Prof. Benjamin McMorran
Deptartment of Physics
University of Oregon
Winter 2012

PHYS 155 – Physics Behind the Internet (CRN 17509)
Syllabus

INSTRUCTOR	Professor Benjamin McMorran Email: mcmorran@uoregon.edu Office: 171 Willamette Hall Office hours: Tuesdays 10-11am, Wednesdays 2-3pm, or by appointment
CO-INSTRUCTOR	? Email: ? Location: ? Office hours: ?
CLASS TIMES	MWF 1:00-1:50 pm, 110 Willamette Hall *Attendance is not required, but is strongly recommended. Note that there is a "clicker-based" participation grade as well as in-class reading quizzes – see the Grading section below.*
BLACKBOARD	We will be using Blackboard in this course to distribute course materials. URL: https://blackboard.uoregon.edu/

GRADERS	? (graduate student, Physics) – ?
	    Office hours ?, ?
	? (graduate student, Physics) – ?
	    Office hours ?, ?

OFFICE HOURS	Listed above. *You're encouraged to come to my or the co-instructor's office hours, either with specific course-related questions, or just to chat about science or other general topics.*
EMAIL	You can certainly ask questions of me and the co-instructor by email. **You must use your uoregon.edu email address**, since I will be using email filters to sort messages.

TOPICS AND AIMS

"Any sufficiently advanced technology is indistinguishable from magic." – Arthur C. Clarke

Is the internet magic? The internet allows us to communicate with people wherever they are, gives us access to vast stores of human knowledge, and lets us summon endless forms of entertainment, all instantaneously and with a few quick movements of our fingertips. The internet is complex, to be sure, but it is not magic. It is a feat of engineering, resulting from hundreds of years of scientific insights. Here we aim to gain a peak at just some of the key physical principles that underlays this technology.

Goals for the class include being able to discuss the following questions: How can information be quantified? How can it be stored? How do we transmit it? What exactly *is* the internet?

We'll examine a variety of topics:

1. Digital information and logic
2. Electricity and magnetism (physics of computers)
3. Electromagnetic waves (physics of communications)
4. Energy and power (physics of data centers)

Other goals: Through readings and discussions, we will also use our knowledge of the physics underlying the internet to gain insight into important economic, social, and technological issues in internet technology

TEXTBOOK	*The Silicon Web* by Michael Raymer
MATERIALS	• We'll use "i>clickers," personal response systems that allow real-time polling in class. Each enrolled student must bring one clicker to every class. Clickers can be purchased at the bookstore for about $36 new, with decent resell value. If you know someone *not* enrolled in this course, borrowing their clicker for this class will work fine. You will need to register your clicker following instructions on Blackboard in the Course Documents section for this course. **Please obtain and register one prior to Friday of the first week of classes.**
HOMEWORK	Weekly homework sets will be assigned on Blackboard about one week before they are due. Homework is due each Thursday by 5:00 pm; put into the designated In-Box (location: basement of Willamette - directly below our classroom, bottom of stairs and to the right). We will accept late homework *no more than 24 hours late* (5:00 pm Friday in the homework In-Box), but the score will be reduced by 50%. Feel free to discuss the questions with others, but of course, *the work you submit should be your own*. Solutions to all the problem sets will be posted – **study** these. 　　*Homework grading:* (1) Each student's lowest score will be dropped from the overall total. (2) Due to the large size of the class, we will not be able to comment in detail on your homework when grading it. Because of this, it is especially important to study the problem set solutions.
READING QUIZZES	Most of classes will begin with a very short reading quiz, using your clicker. The quizzes should add incentive to do the assigned reading before class, and the questions are designed to be easy if you've done the reading (they won't test mastery of the material). Your responses are known only to you and the Instructors. Bring pencil, paper, and calculator to every class for these.
MIDTERM EXAMS	There will be two in-class midterms, one on Friday, ? and the other on Friday, ?. <u>There will be no makeup exams.</u> If there is a serious (e.g. involving illness) and well-documented (e.g. with a doctor's note) reason for missing the midterms, the final exam score will count extra, in place

	of the missed tests.
FINAL EXAM	The final exam will be held from 15:15 am-17:15 pm on Wednesday, Dec. 5. You must take the exam at this time. (No exceptions.) You must bring a calculator to the final.
COURSE GRADING	In general, vibrant class participation enhances all students' learning experiences – one of the motivations for "clicker" usage. However, I consider it overly paternalistic to require attendance. Therefore there will be two possible weightings of the various grade components: • *Reading quizzes (RQ):* Short, simple clicker questions occasionally at beginning of class • *Participation (P):* In-class i>Clicker-based polls related to the present topic, scored by participation only, not the accuracy of the response. • *Homework Assignments (HW)* • *Midterm Exam 1 (MT1):* tentatively Friday, Feb. 10 • *Midterm Exam 2 (MT2):* tentatively Friday, Mar. 2 • *Final Exam (F):* Monday, March 19, 10:15 AM – 12:15 PM Grading option 1: RQ/P/HW/MT1/MT2/F = 5/10/30/15/15/25 % Grading option 2: RQ/P/HW/MT1/MT2/F = 0/0/30/20/20/30 % I'll grade each student using both options, keeping the higher overall score. **Final Grade:** A=88-100%; B=76-87.9%; C=64-75.9%; D=52-63.9%; F<52%. If necessary, I may apply a curve to achieve a higher average final grade. However, you are guaranteed at least the grade listed here based on your course average. Pass/fail grading option: A passing grade requires at least the equivalent of a C- grade.
USE OF MATH	One of the main aspects of physics is that you can use mathematics to understand how things work. As such, you will need to employ some basic math skills—fractions, simple algebra (solve $2x = 5$), square roots, exponents and scientific notation. Physicists use units to add meaning to math, and you will learn how to use units as a tool for problem-solving.
PHYSICS DROP-IN HELP CENTER	Free help with any standard math or physics question can be obtained in 147 Willamette Hall. The Drop-In Help Center is staffed 5 days a week and most of the day (hours are posted on the door). Note: some of the computer-related topics in this course may be outside the expertise of the tutors there, but they can probably still help you.

LAPTOPS AND PHONES IN CLASS (NONE)

Ironically, the use of laptop computers and phones in class is not allowed. Why? Several studies show that students using laptops in class spend a great deal of time on non-class-related activities (FB, surfing the web, playing games,...) and that these distractions negatively impact both learning and grades. This alone isn't a reason to ban laptops – you're responsible for your own performance in class. *In addition*, however, studies have shown that

non-class-related laptop use distracts and impacts the learning of *other students nearby*. (E.g. Fried, C. B. *Computers & Education* **50**, 906-914 (2008).) Plus, *students* have complained about the environment created by their classmates' laptop use. Taking notes by hand, by the way, is more effective in cementing concepts in your mind – you can always take a quick photo of your notes if you want a digital copy.

In summary, laptops and phones are not allowed in class. The only exceptions will be for people with documented medical needs; please see me if this is the case.

HOW TO DO WELL IN THE COURSE	• Attend class. • Participate in discussions (both talking and listening) • Do the homework, and study the solutions. • Work on understanding all the concepts and example questions discussed in the lectures and the homework. "Understanding" does *not* mean "it sounds like it makes sense to me," but more deeply, "I could explain this concept to one of my classmates." • Come to my or the teaching assistants' office hours with questions! • *Another suggestion: Sleep! Numerous studies show that sleeping helps both memory and understanding.* • *And another: Avoid low blood sugar during exams (and all class periods) by eating a healthy snack just beforehand.*
STUDENTS WITH DISABILITIES	If there are aspects of the instruction or design of this course that result in barriers to your inclusion, please notify me as soon as possible. You are also welcome to contact Disability Services in 164 Oregon Hall, 346-1155.