

BAD MOVIE PHYSICS

by Larry Camarota

You know you've seen it before. A person goes flying after being shot, or you see a laser beam whiz by, or perhaps you hear a loud scream from the next space ship over. All are examples of the extraordinarily bad physics that gets portrayed in movies.

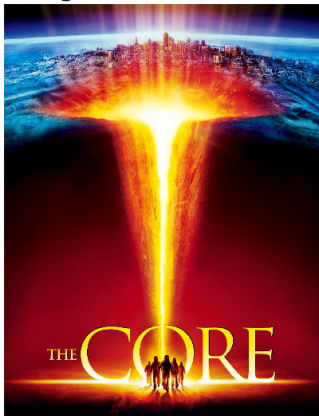
The bad physics that you see in movies tend to fall in a few groups. The first (and most easily excusable) group is the bad physics that are unavoidable for technical reasons. The next group is the physics that are ignored for artistic or story reasons. Following right after is the physics that just somehow got missed. The last group consists of outright bull hoisted upon us by clueless Hollywood writers.

Sometimes movie makers have to include bad physics into their movie because of difficulties in filming. For example, most movies showing microgravity fail to do so, mostly due to a lack of gravity-less filming locations here on earth. Even this has exceptions though; Apollo 13 filmed its microgravity scenes in NASA's Vomit Comet. There are other times when actually getting the physics right would be detrimental to the movie itself. In Star Trek, the transporters were invented so they wouldn't have to shoot a shuttlecraft scene every time they went down to a planet.

It is also common for movies to include intentionally bad physics for artistic reasons. A good example of this can be seen in almost any modern action movie. There's always at least one scene where the hero performs major feats of acrobatics, relying on wires and the fact that we like a really cool fight scene to take care of the obvious violations of pretty much everything you learned in physics 1. Then, there is the physics violated for story reasons. Take the Matrix trilogy. The entire series is one giant violation of every known physical law, yet it always has the same excuse; the rules of the matrix can be broken by someone who knows them.

Some physics just doesn't seem to exist

in Hollywood-land; mostly dealing with guns. For example, if you shoot someone in this land of make-believe, they go flying backward from the momentum imparted upon them by the bullet; never mind the fact that the same momentum was imparted upon you when you fired the gun in the first place. Bullets also make great lock picks; you can ignore the obvious danger of ricochets and the fact that destroying a lock takes much more energy than you will find packed into a .45 clip. Finally, there are those long, drawn out battles in which both hero and villain each unload a few thousand rounds at each other, without once thinking about the sheer weight of the spare clips that they must have been carrying.



The most painful of all bad movie physics to watch is the kind that is utter and total baloney. A big part of this is because said baloney flows most readily in supposed science fiction movies. This utter destruction of physics in general can be seen in "The Core," which intuiitor.com had declared to be the worst physics movie ever. From the get-go, the script seems to intentionally get everything it can utterly get wrong. The premise of the movie is that the earth's core has just stopped spinning, is destroying the earth's magnetic field, and letting deadly microwave radiation onto the earth's surface. To fix the problem, the U.S. government decides to send a manned craft made of something called unobtanium into the core to give it a kick-start with a nuclear bomb. This unobtanium, by the way, converts pressure and heat into energy, while being utterly resistant to both.

There is hope. Not all movies incorporate bad physics, and a large number only include the unavoidable garbage. Sometimes you get a glimmer of decent physics. For example, the television shows Babylon 5 and Battlestar Galactica both show space ships that don't flagrantly violate the law of conservation of momentum (a sadly common event for space shows).

who we are

UP is a monthly undergraduate physics newsletter sponsored by the University of Florida's chapter of the Society of Physics Students, for students, by students. We seek to strengthen the undergraduate physics community at the University of Florida by providing a forum for undergraduates to share their views and experiences with each other and acting as a source of information for opportunities and events in physics.

SPS EVENTS

11/6 : REU Info Session

11/9 : Feynman Lecture Showing

11/13 : ROFU

<http://www.phys.ufl.edu/~sps>

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SURVIVOR: FIELD QUANTUM MECHANICS

by Larry Camarota

The man is a legend in his own classroom. He has a Ph.D. from Berkley, a very famous sister, and a hat always covering his head. This man is Professor Rick Field, and he teaches physics here at the University of Florida.

Last year, Professor Field started teaching quantum mechanics I. The first test was a disaster. That year's class got to take a retest, and Professor Field has modified his style a bit, but there is still much that his students can do to succeed in his class. Many of these points apply generally to any class, so you would be wise to heed these words, even if you aren't in Quantum.

1) Be prepared. Dr. Field posts his lecture notes on his website, before class. His lectures are then taken almost directly from these notes. Unfortunately, these notes are both highly condensed, and highly confusing, so you can't use them to skip class. Use them, instead, as both a guide to the current lecture

(print them out and bring them to class), and as a memory aid for past lectures.

2) Watch out for traps. Dr. Fields homework can often look deceptively simple. Simple enough that one might be tempted to put off the homework until the weekend before (knowing how well that usually works?). Don't. In general, you probably shouldn't for any class, but I repeat DON'T. Those two pages of assigned homework (with the answers already given to you) can take you more hours than you have in a weekend to finish. Certainly more hours than you can spend thinking straight during one homework session. An hour here and there over the time the homework is assigned can let you see sunlight on the weekend before it is due.

3) Don't panic. The first attempt at one of Dr. Fields' homeworks may leave you wishing you opted for a different class; one, preferably not involving math in any form. Do not lose hope, for Dr. Field does a

couple things that, through careful observation, will make the problems much easier. First, he will often use homework problems from the textbook. Second, he will tell you exactly where in the textbook he got said problems. Third, for problems not taken from the textbook, he will point out exactly where in the textbook you should look. These little things will help you understand the homework almost as much as attending lectures.

4) Be brave. Dr. Field is fairly friendly. He invites all of his students to interrupt him during lectures to ask for clarification. Take him up on it. Quantum Mechanics is a very confusing subject, one which tends to throw away everything you have ever learned in physics before. Just stand right up and say, "Hey, Rick..."

Quantum Mechanics with Dr. Field can be hard. But with a little work, and this handy survival guide, you can see the light at the end of the semester.

YOUR PHYSICS NEIGHBORHOOD

by Amruta J. Deshpande

Have you ever wondered about the physics research that goes on right under your feet, as you might tap them in class? There are labs with wires, liquid Helium, vacuum systems, and more delicate equipment hard at work while chalks click away at the chalkboard. Papers, pencils, and desktops are lettering away upstairs on theory. What physics do these researchers wonder about? You can find answers at the weekly Thursday colloquia.

Every Thursday at 4:00 PM, UF researchers come out of their labs and offices to attend a lecture, one that will keep them updated on ongoing research. In room NPB 1002, these lectures, referred to as colloquia, present topics under investigation at UF as well as at other universities (when guest lecturers present). Colloquia are specifically structured to appeal to levels of understanding of

professors as well as graduate and undergraduate students. Generally the first 15 minutes are to be understood by all, the next half hour, only by those with some knowledge of the field, while the last 15 minutes are to be understood only by experts. Thus an hour of fun! Not all colloquia follow this format to the tee, but they certainly introduce the issues and the physics in a manner that may be understood by undergraduates.

Attending colloquia is a great way to get an idea of the physics scene today. See what kinds of questions your professors are asking. See what kind of research is out there. Find your own interests while you listen to others'; then go research it yourself to see what physics you'll want to investigate. Meet the physics community, and even be a part of it!

Whether you attend every Thursday or just when you know a topic of your interest is being presented, be sure to attend at least a few times! Colloquia are free to you, unlike magazines you'll have to pay subscriptions to. And what's more is that you can talk to the researchers yourself! The next Thursday-colloquium coming up is on November 9th and has the following specifications:

Speaker:

Walter DeHeer (Georgia Tech)
Title: Epitaxial Graphene: A New Material for Nanoelectronics
Host: Art Hebard

Last week you missed one on, "A microscopic view of magnetic phase transitions," while the week before hosted a colloquium on cosmic microwave background radiation. Read more on abstracts for future colloquia at <http://www.phys.ufl.edu/calendar/colloq.html>

RESEARCH OPPORTUNITIES FOR UNDERGRADUATES

by Jonathan Young

At the last Research Opportunities for Undergraduates meeting, one of the speakers was Dr. Stephen Hill. He spoke briefly about some of his own research projects and was interested in having undergraduates gain research experience in his laboratory.

Dr. Hill is an experimental condensed matter physicist. Among his primary research interests are magnetic quantum tunneling and the properties of molecular crystals. More specifically, the research areas of the Hill group involve microwave spectroscopy and single-molecule magnets (SMMs). Dr. Hill's work in single-molecule magnets has led to a collaboration with Dr. George Christou of the Chemistry Department.

Single-molecule magnets refer to bodies that consist of molecules, where each molecule has properties similar to magnets. In other words, the body must have a net magnetic spin. Single-molecule magnets are a relatively recent development, with the first single-molecule magnet produced in 1991. Researchers continue to dedicate time and effort to improve the SMMs we have today. The goal for single-molecule magnets is to incorporate them into molecular devices, and as a result, current research focuses on raising the critical temperature of single-molecule magnets. The applications of SMMs can have far-reaching consequences. Single-molecule magnets have many important advantages over ordinary magnetic particles composed of metals, metal alloys or metal oxides. Some of these advantages are uniformity in size and solubility in organic solvents. Current hard drives and other devices store information using magnetic particles. Naturally, maximizing the density of information

storage is desirable. A method to increase the amount of storage is to minimize the magnetic particles. This is one key aspect that has led to interest in single-molecule magnets. Furthermore, uniformity in size of the magnetic particles is required for reliable storage. There are still many more refinements needed to be made to the production of SMMs and work on SMMs is expected to continue well into the future.

A second area of interest to the Hill group is microwave spectroscopy, which is the study of emission and absorption of electromagnetic radiation by molecules that experience a corresponding change in their rotational quantum number. One area to which microwave spectroscopy has a fair amount of application is chemistry. It offers an additional analytical technique for identifying stable reaction products, purity analysis, and studies of reaction efficiency among other areas. Since some traditional analytical chemical techniques are not well suited for the gas phase, microwave spectroscopy can be particularly useful. But chemistry is not the only area where applications of microwave spectroscopy are found; indeed, rotational spectroscopy has been used in the study of coronal field changes, for example. It is clear that microwave spectroscopy continues to be of scientific interest and value.

Single-molecule magnets and microwave spectroscopy are not the only areas that the Hill group investigates. In general, Dr. Hill also has projects dealing with research at magnetic fields. Undergraduates who are interested in the research topics involved with the Hill group are encouraged to contact Dr. Hill regarding opportunities for a laboratory position.

DATES & DEADLINES

by Harold Rodriguez

Have you been keeping up with your deadlines? If not, now's the time to hustle: the end of the year is approaching. Make your letters-of-recommendation requests to professors, apply for scholarships, and attend physics-related gatherings.

Not to alarm you, but some of you may have a GRE subject exam coming up! Critical dates include:

11.04.06: Exam 1
12.02.06: Exam 2

Note: Both exam registration deadlines have passed.

In between Exam 1 and 2, attend meetings hosted by the Society of Physics Students:

11.06.06:
REU (Research Experiences for Undergraduates), students talk about the research they've done as part of REU.

11.09.06:
Feynman Lecture showing in room 2205 at 5:30 PM.

11.13.06:
ROFU (Research Opportunities For Undergraduates), physics professors explain what research projects they're working on, and how you can get involved.

Forscholarship deadlines, as always, first check www.clas.ufl.edu/scholarships. CLAS has compiled a list of outside and UF-endowed scholarships worth thousands. Scholarships include:

Deadline: 11.13.06. Make sure to check out fellowships, such as those from the National Science Foundation. Physical science students may get details at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06592. Value: \$30,000 in stipend + tuition allowance.

Deadline: Feb 2007. Scholarships from The American Physical Society: APS (who fathers the Society of Physics Students) has minority scholarships worth \$2,000. Eligibility: Black, Hispanic, or Native American; www.aps.org. Value: \$2,000.

Deadline: 03.31.07. If you are thinking of majoring in chemistry, the Colonel Allen R. & Margaret G. Crow Undergraduate Scholarship may be for you. Contact: Kathryn Williams, 202 Leigh Hall. Value: \$2,000.

BEING COMPUTER SAVVY

A QUICK REFERENCE ON WHERE TO FIND GOOD SOFTWARE AT MINIMAL OR NO COST

by Amruta J. Deshpande

If you're not among the thousands who know lots about computers already, this article is for you. I've got some basic information on downloads and software that is free and good for your system. Most of my information I got from the physics computer help page at <http://www.phys.ufl.edu/computing/index.shtml> and the CIRCA page at <http://notebook.ifas.ufl.edu/>. The IFAS site provides a free software link at <http://notebook.ifas.ufl.edu/Free/> which lists free software available from various internet sites.

Some useful downloads include Firefox web-browser from Mozilla, AD-Aware spyware removal software and McAfee V 8 anti-virus software. The first 2 are available from the IFAS or the physics computer site, while for the anti-virus software, the physics computing site suggests you contact them at room NPB 2121.

The IFAS Free link makes available

word processors like OpenOffice which works like or better than Microsoft Word in some cases however it does not readily convert documents to the commonly used .doc format.

You will also learn that UF makes certain software available to students, staff, faculty etc. at a nominal price. This includes security software, operating systems as well as word processing software. You must contact the Technology HUB (located at the welcome center) at (352) 392 0306 and ask for information regarding the purchase of the UF software CD. Visit <http://www.circa.ufl.edu/cd-rom/> for information on the specific software available on the CD.

Get set up using some free ware that will protect your computer and make your computer usage more pleasant.

HOW TO SAVE TIME WHILE STUDYING

by Amruta J. Deshpande

Almost all of you can probably identify with the situation in which you're trying to study a subject that is not intuitive to your reasoning. Studying thus drains that most precious of your precious items - time! If you're like me, time will really be your most precious possession by the time of your graduation. Luckily, I came across a video by Professor G. Mann, which instructed on efficient study tactics. I was fully ready to day-dream through it, when I heard Professor Mann run through a list of problems that kept students from studying efficiently. I've successfully completed 4 years of undergraduate studies in 2 majors, but I was shocked to learn that 7 out of 8 on his list could be ascribed to me!

Some problems and consequences he mentioned:

1. Glossing over pages, so as to have read roughly a paragraph in 3 pages worth of words.
2. Forgetting what you've learned after the page/class period/week/exam/semester.
3. Procrastinating.
4. Reading something repeatedly and not understanding what you've read.
5. Allowing distractions like music, television, internet or birds even while studying
6. Studying in an ill-suited environment

On average, he claimed, people only use 30 percent of the time they spend while

studying while many others use 20 percent or less. Even engines perform better, and they're limited by thermodynamics!

Well, some of his suggestions are surprising, while others are not as much.

He suggests that you condition and time yourself simultaneously (i.e. pretend you're both Pavlov AND his dog)! Do something each time you begin to study and "undo" it when you stop. This could be something like taking off a wrist watch or putting on a jacket (something that can be easily undone). When you notice your thoughts trailing, or your actions shifting off-task, put the wrist watch on or take the jacket off. Document the time you were actually studying and at the end of your study session compare how long you've been sitting there against how long you were actually studying. This is your starting point from which to improve your efficiency.

Choose a good environment. Internet has tremendous entertainment value and is NOT your study buddy. Choose a place that is well lit and has no visual or audio distractions. Create your own "white noise," if it is difficult to find a noiseless environment. A friend of mine solved lighting and noise issues by placing several white tube-lights in his bathroom, and running the shower for white

UP Staff

Editor-in-Chief

Amruta Deshpande

Layout Director

Erica Bolin

Online Editor

Nick Park

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Harold Rodriguez

Assistant Editor

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Dr. Yoonseok Lee

CALL FOR WRITERS

UPNews is always looking for undergraduates who want to contribute. If you'd like to get involved, e-mail us at upnews@phys.ufl.edu (no experience necessary)

noise while he studied. He not only received A's but can now recall the meat of any subject at the drop of a hat.

The best way to study he suggested was to use flash cards; they have only the information you want, and nothing extra. Professor Mann suggests making 5 flash cards to sum up the notes per lecture for a given class. You've now reviewed in time and condensed information for later reviewing.

Finally he also advocates the SQ-3R method developed for pilots to memorize their flight plans. SQ-3R stands for Survey, Question, Read, Recite, and Review, and it is a proven method. The idea is to quickly survey reading material, while mentally asking yourself questions about it that you'll be trying to answer in your first actual reading. Then you recite what you've read (just repeat some of the concepts) and review what you've just done. This gives you the necessary repetition and inquisitive mind for concepts to sink in or for understanding beyond the reading material to develop.

The key is to focus, understand as you go along, and have repeated mentions of the study material to improve your retention. All methods suggested above help you do these three things. You can come up with your own techniques; whatever you do, do it diligently.