

# Physics 471J

Order of Magnitude Physics( OOMP) module  
Fall 2020

Instructor: David Newman

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Office Hours:

Monday 4:00-5:00pm by Zoom

Wednesday 2:30-3:30pm by Zoom

[Semester schedule \(calendar\)](#)

[Homework](#)

[Link to Auroral Forecast at the GI](#)

[Videos of Class](#)

This syllabus is located at: [http://ffden-2.phys.uaf.edu/471J\\_fall\\_2020.html](http://ffden-2.phys.uaf.edu/471J_fall_2020.html)

## Course Syllabus

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**Course Content:** OOMP deal with getting quick approximate answers. We will develop the mathematical (and hopefully intuitive) tools to study these all systems.

This course will cover the following topics among others:

Basics of making estimates

What's important and what's not

Developing a physical feeling and trusting your gut

Big estimations

**Prerequisites:** A gut feeling, Algebra, trigonometry and calculus will be used.

**Materials Needed:**

Interesting Text: [Order-of-Magnitude Physics: Understanding the World with Dimensional Analysis, Educated Guesswork, and White Lies, Peter Goldreich, California Institute of Technology Sanjoy Mahajan, University of Cambridge Sterl Phinney, California Institute of Technology](#)  
[Street-Fighting Mathematics The Art of Educated Guessing and Opportunistic Problem Solving, Sanjoy Mahajan, MIT press](#)

Calculators: No calculators may be used during exams. Otherwise, buy yourself a nice one. A basic, simple

scientific calculator with trigonometric, exponential, and logarithmic functions is all that you need.

**Lectures:** 1:00pm MWF in 204 Reich. *The lectures supplement but do not substitute for the reading.* Lectures will cover the major topics, emphasizing and discussing the important points. They are not sessions to regurgitate material already written in the text. Your personal participation is important.

**Homework:** There will be approximately one homework assignment per week. The assignment will be given out on Wednesdays and will be due in on the following Friday in class. You are encouraged to work with others on the homework, but make sure the paper you turn in is not simply copied from someone else. These assignments help me assess your understanding of the material, and will count toward your final grade.

**Late problem sets will not be accepted.**

**Project:** Project will be a small group OOM analysis of some big future project (Space elevator or Dyson sphere scale).

Deadlines:

Wed the 10th - groups chosen (3 or 4 people ≈ 3 groups)

Mon the 14th - preliminary topic idea

Friday the 18th - finalize topic

Friday the 25st - list of Physics/engineering/??? issues

Friday the Oct 2nd - written report and (15min) group presentations

Report should have description of project, discription of physics/engineering/??? issues identified, OOM analysis and finally group judgement as to fesability. Does not need to be more then a few pages but clearly written. Presentation should sumarize the same things.

**Hour Exams:** Exam will be given during lecture on:

Oct 5

The exams will be closed-book, but you will be given one side of an 8 1/2 x 11-inch sheet with most of the needed equations. No calculators are allowed. The exams will be graded and handed back as soon as possible.

**Grading:** The course grade will consist of the following components (though I reserve the right to make grade adjustments based on performance trends):

1 hour exam	25 %
Homework	25 %
Project	25 %
Participation	25 %

I grade on a curve however to satisfy university requirments, above 95% will be at least an A, above 85% will be at least a B above 75% will be at least a C, above 65% will be at least a D (in most cases the actual curve is significantly lower!).

**Contacting Me:** I have office hours as listed above. You can drop by at other times if I'm not busy, or make an appointment. I am (almost) *never* available before class.

**Special Needs:** The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.

**COVID-19 statement:** Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this

website: <https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0> Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

**Plagiarism etc:** Plagiarism and cheating are matters of serious concern for students and academic institutions. This is true in this class as well. The UAF Honor Code (or [Student Code of Conduct](#)) defines academic standards expected at the University of Alaska Fairbanks which will be followed in this class. (Taken from the [UAF plagiarism web site](#), which has many links with good information about this topic)

**Complaints and Concerns:** You are always welcome to talk to me about anything, however, if you have a non-subject matter question or concern that cannot be resolved by me, contact the department chair, Dr. Truffer, Physics Department Office, room 102 Reich.

**Alternate References:** To see the same topics explained differently, try the following:

Consider a Spherical Cow: A Course in Environmental Problem Solving by Harte  
Consider a Cylindrical Cow: More Adventures in Environmental Problem Solving by Harte  
Back-of-the-Envelope Physics by Swartz  
Physics to a Degree by Raine  
The Flying Circus of Physics by Walker

Here is a good web site on how to study physics which might be of interest and use: [How to study physics](#)

**General Advice:** Physics is not something you read and memorize, rather it is something you learn how to do. Try the following study procedure:

1. Read the chapter prior to lecture, so that you will know what it's about.
2. Listen carefully to the lecture and take notes.
3. This is crucial: *Do not go back and read and re-read* the chapter until you "understand it." Rather, start working problems, going back through the chapter to clarify points as they come up. I suggest you try to answer all "Checkpoint" problems in the text and the questions at the end of the chapter. If you understand these, you've probably understood the salient points of the chapter.
4. Think! Don't simply try to fit the problems into the form of another problem, think through the problem first.
5. [Interesting Physics computer demos](#)

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Last updated 1 September, 2020