undergraduate physics newsletter

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WITH A CAPITAL P

by Harold Rodriguez

In a blatant disregard for spelling, the UF chapter of SPS (Society of Physics Students) performed their "Physics is Phun Show" for elementary school students.

As part of the physics outreach program, a handful of dedicated SPS students headed over to Lake Forest Elementary, after dragging and loading tons of gadgets and thingamajigs into The Physics Van. Like jolly old Saint Nick, they arrived on the scene and started unloading the toys. What may seem like an ordinary bicycle wheel to some is actually an amazing "physics-defying" demo for others. And those are the best kind of toys.

The demos in the exhibition included liquid nitrogen stunts, squealing tubes, interfering sounds, spinning chairs, "weight-deceiving" objects, flying buckets of water, rotating pennies, electromagnets, strangely-weighted pipes, freezing batteries, expanding shaving cream, and of course the "angular momentum" bike wheel. Needless to say, the children had lots to marvel at.

The show started off with a bang as liquid nitrogen was precariously poured over the floor (precariously by professionals, of course!). The reaction was one of Oohs and Ahs, and a few chilly toes. "This is just the beginning," we said. Next came an old crowd favorite: the wheezing tubes. By spinning them around quickly, air travels up the tube (directed away from your hand) because of Bernoulli's Principle. Low pressure builds up near the faster spinning end of the tube causing the air to migrate there and resonate through the tube.

Another sound demo was the two xylophone keys of adjustable frequency. This way, when

Top: Erica Bolin prepares to rotate in her chair by tilting a bike wheel.

Bottom: Two students desperately try to separate electromagnets.

played together, one could hear variable beat frequencies. Next came the angular momentum portion of the show, starting off with having people spin in a chair. Masses were given to them, and whenever they brought the masses closer to their bodies, they spun faster, and vice versa. The kids seemed to have a good time with this one. After, they tried it with a spinning bicycle wheel. Whenever they tilted the bike wheel, they'd start rotating the chair. Like magic! Other objects were spun around (like buckets of water and a penny on the tip of a clothes hanger!).

After some demos about the distribution of weight (and its difference to mass), it was now time for Return of the Liquid Nitrogen. This demo involved putting a fully-inflated balloon into a pool of N2. Contrary to the hypotheses of the students, who thought the air escaped the

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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.

Physics vs. Philosophy... Discussion Inside

what's UP
in this issue

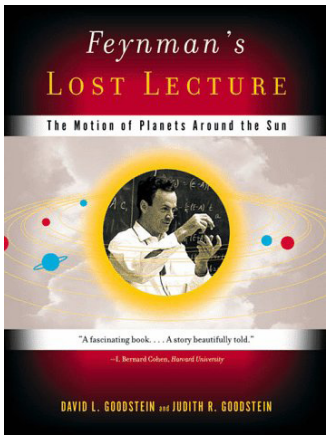
BOOK REVIEW

Feynman's Lost Lecture: The Motion of Planets Around the Sun

By David L. Goodstein and Judith R. Goodstein

Note: This book is sold with a CD that contains an audio recording of the lecture.

by James Stankowicz



OK, so there are tons of Feynman books out there. What's so great about just one more on top of the heap of them? In "Feynman's Lost Lecture: The Motion of Planets Around the Sun" ("FLLTMOPATS" for slightly shorter) the reader gets to see Feynman test his intellect against that of Newton as Feynman recreates Newton's geometric interpretation of gravitation.

The book (as discussed in the preface and introduction) is a re-creation of one of Feynman's guest lectures, the content of which was very difficult to obtain and reproduce for various reasons. Essentially the lecture was given for fun because the class to which it was given had an exam soon, and the professors did not want to throw anything new at the students.

After the preface and introduction, the book first traces humanity's progressively improving understanding of the heavens as the torch passes from Copernicus to Brahe to Kepler to Galileo to Descartes and finally rests on the three pillars of Newton's Laws. Having made a solid foundation, the second of the two chapters is then a brief biographical chapter on Dr. Feynman. This section of the book is certainly not as in depth as many of the other books out there (neither was it written to be), however Goodstein presents several anecdotes that place Feynman in an academic setting, which is a slightly different canvas than most of the ones on which Feynman's life stories are normally painted. This results in some entertaining reading.

Finally, 63 pages into the book, we come to it: Feynman's Proof of The Law of Ellipses. This portion of the book is not Feynman's transcribed lecture (that's yet to come). These pages are a reproduction, in full, of Feynman's process of thinking. There is nothing more advanced to any of it than high school geometry and algebra, and there are plenty of illustrations to help make clear the points and proofs. This is really the meat and potatoes of the reading, and it is likely not material you'll understand if you're not paying full attention to what you're reading (that comes from personal experience). As stated in the book, it's a simple process (requiring about 2 lines) to work through all the details and gravity laws with calculus. It is not that the calculus method lacks elegance and beauty; it is that there is something far more gratifying about following this long, geometric 'proof' the whole way through that yields a satisfaction you just can't get out of PHY2049 or equivalent. And while the words used in this part of the book aren't those of Feynman, they are careful and well explained glimpses of what's to come.

Admittedly, it's difficult to read and follow the written words of Feynman's lecture (about 25 pages near the end of the book), but that's why they give you a CD. Reading and listening to Feynman's words as he discusses his own, inventive validation of Newton increases the sensation that the analytical manner in which our physics today are taught to us may not be so fulfilling. So, FLLTMOPATS is not the book you want if you're looking for crazy, wacky stories of one of the most famous physicists of recent times (although there are some elements of that in it). What FLLTMOPATS has to offer over any other collection is a unique, new way to view relatively 'early' physics through the eyes of a great teacher.

Restaurant Reviews

by Erica Bolin

2nd Street Bakery

$ 2 - 8

On the southeast corner of NW 16th Ave and 2nd Street

2nd Street Bakery is a relatively new eatery in Gainesville. Not only do they offer baked goods, such as scones, muffins, a variety of breads, and pastries, they sell coffee, smoothies, sandwiches and salads. All of their ingredients are organic. One of the most interesting parts of the bakery is the beautifully remodeled interior. The exterior looks as if it was an old brick warehouse with an arching rounded roof. In contrast to the antiquated charm of the outside, the inside is pristinely modern with lots of bright, vibrant colors and geometric shapes with seating inside and out. It's definitely one of my favorite sunny Saturday afternoon destinations. The coffee is good – strong, but that's how I like it. One thing to certainly take advantage of is their gourmet sandwiches – particularly the tomato & mozzarella.

The Jones

$ 4 - 10

Located on NE 23rd, in a small plaza just East of Main Street

Continuing with a theme, the Jones is an even newer eatery in Gainesville. Locals might remember the location as 'Home on the Range', a small breakfast joint. The Jones takes the same local feel of its predecessor and extends it. They serve breakfast and lunch with an emphasis on quality ingredients and a bias towards the organic. There are several vegetarian options that even non-vegetarians would enjoy. Personally, I'm partial to breakfast foods, so that's what I've enjoyed there so far. The French toast was particularly scrumptious, as well as the spinach and garlic omelet (just make sure to bring gum for afterwards). An important note is that The Jones is a cash only establishment, but there is an ATM nearby.

ON THE DIFFERENCES BETWEEN PHYSICS AND PHILOSOPHY

by James Davis

For those of you that do not know who Karl Popper is, he is a 20th century philosopher who is responsible for the arguments where your philosophical roommates tell you that "You can't like… prove gravity exists. Just because the theory has worked until now doesn't mean it'll work tomorrow." Here's how his philosophy breaks down.

The following is a transcript between Ricky P. Feynguy and Karl Poppy and is true. Not true in the sense that it actually happened, but true in the sense that it's made up. But it is real, in that it exists… from an ontological standpoint. Philosophically, isn't that what's really important? Probably not.

Ricky P. Feynguy: Hello Sir Poppy, I'm curious about your views on the falsification of scientific theories.
Karl Poppy: Simply put, the criteria for an idea to be scientific depends on whether or not it can be falsified by observation. Although no theory can be proven true, it must have the capacity to be proven false.

R.P.F.: Absolutely. For an idea to be useful it has to make predictions about the outcomes of experiments. If those predictions are wrong, the theory is discarded… But if those predictions are correct, then the theory is confirmed. That's the definition of science; the belief that the truth of a theory is determined by observation, nothing else.
K.P.: But you're missing something profound. While no number of confirmations of a theory can prove it true, a single counter-example can falsify it. Thus, my philosophy of "critical rationalism" correctly asserts that all of our scientific knowledge is necessarily unconfirmed. No matter how many experiments fail to disprove quantum theory, you have no reason to believe that it will work in the next case. Induction is never valid; an idea is only "corroborated" by each instance it fails to be disproved.

R.P.F.: First, basic logic indicates that if any statement can be proven false (which you claim is possible), then its logical negation is necessarily proven true. Sure, if you take a very specific definition of what a "scientific theory" is, then it's easy to formulate things so that there is always an element of uncertainty. True, one can't confirm most theories in every case; but good theories are confirmed very well over time. From all of these confirmations, we can use induction to say that the theory is probably true.
K.P.: Absolutely not. Induction is never valid, logically. No matter how many falsification tests a theory passes, it only gains corroboration.

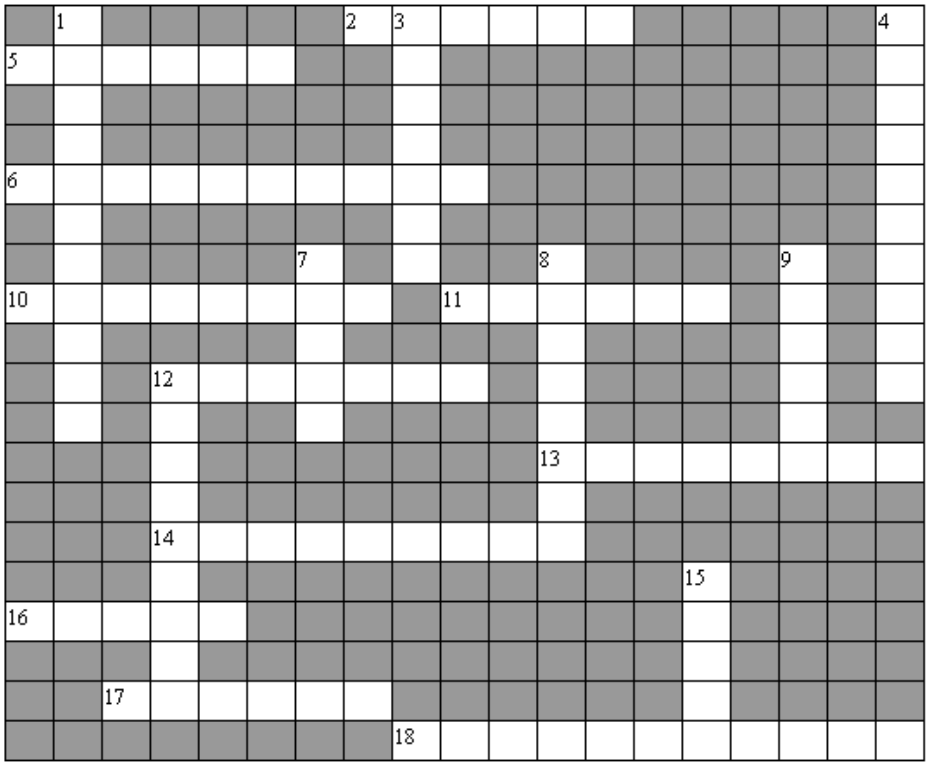
R.P.F.: Your emphasis on falsification is confusing and completely unnecessary. If someone theorizes that their pencil has rolled under the couch, no one would discover it and shout, "Fantastic, my 'pencil under the couch' theory has failed to be falsified in this instance." Physicists spend their time looking for the Higgs boson or a superconducting transition, not trying to disprove some awkwardly worded negative theory.
K.P.: Regardless of your objections, the only sensible statement that can be made with a general scientific theory is of the form, "If theory A is correct, then result B will be obtained." The theory itself can never be proven, only corroborated.

R.P.F.: Isn't that what the rest of the English speaking world calls "deduction"? All you've done is substituted the word "corroboration" for "confirmation" or "proof". It seems like the job of the philosopher is not to develop new ideas, as much as rephrase old ones in bizarre and convoluted language.
K.P.: …

Editor's note: Above views are expressed in the following works: Karl Popper's The Structure of Scientific Revolutions*, and its rebuttals in Martin Gardner's* Are Universes Thicker Than Blackberries*, and also in Richard Feynman's* The Meaning of It All*.*

PHYSICS CROSSWORD

compiled by Steven Hochman



ACROSS

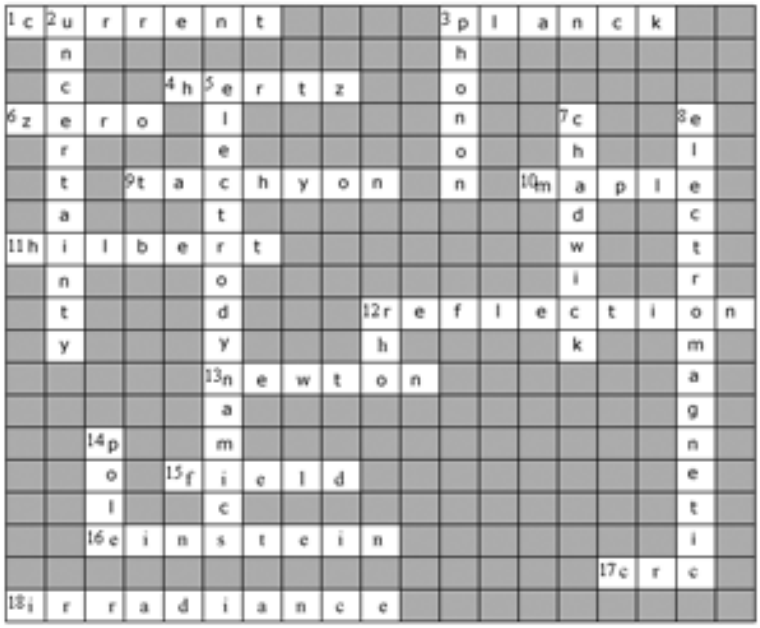
2. a volume of space essentially empty of matter
5. most common phase of matter
6. the distance between repeating units of a wave pattern
10. antimatter counterpart of the electron
11. position crossed with force
12. unit of electric charge
13. beyond red - think remote controls
14. the process of emitting energy in the form of waves or particles
16. a disturbance that propagates through matter as a pressure wave
17. a measurement of the gravitational force acting on an object
18. a measure of the amount of electric charge stored for a given electric potential

DOWN

1. short wavelength light, but longer than x-ray
3. instrument used to measure the flow of electric current in a circuit
4. the internal movement of currents within fluids
7. work done or energy required to exert a force of one newton for a distance of one metre
8. the force that opposes the relative motion or tendency of such motion of two surfaces in contact
9. a rotating neutron star
12. the property of wave-like states that enables them to exhibit interference
15. a device which allows electrical current to pass around another point in the circuit

Answer in next issue

Answers for Last Month



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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

PHUN

CONTINUED from FRONT

balloon, the balloon decreased in size because the molecules of air inside stopped moving so quickly. The decrease in temperature caused the gas's volume and pressure to decrease. When the balloon was lifted out, the gas warmed up and expanded to blow the balloon up again. Along the same lines, a pressure chamber caused shaving cream to more than quintuple in size.

Our work here was finished. The kids had an entertaining distraction from regular coursework, the teachers were happy, and our next class awaited us back at UF. Before going home, however, there was a little matter about how to dispose the left-over liquid nitrogen. We discovered that angular momentum is more useful than anticipated.