



Introduction to Physics and Astronomy Research including Graduate School Research

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For the OU REU Program

Goal

What is the goal of research? Ideas?

- Solving problems
- Discover and test new things
- Answer questions
- Understand the world
- Communicate those ideas
- Retest current theories
- Develop ways to express ideas and theories

Goal

What is the goal of research?
(some thoughts from the REU leaders)

- Discover something previously unknown about the natural world.
- To confirm aspects of current theories that have not been confirmed.
- To understand something more fully that is partially known.
- To measure something more precisely.

Basic scientific research (scientist) is not the same as technological applications (engineer). Some fields of science are more easily applicable than others.

Research Demands

What is required to succeed in research?

- Dedication

- Your research should be of highest priority. Spend time on the important things even if they are not urgent.

- Productivity

- Simply putting in time isn't sufficient. Only your productivity matters. If you don't produce results, how much time you spent working doesn't matter.

- Self-Motivation

- No required classes. Not just an 8 hour day.

- Creativity

- What you are doing, by definition, has not been done before. Any new ideas?

Research Demands

What is required to succeed in research?

- Perseverance

- At some point you will hit a wall. You have to be dedicated or you will quit when this happens. Research is hard. People who simply try graduate school are rarely successful.

- Carefulness

- In research, your final results can't be wrong. Any mistakes in a publication are unacceptable. Be careful doing each step.

- Thoroughness

- Good enough often isn't. Don't let anomalies go. Ask tough questions about the results.

- Others?

Graduate School Curriculum

Is graduate school simply 6 more years of classes?

- No
- The first two years or so of graduate school involve taking classes and maybe taking qualifying exams.
 - You will take mechanics, E&M, quantum mechanics, statistical thermodynamics, etc. at the graduate level
- The next three years or so will consist of doing original research with the guidance of a research advisor.
 - Doing research is more like a job than like traditional classes.
- Most graduate students in physics and astronomy get stipends as teaching assistants or research assistants and do not incur any debt.

Graduate School and an REU

How might this REU relate to future graduate studies?

- Part of the selection criteria for our REU program was your interest in further studies in Physics and Astronomy.
- This summer may help you decide if you like doing research and want to pursue graduate studies.
- This summer research may help prepare you for the kind of research you would do in graduate school.
- Survey Results:
 - First summer REU? Yes: 12, No: 2
 - First research at all? Yes: 5, No: 9

Graduate School in Physics or Astronomy

Why go to graduate school?

Only go to graduate school if the job you want requires graduate education.

- A Ph.D. is a research degree which requires that you do original research.
- Careers involving research in physics and astronomy require a Ph.D.
- Almost all higher education jobs require a Ph.D.
- Many jobs opportunities outside of pure research are enhanced with a Ph.D.
- Almost all physics and astronomy graduate students apply for the Ph.D. program.

Graduate School in Physics or Astronomy

Is there any reason to get a Masters Degree?

- A masters degree does not really provide new opportunities in pure science research fields.
- A masters degree may provide opportunities for teaching at a high school or 2-year college.
- A masters degree may help job prospects in the corporate world.
- Very few people apply to graduate school pursuing a terminal masters degree in Physics and Astronomy.

Research and Graduate School Challenges

- Imposter Syndrome
 - Everyone else is doing fine and they don't have any anxiety or problems. They are all succeeding and I'm not. I shouldn't be here.
- Time Management
 - I have way too much to do. I'll never accomplish it all.
- Stress Management
 - I can't handle all the challenges. I'm in way over my head.

These issues are common to all graduate students

- Despite the challenges, most students who give their best effort do succeed in graduate school.
- There are resources to help you succeed and face these challenges.
- Ultimately it is all worth it and extremely rewarding.

Life at the OU REU

This summer is an introduction to research. You are not expected to start the summer with any experience or needed tools. You were selected to participate from many qualified applicants.

We want you to

- succeed.
- enjoy the summer.
- have a fulfilling research experience.
- learn something about what research is.
- experience a positive and supportive environment.

If the above things are not a part of your experience please talk with Dr. Abbott, Dr. Strauss, your advisor, or someone who can help. There are lots of resources available.

Further comments/questions

Questions about:

- Research?
- Grad school?
- Careers in Physics?
- Summer Research?
- Other?

