Physics and Film: Fact or Fiction?

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Syllabus (Tentative)

Course Objectives: To learn about a broad range of topics in physics and to be able to apply these principles to solve problems. To look at films with the discerning eye of a physicist and to criticize their scientific accuracy by doing simple back-of-the-envelope calculations.

Prerequisites: All calculations we do will be accessible to a student with knowledge of algebra. No previous knowledge of physics is required, as the necessary physical principles will be discussed in class. Students who have prior exposure to physics are welcome as well, of course!

Each week, we will begin by discussing the basic principles of a different area of physics. Then we will watch 1-3 movie clips which present problems where we can apply these principles. By doing some simple calculations we will discover the difference between what happens on film and what would happen in real life.

Weekly physics topics:

WEEK 1: Introduction and Newtonian Mechanics
Newton’s laws, kinematics, momentum

WEEK 2: Newtonian Mechanics Part II, Gravitation and some Astronomy/Astrophysics
We will finish our discussion of mechanics and discuss: gravitating bodies, angular momentum, the universe

WEEK 3: Sound Waves
The nature of sound waves and applications: explosions far away, explosions in space, shock waves, shooting guns

WEEK 4: Thermodynamics/Heat
Nuclear physics, the laws of thermodynamics

WEEK 5: Scaling Problems
What would actually happen if people/animals expand or shrink? Relation to neutron stars/black holes

WEEK 6: Light/Optics
The nature of light, lasers, and Heisenberg uncertainty and the quantum mechanics of light

WEEK 7: Electromagnetic Pulses/Weapons
Calculations with EMPs and circuits/electronics
WEEK 8: Time Travel

What do we know about time travel today? How far have we gotten experimentally? Philosophical paradoxes and physical practicalities

About the movies:

All clip selections will be taken from the following list of movies, though not all movies will be included in the class. A PERMISSION SLIP WILL BE GIVEN TO STUDENTS IN THE FIRST CLASS THAT PARENTS MUST SIGN AND HAVE STUDENTS RETURN BY THE SECOND WEEK. This will take care of all the movies on the list of rating above PG. (On the first week of class, we will be discussing The Incredibles, which is rated PG.) All clips will be about 5-10 minutes, will contain scenes highlighting physical problems which we will discuss in class, and will not include any material not age appropriate.

Note: It will not be necessary to have seen the movie beforehand to understand what we will be discussing in class. The necessary background information will be provided before the clip is shown.

Movie List (not all of these may be used):

- Godzilla (1954)
- Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb (1964)
- 2001: A Space Odyssey (1968)
- Star Wars: A New Hope (1977)
- Stars Wars: The Empire Strikes Back (1980)
- Back to the Future (1985)
- Indiana Jones: Raiders of the Lost Ark (1981)
- Honey I Shrunk (Blew Up) the Kids (1989/1992)
- Speed (1994)
- Goldeneye (1995)
- Armageddon (1998)
- Ocean’s 11 (2001)
- Spiderman (2002)
- The Day After Tomorrow (2004)
- The Incredibles (2004)
- Spiderman 2 (2004)
- Futurama: Bender’s Big Score (2007)