SMU Honors Physics Section

SMU Department of Physics

SPRING 2017

Instructors Eric Godat and Rick Guarino

Syllabus for Honors Physics

General Information

The Honors Physics Section is intended to provide honors students with additional activities, information, and challenges to allow them to broaden and deepen their physics knowledge while concurrently taking the introductory physics course sequence. The framework of this syllabus is intended to allow honors students to go above and beyond the normal classroom environment without creating a huge additional burden on the students. Honors students should be looking to go a little further than non-honors students, and this syllabus reflects that.

Participants in the Honors Physics Section will engage in the following activities each semester:

- They will use class time to engage in learning exercises that synthesize information from the 130X introductory physics courses, allowing them to find more breadth and depth in the subject of physics.
- They will have access to expertise from outside the classroom environment, including faculty, staff, and students from SMU and other institutions, as well as individuals with a physics background working in private industry. The goal here is to enrich their learning environment by giving them direct access to experts at various levels of the field.
- They will engage in a coherent, semester-long project. Preparing for, and delivering, this project will be the focus of various activities throughout the semester. Honors students will be expected to learn to present their work to an audience, including (but not limited to) their peers in the Honors Physics Section.
- Students will pass or fail the section based on an assessment of their work and participation, to be determined by the instructor.

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Students will engage in a semester-long "Grand Challenge" problem-solving exercise. This will define the arc of the semester, setting the tone for planning out classroom activities and eventually defining the deliverable at the end of the course. In between class periods relevant to the development of solutions to the Grand Challenge Problem, the students will be engaged in demonstrations of physics principles and exercises to explore these demonstrations. These class periods will follow a pattern consistent with the scientific method: observation of a physical phenomenon, hypothesis building to explain the phenomenon, and calculation and testing to assess the hypothesis. The details of this program are given below. Taking into account Thanksgiving in the Fall and Spring Break in the Spring, each semester has 14 weeks in which a classroom period or activity of the Honors Physics Section is possible.

Plan of Activities

WEEK	SPRING 2017
1 (JAN 24th)	Introduction to the Honors Physics Section
2 (JAN 31st)	Development of teams for Grand Challenge Problem *Fun with Gravity: Slinky Drop*
3 (FEB 7th)	*Earth's Yellow Sun: Spectroscopy*
4 (FEB 14th)	*Guest Lecturer – Eric at Santa Fe Jets and Heavy Flavors*
5 (FEB 21st)	First "Honors Collaboration Meeting" Presentation of the three ideas on outcomes of the premise in the Grand Challenge Problem
6 (FEB 28th)	*Hero For Hire: SuperDemos in the Real World*
7 (MAR 7th)	Guidance on Writing Good Presentations (e.g. posters)
8 (MAR 14th)	SPRING BREAK

9 (MAR 21st)	Second "Honors Collaboration Meeting" Presentation of status of solutions to the Grand Challenge Problem, including first draft of your posters.
10 (MAR 28th)	*<<TBD>>*
11 (APR 4th)	*Fractals, Self Similarity and Coding*
12 (APR 11th)	*PHYSICS DISCUSSION WEEK* (Each team meets with the instructors for 1 hour at a mutually determined time during the week. This substitutes for class period)
13 (APR 18th)	*Game Night: Just Remove the Electrons*
14 (APR 25th)	Third "Honors Collaboration Meeting" Final presentations of status of solutions to the Grand Challenge Problem, POSTER DRAFTS DUE IN CLASS
15 (MAY 2nd)	**Final Poster Presentations** Fondren Science Building Foyer All 130X students are invited to ask questions of the presenters. Food and beverages will be provided.

Assessment

Student performance for Honors Credit will be assessed as follows:

- Attendance in weekly classroom meetings
  (Minimum attendance of 8 classes and poster presentation night)
- Participation in weekly classroom meetings
- Quality of presentations at "Honors Collaboration Meetings"
- Quality of final poster
- Quality of final poster presentation and Q&A skills

The Grand Challenge Problem

The focal event of each semester is the solving of a "Grand Challenge" problem. This is a physics problem with no textbook solution. Rather, you will draw upon your own creativity, informed by the principles of physics you are learning in PHYS 130X, to address the question in as detailed a manner as possible. You will be assessed on:

- your incremental progress on developing answers to the question (see below);
- the creativity, originality, or novelty of the ideas that lead to your final answers;
- your ability to investigate the ideas through physics calculations and supporting material;
- and the reliability and accuracy of your calculations.

This is not purely a storytelling process; rather, you will engage in a mathematical and physical exercise where the math speaks, and you will describe what it says. The Grand Challenge process and solution will build gradually over the semester, woven into the fabric of the Honors Physics Section.

The Grand Challenge will be a team exercise[1]. You will be randomly assembled into teams at the beginning of the semester. Your team will be expected to meet at least once a week outside of class to discuss the Grand Challenge and, in particular, how what you have learned that week might be used to explore a consequence of the theme of the Grand Challenge. Your team will report the status of your work (each individual presenting a brief, 5-minute overview of their status) at the "Honors Collaboration Meetings" - periods of in-class time (see schedule) devoted entirely to a public airing of progress. Members of other teams are free to ask questions and offer suggestions or criticism of presented work. In addition, one of our week's will be devoted to in-depth discussions on the physics principles and details; these discussions will happen outside of class time (instead of class period) between each team and the instructors. This entire exercise is to model how real, collaborative, scientific work, as well as peer review, operates in the real world.

A separate and detailed explanation of the entire Grand Challenge exercise will be made available by the instructor.

1 Depending on the number of students in the Honors Physics Section, we will revisit this aspect of the Grand Challenge Problem.

University Honor Code

The student honor code can be found on page 32 of the 2014-2015 student handbook[2]. All students will be expected to adhere to it. Any student found cheating or plagiarizing another's work will be given a zero for that work and a complaint will be filed through the Vice President for Student Affairs Office. If you are uncertain of the definition of plagiarism as it regards independent works of mathematical and physical computation, documentation, and demonstration, it is your responsibility to speak with the instructor and understand these rules.

Disability Accommodations

Students needing academic accommodations for a disability must first be registered with Disability Accommodations & Success Strategies (DASS) to verify the disability and to establish eligibility for accommodations. Students may call 214-768-1470 or visit the DASS website[3] to begin the process. Once registered, students should then schedule an appointment with the professor to make appropriate arrangements.

Please find detailed information about DASS at the end of this syllabus.

University Policy on Religious Holidays

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

2 http://www.smu.edu/StudentAffairs/StudentLife/StudentHandbook
3 http://www.smu.edu/ALEC/DASS

Excused Absences for University Extracurricular Activities

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

Grand Challenge Problem (SPRING 2017)

For reasons that may be scientific or supernatural, you have just obtained one of the "superpowers" on the list below. Select one and only one. Describe three distinct consequences of having or using the selected superpower on the world around you, assuming that everything that happens after you gain the power is governed entirely by the laws of physics and that you are impervious to harm from your own power.

LIST OF SUPERPOWERS

Invisibility
(bend light, focus light, absorb light, …)
Kinetic Absorption
Super Strength
Magnetism Manipulation
Density Control
(ability to shrink or grow at will)
Radical Temperature Change
(super-cool, super-heat)
Super Speed
Teleportation
Electricity Manipulation
Flight
(Must be physics based)

GRAND CHALLENGE PROBLEM (XXX of YYYY)

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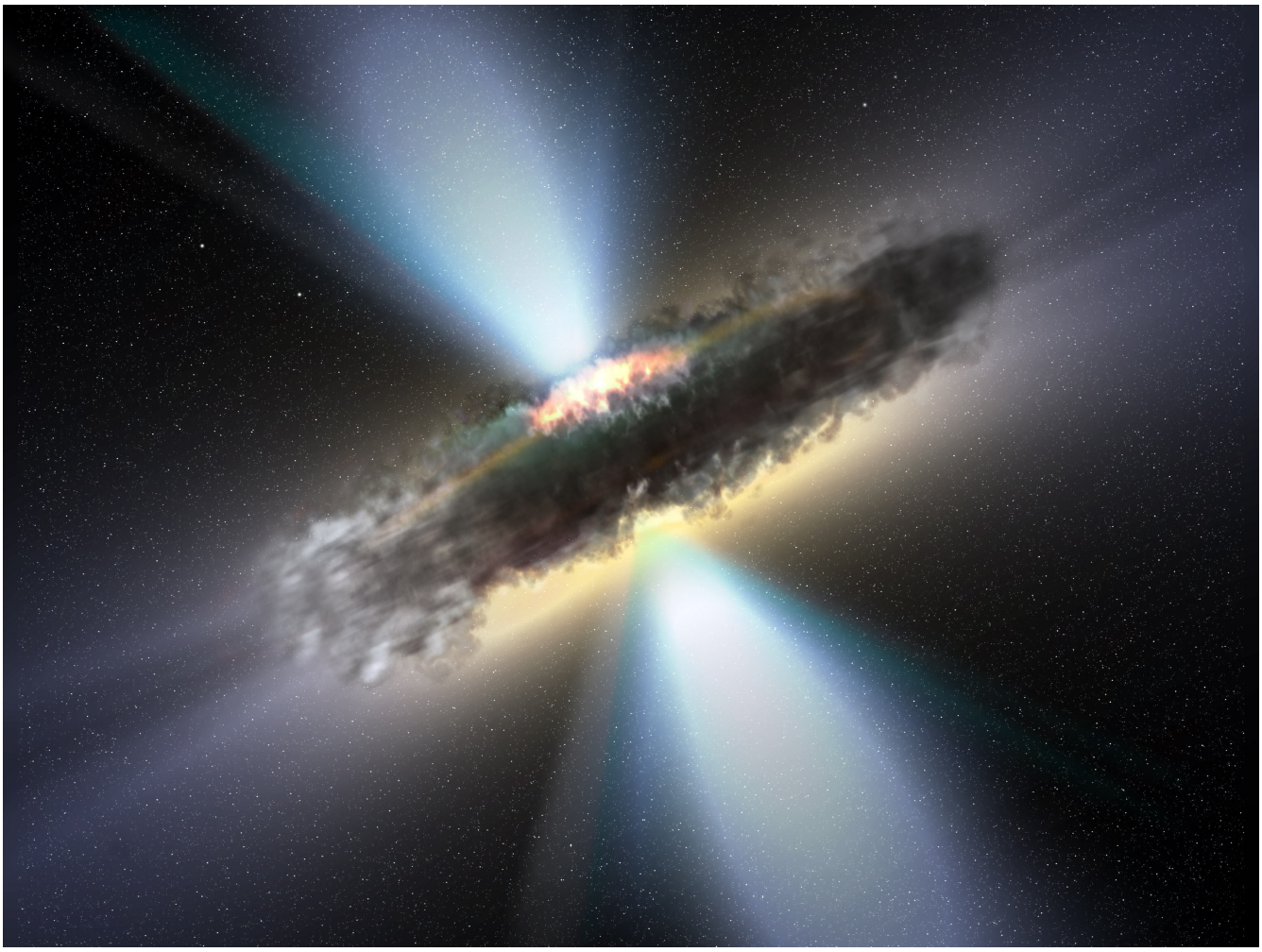
Electricity Manipulation

GRAND CHALLENGE PROBLEM (XXX of YYYY)

Photograph courtesy of NASA

Suddenly and without warning, the entire Earth's gravitational field is switched off. Describe three distinct things that could happen next.

GRAND CHALLENGE PROBLEM (XXX of YYYY)



Graphic courtesy of NASA

A rogue black hole passes through the solar system; its distance of closest approach to Earth is halfway between Earth and Mars. Describe three distinct things that could happen when this event occurs.

GRAND CHALLENGE PROBLEM (XXX of YYYY)