undergraduate physics newsletter

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YouTube & PHYSICS GAMES

by Harold Rodriguez

Let's face it: dramatic squirrels and the evolution of dance can lose its spark after a while. Luckily, YouTube has a ton of videos for us Physics majors to waste an afternoon on. Do a YouTube search for "Crayon Physics Deluxe". It's a physics puzzle game with graphics only a mother could love, and hang on a fridge. As the video shows, every object in the game is crudely drawn in Crayon, including your additions. If you draw a square, or a random shape, the shape falls as it were affected by gravity. If you draw a staircase, objects can tumble down them. Miraculously, if you draw two circles and a "shell" above them, the circles act as wheels--the program knew you drew a car! Moreover, drawing a big "golf club" and putting a dot in the middle creates a swinging "whacker". It's incredible to see how the engine interprets the physics of simple crayon shapes.

Now search "Phun 2d physics sandbox". This game is not "Crayony", but its the same type of deal. You can "freeze time" until everything is set up. If you draw and pile boxes on each other over uneven ground, they stand still - until you lower their coefficients of friction, and then they all slide off! With the help of ropes, springs, and hinges, you can create guns, projectiles, rag dolls, and more. The YouTube video is great because the user creates a simple piston which turns into a pellet shooter. The best part is "liquifying" an object, which replaces it by a bunch of tiny particles. This game is free! If you have an iPhone or unlocked iPod Touch, you can search for "iPhysics" and see how people hacked this to use a touchscreen.

Last but not least, search for "3000 barrel explosion". Some background: "Crysis" is probably the most realistic video game to date, as its game engine "CryENGINE2" and physics subsystem "CryPhysics" is pushing what a personal computer can do in terms of interactive simulations (i.e. realistic games). Anyway, the video shows someone in the game's accompanying editor, stacking 3000 explosive barrels, and performing many "physics experiments". For instance, pulling out the bottommost ones, or colliding himself into them as they realistically react. He also casts an "invisible" tornado, causing thousands of barrels to spin and collide. Remember, this is *not* calculated using the engine's particle physics system but its actual in-game physics. Lastly, he shoots the barrels, causing a huge chain reaction. The user notes he can't look directly into the blast "for more than 2 seconds... or [his] system will freeze". Has anyone tried to simulate the explosion of 3000 bombs before? This game does a good job. Have you ever wanted to simulate the collapse of a star? Someone has updated this concept and triggered your next YouTube search: "13265 barrel explosion".

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 to act as a source of information for opportunities and events in physics.

Visit Department

Coffee Time

Mondays & Tuesdays
3-3:45pm in NPB 2205
Professors, staff, and students are all invited!
Coffee, tea, hot cocoa, and cookies only 50 cents

what's UP
in this issue

Spotlight on Science
PHYSICS & CHEMISTRY

by Victor Albert

Throughout the last 100 years, science has fragmented into a mess of various disciplines, most of which overlap each other. This section attempts to clear up and organize the various scientific kingdoms and phyla one topic at a time. This is only an attempt, as the distinctions among the fields are always debatable. This month we deal with the interface between physics and chemistry.

The broad field of chemistry can be separated into two relatively distinct groups:

1. **Synthesis of chemicals**
This can include analytical chemistry and hands-on laboratory research. This field is closely related to chemical engineering in that engineers can use the reactions that scientists have developed in order to mass-produce chemicals.

2. **Structure and properties of matter**
includes aspects of biochemistry, theoretical chemistry (based on mathematical derivations), and inorganic (non-Carbon) chemistry. It also can include physical chemistry/chemical physics. The main difference between chemical physics and physical chemistry is that the respective field concentrates on the noun in its name, i.e., "physical chemistry" is the term that chemists are likely to use if their research is on the interface of physics and chemistry.

Of course, most of the sub-fields of chemistry can be classified in both groups. Anything that uses non-trivial computer power and that deals with chemistry can be classified as computational chemistry. Computational chemistry includes a broad range of both theoretical and experimental topics. For examples, both quantification of molecular properties using quantum mechanics and simulations describing the folding of proteins in cancer cells can be classified as computational chemistry.

The northeastern corner of the New Physics Building is the home of the Quantum Theory Project. This diverse group of excellent professors and students generally concentrates on computational chemistry. However, as previously stated, computational chemistry can involve both mathematically intensive and theoretical topics as well as the research areas related to more-applied disciplines, such as biochemistry or biological physics.

Next issue:
PHYSICS & BIOLOGY

ARTHUR C. CLARKE

by Larry Camarota

The world has just lost a futurist. Sir Arthur Charles Clarke. Born December 16, 1917, died March 19, 2008. You have probably heard of him. You may have read one of his books. You have definitely heard the theme to his movie. There is no doubt that he has helped to shape our vision of the future.

Arthur C. Clarke was born in England, but lived most of his life in Sri Lanka. During WWII, Clarke served in the Royal Air Force as a RADAR specialist. After the war, he earned his degree in mathematics and physics. His career as a science fiction writer took off after the war, and he soon became known as one of the 'Big Three' of science fiction. In 1973 he penned Clarke's law, which is that any sufficiently advanced technology is indistinguishable from magic. Think about this the next time you get on a computer. As a science fiction writer, he was best known for his work *2001: A Space Odyssey.*

Most of Clarke's contributions to the world have been in the area of space. He proposed the idea of geostationary telecommunication satellites in 1945, 10 years before they were developed. As a result, geostationary orbits are now called Clarke orbits. He was the CBS correspondent for the Apollo missions, and the command module of Apollo 13 was named 'Odyssey' in his honor. In 2001, the Mars Odyssey mission was also named in his honor. Clarke's name is attached to two writing awards, an asteroid, and a dinosaur (Serendipaceratops Arthurcclarkei).

Professor Spotlight

DR. KATIA MATCHEVA

by Steven Hochman

UPNews: Let's start from the beginning. Where are you from / where were you born?

Katia Matcheva: Plovdiv, Bulgaria.

UP: Where did you go to school?

KM: I got my undergraduate degree in Physics Engineering at the University of Plovdiv. My post-graduate studies there involved lasers, optics, and related technologies. After that, I went to Johns Hopkins to get a Ph.D. in Planetary Sciences.

UP: What did you do after you got your PhD?

KM: I worked for 2 years at the Observatory of Paris. After that I was a Postdoctoral Research Associate at Cornell. In 2005 I came to UF.

UP: What kind of research do you do?

KM: I study the dynamics of the planetary atmospheres. Presently, I am working on Jupiter and Saturn. The research deals with atmospheric waves: how they propagate; how they interact with the rest of the atmosphere. We are trying to detect their presence on other planets and then we analyze their properties (wavelength and frequency). We often compare the results with what we observe in the Earth's atmosphere. I am also interested in cloud physics. I am using spacecraft data from Cassini, Galileo and Voyager to understand the properties of the clouds on Jupiter and Saturn. The clouds are made of ice particles in some combination of ammonia and water ice, but the exact chemical composition remains elusive to the observations. Most likely the cloud particles are coated with some chemical compound that is present in small amounts in the atmosphere, but enough to make the chemical composition of the clouds difficult to identify.

UP: What do you do in your research?

KM: Mostly the research involves analyzing the data and then making a model to see how it all fits together.

UP: How complicated are these models? Do they require supercomputers?

KM: Most of the models I make require only my office computers to run. I write these in Fortran, and I use a Unix-based OS. I only use Windows for classes and presentations.

UP: How do you get the data?

KM: Sometimes probes are sent out to the planets and a weather package is sent down through the atmosphere. It measures different atmospheric parameters (temperature, density, pressure, wind, chemical composition …) as it falls. Unfortunately this doesn't happen very often since probes are expensive to send out. Because of this we rely mostly on remote sensing. To observe the planets we often use infrared rather than visible wavelengths. Heated objects emit photons at a wide range of wavelengths. The colder the object the longer the wavelengths at which the peak of the emission occurs. This is why, when we study the thermal emission coming from the planets, we need to go below the visible spectrum (which the sun peaks at) and rely on Infrared.

UP: Why doesn't Mercury have an atmosphere?

KM: Mercury's escape velocity is only half that of Earth's. The temperature on Mercury is very high, so the average kinetic energy of air molecules is much greater. Most of these particles reach escape velocity and leave. That combined with the impact of the solar wind has blown away most of Mercury's atmosphere.

UP: Which classes have you taught/will teach?

KM: I have taught PHY 3233 Electromagnetism and MET 1010 Introduction to Weather. Weather is a big class. There are about 150 undergraduates, mostly non-science majors. EM is very logical like most of physics. It is also somewhat abstract which makes a lot of the problems very interesting. I'll be teaching EM next fall as well. It's normal for professors to teach the same course 2 or 3 years in a row. It's practically inevitable that I will switch to teaching other classes and I look forward to that. In the near future I might be switching to lower level bigger classes like physics 1.

UP: What are your thoughts on teaching?

KM: Teaching is mostly about interaction with the students. This makes it challenging for me to stay concentrated on the "story line". A one-page outline of the lecture helps me a lot to stay on track and have a discussion at the same time. The most difficult times are, however, when nobody is asking any questions.

DEPARTMENT OF EDUCATION STUDY: *'PHYSICS IS HARD'*

by Alicia Swift

According to a surprising study released last week by the Department of Education, Physics is considered more difficult than English, Public Relations, and even Sports Management. "I have always feared this were true," said someone speaking on the basis of anonymity. "Now I understand why my parents cried when I switched from Electrical Engineering to Physics, and why they made me visit the shrink!" Upon learning of this astonishing result, another student said: "My best friend is a Philosophy major, and she used to make fun of me, saying I had picked the easiest major ever. Now I have proof!" Physics professors were excited at the news.

The study was released late last Wednesday, sending a shock wave through universities nationwide. Many great minds in other fields, including literature professors, were uncharacteristically unavailabe for comment - many literature majors were thrilled by this development. Non-physics professors at the University of Gerogia have closed down shop, and plan to spend the rest of their days raising pet bull dogs, and repeating the mantra "at least we made the tournament." Florida State University has lost their entire Classics and Creative Writing departments, and will no longer be able to run its circus school.

On a more positive note, the College of Liberal Arts and Sciences here at the University of Florida can now pay its physics professors an elevated salary, some estimating as high as $15,000 a year, all while reducing its debt. This is due to the shrinking English and History departments as students defect to physics majors for prestige, and other professors retire out of shame and boredom. We at UPnews formed a committee to ask the Dean of CLAS what he felt about this. The committee could not decide what to ask or who to ask.

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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

SPS ANNUAL **SPRING PICNIC**

by James Stankowicz

Pendula, orbits, and the Society Of Physics Students picnic, believe it or not, all share something in common. They all have a periodicity to them. It turns out we're quickly approaching the end (or beginning, if you wish) of one of them, namely the yearly SPS Picnic. From time immemorial, the SPS has hosted a Spring Picnic at Lake Wauburg. The idea is to promote interaction among the professors, faculty, graduate, and undergraduate students outside the homely walls of NPB.

You may have noticed throughout the year that SPS is big on giving its members free food. This event more than any other highlights this giving characteristic. Professors and students use humanity's nearly perfected control over fire to create astoundingly delicious hamburgers, hotdogs, and other grill-related concoctions. Chips abound, cookies run a mock, and there are enough scrumptious beverages to keep a beached killer whale hydrated for weeks.

There's even non-food related fun. Frisbees whiz about, footballs and volleyballs hit the careless in the head, and, of course, the faculty gets dismantled by the superior students in the yearly softball game.

Of course it'd be impossible to have all play and no work, so SPS uses this opportunity to induct qualifying students done with their third semester or more into Sigma Pi Sigma, the SPS Honors Society. The pin, pen, diploma, card, and lifelong membership are more than reason enough to pursue a degree in physics.

As a final selling point I must mention: this is all funded for and planned by SPS. All you have to do to enjoy the (in order of importance) free food, company, and fun, is show up!

This year the picnic is
This Saturday,
April 5th
Lake Wauburg South
Pavilion #2
12pm – 4pm
The faculty vs. student softball game will be at 2:30pm
Free hamburgers, hotdogs, veggie options, and more!
Don't miss it!
If you need a ride e-mail sps@phys.ufl.edu