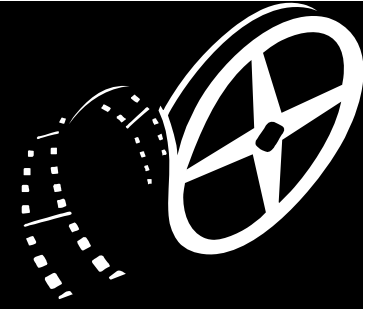


# Welcome to PSC 1121



"Good morning, and welcome to  
The Wonders of Physics."

Summer 2015 PSC1121  
CHRISTOS  
VELISSARIS &  
COSTAS  
EFTHIMIOU



# *PHYSICS IN FILMS*

## *PSC1121*

## **Science In Films**

© Christos Velissaris & Costas Efthimiou



Christos Velissaris

Office: PS 130

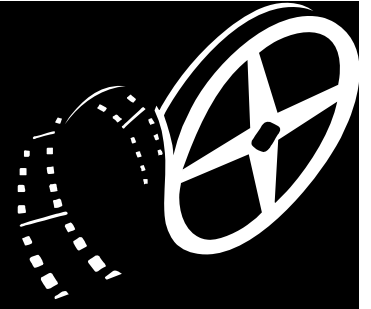
e-mail: [Chris.Velissaris@ucf.edu](mailto:Chris.Velissaris@ucf.edu)

[www.physics.ucf.edu/~cvelissaris/Summer15/PSC112](http://www.physics.ucf.edu/~cvelissaris/Summer15/PSC112)

1

Also at “WebCourses” .

*"The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful. If nature were not beautiful, it would not be worth knowing, and if nature were not worth knowing, life would not be worth living."* - Henri Poincaré.



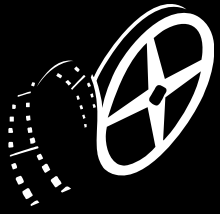
## Why Study Science?

- Active society members make every day decisions that hinge on science.
- Policy makers in government or business are called upon to decide what to do about research programs, development projects, public health and safety issues requiring scientific education.
- Voters you have the responsibility to elect decision makers who will make the best choices when faced with scientific problems.
- Scientific enterprise is essential to economy, educational system, society
- The general public need to understand and evaluate scientific findings

*Jared Diamond, Discover May 1997*

# *Facts about public knowledge*

*(source: National Science Foundation 2004)*



- **Most Americans do not know a lot about S&T.**

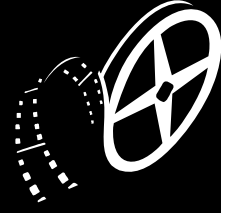
Only 50% know that the earliest humans did not live at the same time as dinosaurs, that Earth takes one year to go around the Sun, that electrons are smaller than atoms.

- **Only 53% know that human beings, as we know them today, developed from earlier species of animals.**
- **70% of Americans lack a clear understanding of the scientific process.**

As a result, belief in pseudo-science, including astrology, extrasensory perception, and alien abductions, is widespread and growing!

- **Alternative medicine (which has not been proven effective using scientific methods) has been gaining in popularity. Two-thirds of the population believe that magnetic therapy is scientific!**

# *Pseudo-science*

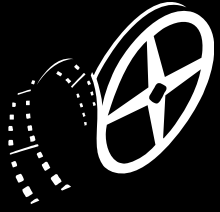


“claims presented so that they appear [to be] scientific even though they lack supporting evidence and plausibility.”

Shermer

- 28% of the public believes in astrology
- 60% of the public believes in the existence of extrasensory perception
- 30% agree that “some of the unidentified flying objects that have been reported are really space vehicles from other civilizations”. 33% believes that “extraterrestrial beings have visited earth at some time in the past”.
- 25% - 50% believes in haunted houses and ghosts, faith healing, communication with the dead, and lucky numbers.

# *Who is Responsible?*

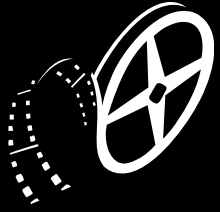


Scientists believe that the media, and in particular, the entertainment industry, may be at least partially responsible for the large numbers of people who believe in astrology, extrasensory perception, alien abductions, and other forms of pseudo-science. Because not everyone who watches shows with pseudo-scientific themes perceives such fare as merely entertaining fiction, there is concern that the unchallenged manner in which some mainstream media portray pseudo-scientific phenomena is exacerbating the problem and contributing to the public's scientific illiteracy.

*Belief in pseudo-science also indicates a lack of critical thinking skills.*




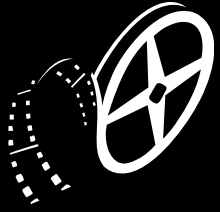
# *Is Belief in Pseudoscience Harmful?*



People drawn to [pseudo-science long] for a world that is some other way than the way it is. They pose no great threat to science. [Pseudo-science] is a sort of background noise, annoying, but rarely rising to a level that seriously interferes with genuine scientific discourse. **The more serious threat is to the public, which is not often in a position to judge which claims are real and which are [not].** Those who are fortunate enough to have chosen science as a career have an obligation to help the public make that distinction.

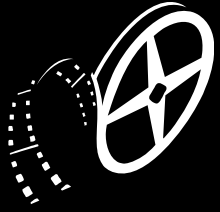


# *Is Belief in Pseudo-Science Harmful?*



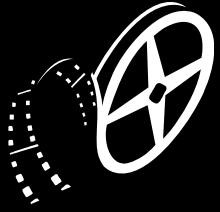
RANCHO SANTA FE, Calif. (Reuter) -  
Investigators Thursday identified the bodies of 39  
cult members who apparently committed suicide  
in the belief that a UFO, shielded behind a comet,  
would take them to heaven.

# *A New Idea in the Course*

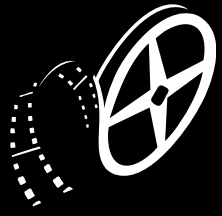


We have introduced an alternative to the standard *Physical Science* course: A course that adopts presentation models that you, the students, have already accepted and presents topics using simple vehicles that are fun and enjoyable. Among such vehicles are the popular movies and TV series that have become part of your daily life from childhood.

# *Topics to Be Covered*



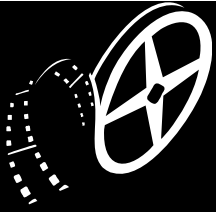
- **MECHANICS**
  - speed, acceleration, momentum, energy
- **DYNAMICS**
  - force, work
- **GRAVITY**
  - Newton's law, motion in the heavens
- **PRESSURE**
  - definition, Pressure from fluids, deep sea pressure
- **ELECTRICITY & MAGNETISM**
  - electric field, current & voltage
  - magnetic field, magnetic levitation
- **TOPICS FROM MODERN SCIENCE**
  - Relativity, space and time travel, black holes, wormholes



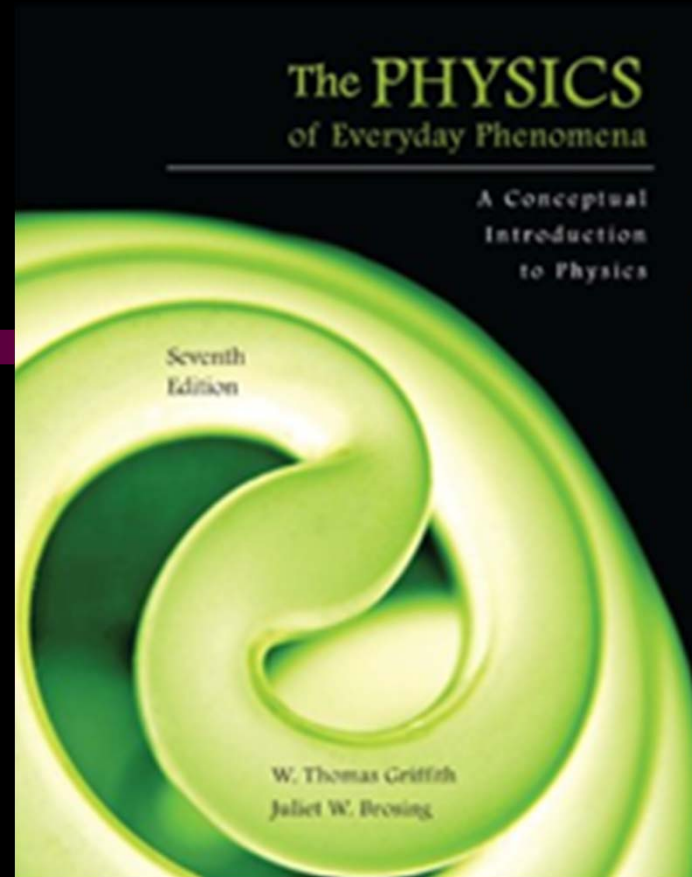
# Possible Films to Be Discussed

- Sherlock Holmes
- Independence day
- Armageddon
- Mission to Mars.
- Speed 2.
- Tango and Cash.
- The Abyss
- Frequency
- Eraser.
- Contact.
- Spiderman.
- X Men 2.



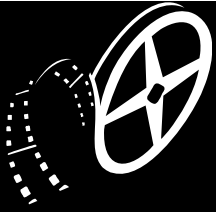


# Text book.



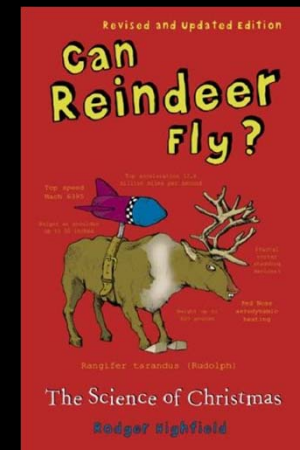
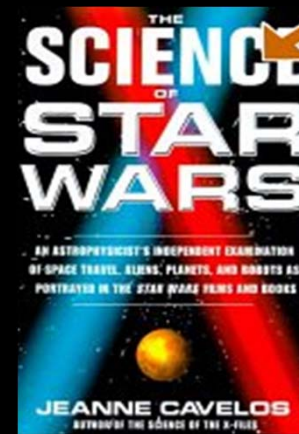
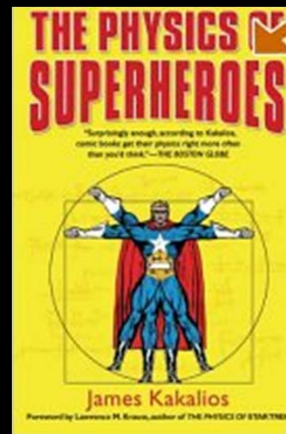
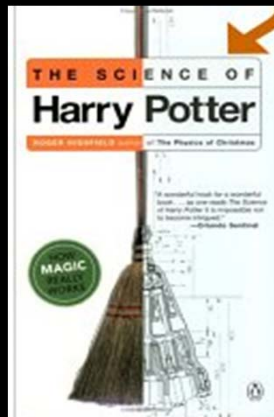
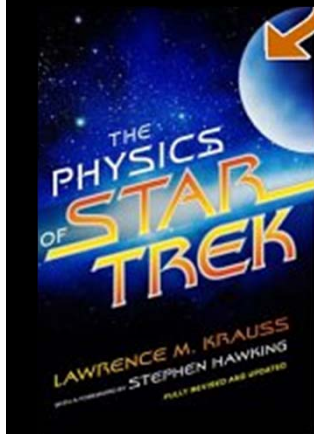
We will use the text book The Physics of Everyday Phenomena, by Thomas Griffith and Juliet Brossing, 7th edition, published by McGraw Hill. Simple homework assignments will be delivered electronically through webassign. ([www.webassign.com](http://www.webassign.com)) Webassign Access code may be purchases individually or in a bundle with the textbook.





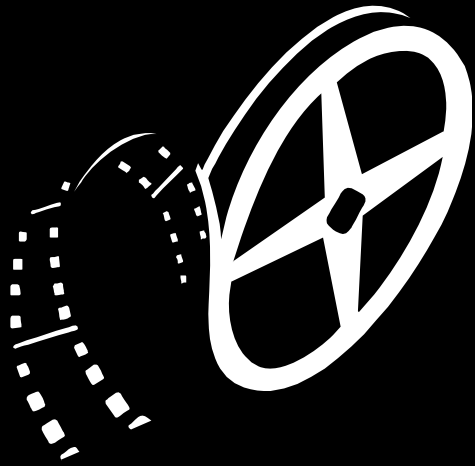
# Texts (for fun!)

1. The Physics of Star Trek.
2. The Science of Harry Potter.
3. The physics of superheroes.
4. The Science of Star Wars.
5. Can Reindeer fly? The Science of Christmas.



# PHYSICAL SCIENCE PSC1121

## Physics in Films



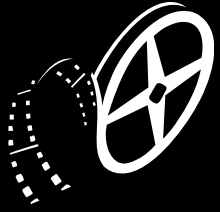
### LECTURE

### The Scientific Method

© Christos Velissaris & Costas Efthimiou



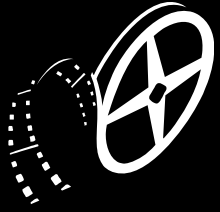
# *The Scientific Method*



**Science** is our accumulated understanding of the natural world.

The **scientific method** is the process by which scientists, collectively and over time, endeavor to construct an accurate (that is, reliable, consistent and non-arbitrary) representation of the world.

# *The Scientific Method*

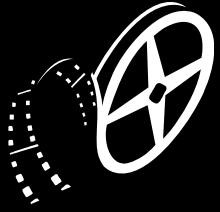


Roger Bacon (1214-1294)



In his three works *Opus Majus*, *Opus Minus*, and *Opus Tertium*, Bacon repeatedly referred to the need to experiment, observe, and directly verify. Speculation was not enough. Analogy was not enough. Logical induction & even deduction were not even enough. One could not be certain of anything unless it could be *independently* verified.

# *The Scientific Method*

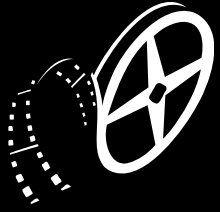


Francis Bacon (1561-1626)



In his *Novum Organum*, he advocated the open accumulation of knowledge through empirical, experimental research for humanity's needs. He also argued for an open hearing for new ideas.

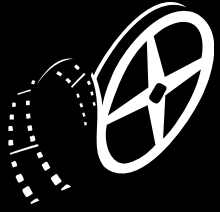
# *The Scientific Method*



The scientific method consists of FOUR STEPS:

- STEP 1: Careful observations are made of some phenomenon.
- STEP 2: A hypothesis is made to explain the observations. In physics, the hypothesis usually takes the form of a formula or another quantitative expression.
- STEP 3: The hypothesis is used to predict new phenomena, not observed up to that point. Experiments are designed to test the predictions.
- STEP 4: If the hypothesis correctly predicted the results of the experiments, then it may be accepted as a **scientific theory**. A **law** is usually a particular statement within the theory.

# *The Scientific Method*

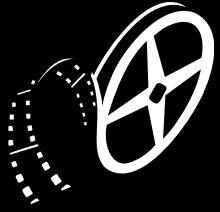


*STEP 1:* Ask Questions – Gather Information

# OBSERVE

**Where do the flies at the butcher shop really come from? Does rotting meat turn into or produce the flies?**

# *The Scientific Method*

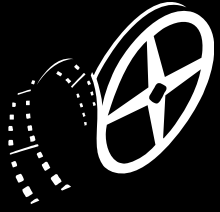


*STEP 2:* Identify Variables – Make the Hypothesis

# HYPOTHESIZE

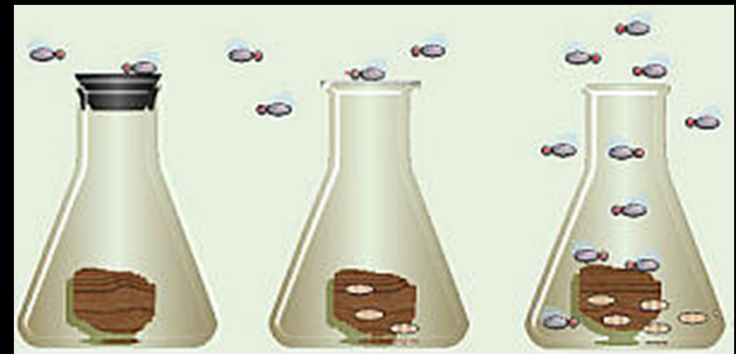
**Rotten (but pure) meat does not turn into flies.  
Only flies can make more flies.**

# *The Scientific Method*



*STEP 3:* Design Experiment – Check Reproducibility – Perform Experiment

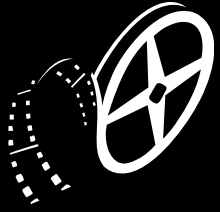
# EXPERIMENT



If meat cannot turn into flies, rotting meat in a sealed (fly-proof) container should not produce flies or maggots.



# *The Scientific Method*



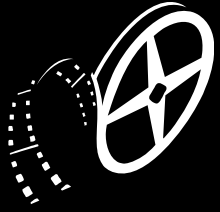
*STEP 4:* Draw conclusions – Create a Law or Reconsider the Hypothesis

# CONCLUDE

In the uncovered jars, flies entered and laid eggs on the meat. Maggots hatched from these eggs and grew into more adult flies.

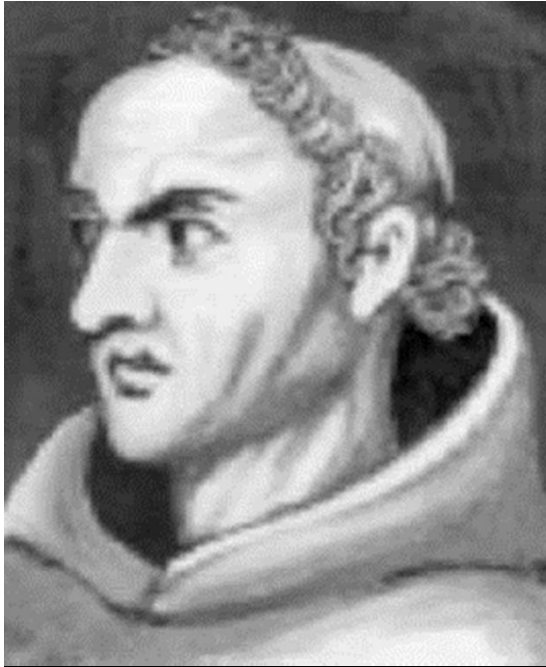
**LAW:** Only flies can make more flies.

# *The Scientific Method*



Notice that the word **Theory** stands in science for something that has been tested, eg. Theory of Relativity.

However, often the word `Theory' is abused by people who assign it to `hypothetical statements', eg Theory of Creationism. For this reason, the public is often confused on the meaning of the word `Theory' which considers it to be `a vague and untested fact'.



## *Ockham's Razor*

Also called the 'Law of Economy' and the 'Law of Parsimony'.

William of Ockham (c. 1280-1349)  
(another spelling: Occam)

**non sunt multiplicanda entia praeter necessitatem**  
(entities are not to be multiplied beyond necessity)

In other words, if there are two different hypotheses that explain the same phenomenon, the hypothesis with the fewer assumptions has to be right.

# *Ockham's Razor*

Example: after a storm you notice that a tree has fallen.

Hypothesis 1: "the storm blew down the tree"

Hypothesis 2: "the tree was knocked over by green space aliens"

Hypothesis 1 requires only one assumption: that it was, in fact, a strong wind that knocked over the tree.

Hypothesis 2 requires several assumptions: the very existence of aliens, their ability and desire to travel interstellar distances, the alien biology that allows them to be able to survive on Earth and have a green color, and the fact that their agenda, upon visiting Earth, includes the attacks on trees.

Obviously, hypothesis 2 is less preferable.