course will be heavily scrutinized. (I still regret my B in Classical Mechanics... sigh...). A 4.0 looks impressive of course, but it needs to be in the right courses. Two big courses are upper-level classical mechanics and electricity and magnetism. Talk to both your mentor here and your advisor at your home college regarding choices for your remaining years.
- 2. Personal essay. Take a lot of time on this early, and give this to faculty advisors, and even other students, for advice. Typically, the essay is a negative discriminant. If you write a bad one, it can really knock you down, but it takes a superb essay to really make this a significant positive part of your application. One hint: do NOT start your essay with your childhood, as in "Ever since I was eight I've been fascinated by the stars...." Instead, try to focus on the excitement of the science, and what you think you can contribute to the field. Also, as much as possible, tailor your essay to the institution. Committee members are always flattered when you actually say something about their own institution.
- **3.** Letters of recommendation. These things really make the edge. If you've truly impressed other people as to your research potential, you will probably impress people in your graduate program, unless your recommender is easily impressed, lying or both. For this reason, *choose your recommenders wisely*. You're looking for someone who knows your work, attitude, background, interests, and potential (and thinks well of them). You're also looking for someone who is a good writer, and if possible, someone who will be recognized by the admissions committee. (This is why your REU advisor is a good choice, assuming the summer goes well.) Most

importantly, you're looking for someone who will remember to send the letter. Make sure to ask them early (one month at least), provide them with a list of clear deadlines, addresses, (envelopes if possible), and particular instructions. [For example, if you know that there is one school that you REALLY want to go to, make sure your recommenders know, so they can pay special attention.] <u>Finally, warn</u> them that you will send reminders of increasing urgency as the deadline approaches, then do so. This is no time to be shy.

4. General GRE The standard lore is that the best "predictor" of success is not any of the above components nor the Physics GRE, but instead the Verbal GRE score. This makes some sense... You can think of the Physics GRE, transcript, letters, and essays as providing a threshold for technical competence and physical insight. But science is done by communities, and if you have a good ability to communicate to others about science, you are going to develop connections and do well. MAKE SURE to do at least one practice General GRE. It's different than the SAT/ACT.

AND NOW... FINALLY... THE PHYSICS GRE...

Many graduate programs will have some sort of Physics GRE cutoff for acceptance, although there is definitely a fairly significant grey area. If you're above 90 percentile, you're probably OK for even the top schools (Princeton, UC-Berkeley, Caltech, etc.) For most major programs (like Wisconsin, Michigan, Arizona, UC-Santa Cruz, Texas) you're probably looking at a cutoff around 40-50 percentile. Why so low? Well, as you may have heard, the Physics GRE is tough, and there are excellent students who otherwise be great candidates who are going to do poorly on the Physics GRE for several reasons. There is significant variation due to what classes are offered at your school, what classes you're taking that semester, what classes you haven't taken yet, etc.

The key thing to remember is that a 50 percentile doesn't mean getting THAT many questions correct. On the GR9677 form for example, it would have taken 26 correct answers (and no incorrect answers). So you only need to answer a quarter of the physics questions correctly to stay in contention for good graduate programs! Is that so hard? [Note: for GR0177, 50 percentile was 38 questions correct.]

Well, yes... but you can do it. And here are some recommendations on how to proceed. The important thing to remember is that you have FOUR practice exams (8677, 9277, 9677, and 0177) to work with. The first three tests used to bundled in a book "GRE: Practicing to Take the Physics Test (3rd ed)" from ETS (Educational Testing Service), but the book is now out of print and going for \$90 used. The fourth test (0177) is available from the ETS website (<u>http://www.gre.org/pracmats.html#subtest</u>). Note that the questions in this most recent test seem somewhat different in character than the older exams. I would recommend saving this exam until the month before you take the GRE.

Finally, the book "The Best Test Preparation for GRE Physics (REA Test Preps)" has generally gotten poor reviews as a useful study guide for the GRE as many of the questions are too involved. But it is a good review of physics, and some of the questions are definitely GRE-worthy.

Recommendations on how to study for the GRE Physics exam

REGISTRATION PHASE (By mid-September)

It bears reminding you right away that you need to remember to register for the Physics GRE before the deadline. As of the writing, there are two fall dates for the Physics GRE and one spring date. The deadline for the first fall date (usually the first week of November) is near the end of September; the deadline for the second date (usually the first week of December) is the end of October. This means you won't know your score from the first exam until after the second exam is administered. It also means that if you want a second shot, you have to register for the second date for the exam <u>before</u> you've even taken the first exam. For this reason, it's hard to recommend that you sign up to take the exam twice. Best to sign up once. I would recommend the December date, simply because you can use the Thanksgiving break to do a final practice exam. However, depending on your class schedule, you might want to take the November exam.

Finally, it should go without saying that you should arrange to take the General GRE at a different date (preferably earlier) than the Physics GRE; otherwise, it is entirely possible that you could cause your brain to explode.

THE COMPILATION PHASE (Recommended time: Early August before exam)

The purpose of this phase is to get all your ducks in a row. Once you start to study for the Physics GRE you don't want to be running around chase down references.

1. Start by collecting all of your physics course information in one place. Put your textbooks and class notes in some reasonable semblance of order so that when you run into a question, you can easily pull out the relevant references and study materials.

2. You will probably also benefit by having a single book that summarizes all of undergraduate physics. I recommend "A Review of Undergraduate Physics" by Bayman & Hamermesh (Current price: \$76 for a paperback!). If your college library doesn't have multiple copies, I would urge the faculty of your department to invest in this, but if you're going on in physics I would strongly recommend this reference work.

3. Get all four copies of the practice GRE exams. (You may want to do this before you leave the REU program). Also get the solutions, but HIDE them. You don't want to be tempted to look at the answer.

4. Put together a notebook where you will keep all of your scratch work and solutions, for later review.

THE STUDY PHASE ONE (Recommended time: mid to late August)

The purpose of this phase is to just get used to the type of questions you might be asked and to identify physics area where you may need to review. It will also allow you to realize which questions are just unanswerable because you haven't covered the material.

I. Find a GRE study partner, if at all possible. If none are available, check out the on-line discussion threads on <u>www.physicsgre.com</u>.

2. Take one exam (recommended 9677) and answer key, and go ahead and mark the answer onto the test form. For this practice exam, it is nice to work through it with the security of knowing how to recognize the correct answer.

3. Using the category breakdowns provided, go through all of the questions on this exam, by category, starting with the easiest questions, and going through to the hardest. Once you're done answering all the questions that you know, start asking classmates about the questions that you're getting stuck on.

4. If you find that you're missing a whole CLASS of questions for which you've already had the course, you should definitely review them with classmates or instructors as soon as possible.

THE STUDY PHASE TWO (Recommended time: late August to mid September)

1. Now go through the questions on two more exams (8677, 9277) working them in order of easiest problems to hardest problems, WITHOUT having the answer key available. I recommend doing them in blocks of twenty. Try the twenty easiest, then the next twenty easiest, etc.

2. Again, check with classmates and instructors when you get into trouble.

THE STUDY PHASE THREE (Recommended time: two months before exam)

1. Set aside an afternoon on the weekend before your scheduled GRE to take the 0177 exam under timed conditions. Remember when you're taking the exam that you're trying to identify the questions that you can answer FIRST, and bank those points. Don't get distracted by difficult looking questions.

2. Also, make sure to check questions for unit consistency and order of magnitude. This can save you a lot of time.