Arkansas Physics Times, May 2011

Society of Physics Students (American Institute of Physics)

Arkansas Physics Times
'THE TRUTH SHALL MAKE YE FRET'

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Amish: Technological Gurus?

Nathanael Franks

Over spring break I stepped into a time machine to visit the past. Or was it the future? The sight of solar panels on homes, houses powered by wind energy, and eco-friendly vehicles rolling down the paved roads gave me the impression I was in Al Gore's wonderland. In reality, I was witnessing the Amish notoriously known for being behind the times. Far from it, the Amish may be more technologically savvy and adaptive than the average American Joe.

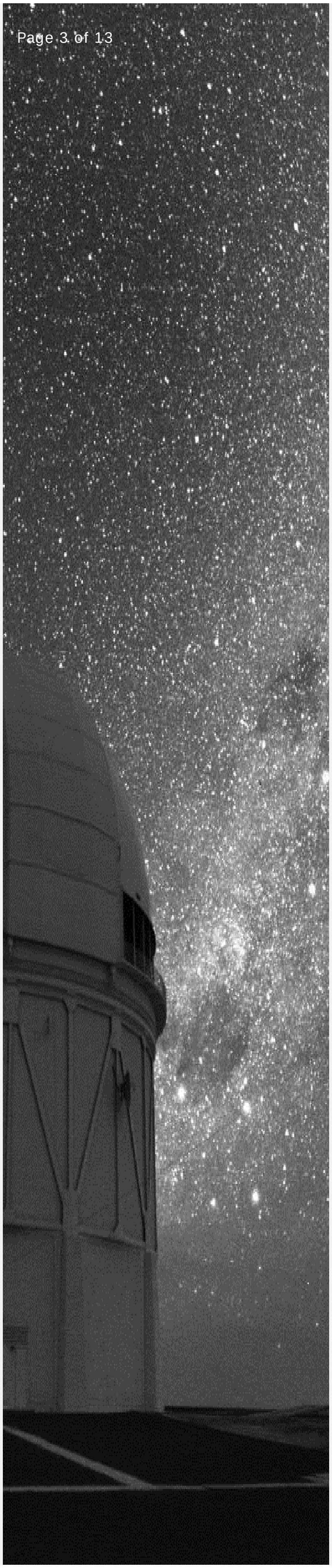
The Amish first came to the USA in the 18th Century. To outsiders, they still live in the 18th Century. Characterized by their use of horse-drawn buggies, Pennsylvania Dutch (an Anglicized version of German), ban on electricity, ability to raise a barn in a day, conservative dress (consisting of suspenders and brimmed hats for men and neck to ankle dresses and a head covering for women), the Amish draw many stares from the "English", as many Amish still refer to modern day Americans. Named after the Swiss biblical theologian Jacob Amman of the late 17th Century, the Amish have faithfully retained their spirituality and culture despite the influx of modern-day conveniences. The Amish certainly don't bob their head to rock n' roll, text their friends the latest buzz, or watch the Final Four on ESPN, but they are certainly in on the mix when it comes to technology that enables them to be able to compete with the market and thus economically retain their lifestyle. This takes the form of suction milking machines for the dairymen, pneumatic power tools for woodworkers, steel rimmed tractors for farmers, and battery-powered headlights for everyone. Due to the genetic drift and the founder effect, the Amish joke that rumor has it that they are born with retractable light bulbs on their foreheads.

Indeed, the Amish are not "one size fits all" when it comes to technology. Many Old Order Amish communities would not allow any of the aforementioned labor-saving conveniences. Even in the same village one family may have a refrigerator and freezer while the neighbor has saved blocks of ice from the winter to cool perishable food during the summer. Some of the Amish mount solar panels on their south facing roof to charge their 12 Volt batteries, and almost all have small wind mills on their farms to pump their water. They are united, however, in their priority of community over convenience. If a community feels a new device causes them to steer away from their proximity to God, family, and friends, the device is outlawed in their *Ordnung*, a set of rules. Naturally, differences in opinion about such gadgets often divide communities and cause offshoot settlements elsewhere. Such a case prompted the birth of a more conservative Amish society in Buchanan County, Iowa, when the Kalona church decided to have a phone. For these reasons, among others, the Amish have spread around the country.

Although the Amish only attend school until the eighth grade, they are by no means uneducated. The end of formal schooling does not mark one's end of learning. Books fill many of the homes and reading is much of their entertainment and free time. The Amish run their own schools, concentrate on the classical three R's (Readin', „Ritin' and „Rithmatic), and have a knack for imparting practical knowledge. A math problem, for example, may involve finding the maximum number of gallons of milk a large oval storage container can hold. One suggestion was to see how many gallon jugs of water it would take! This method would have taken hours! Another suggestion was to calculate the volume of the cylindrical section ($V = \pi r^2 h$) and then add the volumes of the two circular half sections ($V = \frac{4}{3}\pi r^3$). Problem solved. One class project consisted of constructing an intricate purple martin bird house with a pulley system for raising and lowering it; creating masters of rigging.

As an unfamiliar face in their community, I was asked many questions about my lifestyle and activities, such as sky diving. I told them I jumped out of the plane at 13,000 ft. (higher than most mountains!) and accelerated until I reached my terminal velocity at roughly 120mph. After free-falling for a minute or so the altimeter read 2,600 ft, signaling that I should probably pull my parachute. They then collectively reckoned in their heads that I would have about 15 seconds to ponder my doom if my chute failed to deploy. The actual value: ~15.4 seconds. They would have aced University Physics 1! Although it may not appear at first glance that the Amish are in tune with the world around them, I would disagree. The point is often made that the Amish are comfortable with their lifestyle because they simply don't know what they are missing out on. This is far from the truth. The ones with whom I communicated were familiar with GPS, Twitter, Amazon, and Facebook. I've yet to see one actually chatting on cyberspace though! They simply prefer eye to eye conversation, and when such is not physically possible, they often have a communal telephone hut at the end of their country road.

When my spring break came to an end I metaphorically stepped out of the time machine, visiting the past and future, and I saw the present in a whole new light. There I fell in love with people just living the simple life as they had for centuries; adapting to modern society only when needed. With only one week working for the Amish I feel my understanding of technology and the laws of nature has increased as one apple seed gives rise to a thousand apples. Take everything in moderation including technology. I've never seen such genuinely happy people. When I think of them, I can't help but smile widely myself!



Dr. Lieber's Memoirs

James Sloan, Derrek Wilson, & Dr. Michael Lieber

Dr. Michael Lieber graduated with his Ph.D. from Harvard in 1967 under advisor Nobel laureate Dr. Julian Schwinger. Following three years as a research scientist and adjunct assistant professor at NYU, Dr. Lieber, a lifelong NYC area resident at that point, took a position at the University of Arkansas in 1970. He is now retiring after 41 years as an integral member of the department and valuable educator to many.

How has the department changed since you arrived?

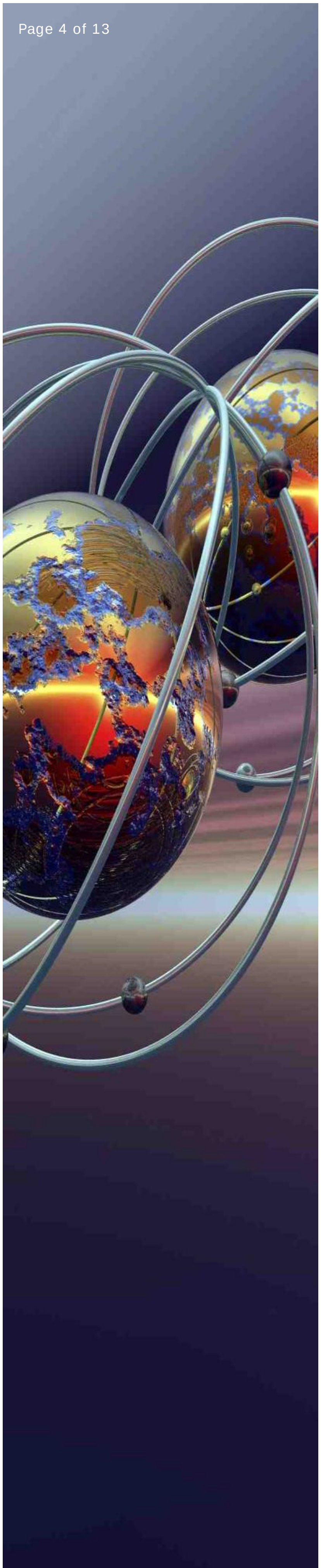
It is much bigger now. We had only 11 professors, many involved with atomic physics. Prof. Hughes had a particle accelerator in the basement with which he was studying particle collisions. Prof. Richardson was doing some beautiful experiments like measuring the Lamb shift in helium. I joined Profs. Chan and Schwartz, who were atomic theorists. There was only one other theorist: Prof. Hobson was working on statistical mechanics.

Today we have almost twice as many faculty, with emphasis on optics and condensed matter. We didn't have any post-docs in the early days, and now we have many. There are many more graduate and undergraduate students than when I arrived in Fayetteville. I should also mention that the building is ever so much nicer now due to the efforts of Prof. Gupta. In 1970 it looked like a factory building.

What is your favorite memory of a class? What was your favorite class to teach?

I've enjoyed almost every class I've taught. Teaching has been very rewarding. I find students in upper level classes more interested and engaged with the material. Today, technology has both enhanced but also complicated teaching. Instead of learning how to solve assigned problems, students can copy solutions found on-line. They are really cheating themselves because they don't learn anything that way.

I've taught several honors colloquia, including "Cosmology" and "The Impact of Quantum Mechanics on 20th Century Thought." Colloquia are fun because of their special topics, the freedom in their content, and the excellence of the students. But they were also challenging because there was a mix of mathematical preparation of the students – the physics and math majors wanted to see the equations and the humanities majors were terrified of them.



You were involved with an effort to build a neutrino detector in Arkansas. Would you give a brief overview of this project?

The project was called GRANDE- the Gamma Ray and Neutrino Detector. Had it been completed, it would have been the first neutrino "telescope" that could locate astronomical neutrino sources within one degree of accuracy in the sky. The telescope would look down, searching for neutrinos that were passing through the whole earth!

Several sites in the US were studied by a group from the University of California at Irvine, led by the late Nobel laureate, Fred Reines, who was the first to detect neutrinos. They chose a barite mine near Magnet Cove, Arkansas as the best location for GRANDE. The initial proposal was for $30 million, so the NSF suggested the US Department of Energy for funding. Over several years, the Department of Energy kept requesting reductions of the project until it became unworkable. It also became entangled in a dispute over whether it was an astrophysics project, traditionally funded by NSF, or a particle physics project, traditionally funded by DOE. After five years, the project was aborted. It took a long time, but it was a lot of fun and I met a lot of interesting people.

What was the most rewarding accomplishment in your research career?

My Ph.D. thesis is still my most cited work ["O (4) Symmetry of the Hydrogen Atom and the Lamb Shift"]. When I published the paper, I did not expect experimentalists to be able to test the predictions. It turns out that they were later tested and confirmed, to great accuracy. The predictions were made to a greater number of digits than I had originally published, and the experiments were consistent with my calculations. My work on the quantum mechanical 3-body problem is continuously rediscovered.

Who is your favorite physicist or scientist?

Einstein. As he was for many, he was an early hero. In many ways he was like the grandfather I never had. Both of mine had died before my birth. My Ph.D. advisor, Julian Schwinger, was a role model. Students always left his lectures with a feeling of clear understanding, though later review revealed that this was not always the case. His lectures seemed so perfectly organized and presented. My post-doc advisor at NYU, Dr. Larry Spruch, was very generous, kind, and helpful. He was a great guy. My father was a high-school drop-out, but Larry was like I imagined my father would have been, had he been able to continue his education. I also very much admired Fred Reines.

What advice do you have for students planning a career in physics?

Besides don't? (Chuckle). You have to have the fire in the belly. You have to want it. In today's world, I would recommend entering a department for graduate school with diversity in research interests. Just as many undergraduate students change their majors multiple times before finding their field, many graduate students change their research field of interest. It is good to have options at your graduate department.

What's in Store – Physical Therapy Path

Holly Jackson, Spring 2010 Physics Department Graduate

Holly demonstrating the "Human Anatomy: On Hand" Study Method

Name: Holly Jackson

Program: Mayo School of Health Sciences Doctor of Physical Therapy Program

Summary: I have spent the past year in Rochester, MN at the Mayo School of Health Sciences. This involves an intensive study of human movement. Through the Mayo Clinic, we are able to explore the practical applications of our studies in different areas and collaborate with other members of the health care profession. We also have access to some of the newest techniques and technology in the field. Next year I will be part of a study testing the reliability of electromyography.

To contact Holly:
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What's in Store – Physics Path

Rachel Lee, Spring 2010 Physics Department Graduate

Since graduating, I've been kept pretty busy at the University of Maryland. At the end of this semester, I will have completed six classes (Classical Mechanics, Mathematical Methods, EM, Statistical Mechanics, and two Quantum courses). I have about 40 people in my entering class of graduate students. We spend a lot of time together working on homework in our graduate "lounge."

Living so close to Washington D.C. has been a lot fun. I have been able to go to events like the USA Science and Engineering Festival (where I had my photo taken with Bill Nye the Science Guy!) and the Rally to Restore Sanity. I saw the cherry blossoms bloom this year, and there are always the monuments and the Smithsonians. Did you know there is an Einstein statue off to the side of the Lincoln Memorial?

I have recently started working with Dr. Losert of the UMD physics department on a research project for this summer. I'll be developing a model for the collective movement of cells. I hope to spend two days a week at the National Institutes of Health working with the cells directly; the rest of my time will be spent analyzing movies of cells and developing the model. The information we will be gathering has applications in many areas, including wound healing and cancer treatment.

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Sigma Pi Sigma Induction and Departmental Scholarship Recognition Colloquium

Dr. John Stewart

This year marked the third year student's have been inducted into Sigma Pi Sigma since the tradition was reinstated. A picture of the new inductees is shown below. Pardon the darkness of the image; next year we will turn off the projector first.

Front Row (left to right): Aisha Mahmoud, Robert Bell, Joseph Courtney, AJ Salois, James Morris, Andrew Bobel, Caleb Wright.
Back Row: Nathan Willems, Dr. Stewart, Yusuke Hirono, Thomas Rembert, William Lewis, James Sloan, Clint Mash.

Also honored were departmental scholarship winners. Departmental scholarship, NSF Robert Noyce scholarships, and NSF ARKPHYS S-STEM scholarship recipients were honored. From left to right: Scott Flescher, Phillip Keil, Juan Aguilar, Jesse Evans, Jeremy Massey, Wes Clawson, Kristin Watson, Joseph Courtney, William Lewis, AJ Salois, Liz Brittain, Andrew Bobel, Derrek Wilson, Robert Adams, and Doug Bohlman.

Physics Fun Fair

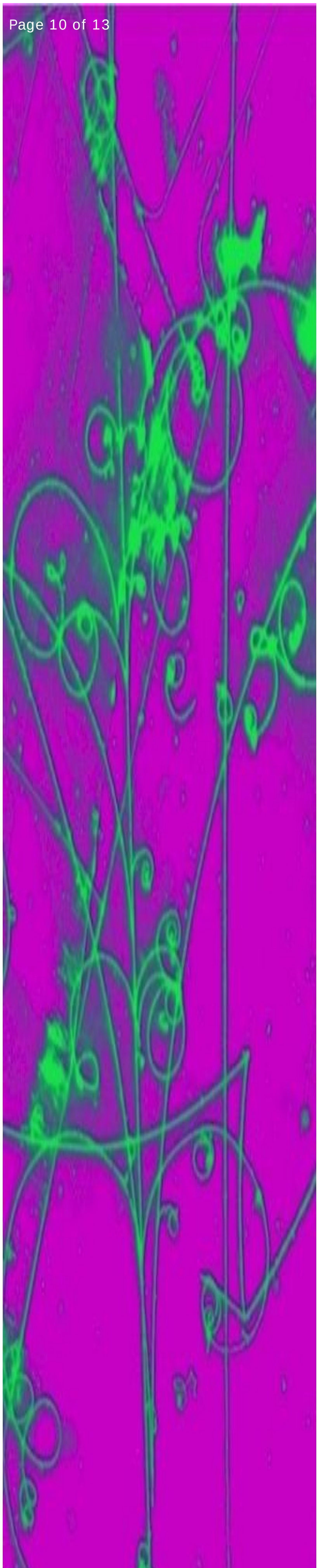
Honors Convocation Spring 2011

Dr. John Stewart

Many students successfully completed honors theses and were honored at the yearly Honors Convocation. In the picture below, from left to right James Sloan, physics double major defended thesis in biology (Summa Cum Laude), Omar Salem, physics double major defended thesis in chemistry (Summa Cum Laude), Kristin Watson (Summa Cum Laude), Joseph Courtney, defended theses in both physics (Magna Cum Laude) and chemistry (Magna Cum Laude) within 24 hours of one another (a record), Robert Bell (Magna Cum Laude). Not shown, Jon Conley (Cum Laude) and Andrew Martin (Summa Cum Laude).

The physics department cleaned up at the national award ceremony. We were easily the most decorated department for its size. In the picture below, front row; (left to right) AJ Salois – Smithsonian Internship, Aisha Mahmoud (Goldwater), Lorie Hess (PhysTECNoyce Scholarship), Dr. Vyas. Back row; Dilawer Singh (HHMI), Mark Bush (HHMI), James Sloan (Fulbright Alternate), Dr. Oliver, Andrew Bobel (Cornell REU), Dr. Lacy, Dr. Salamo, Dr. G. Stewart, Dr. Singh, William Lewis (Goldwater), Dr. J. Stewart, Mathias Bellaiche (HHMI).

Not shown. Elaine Christman (NSF Graduate Fellowship), Scotty Bobbitt (NSF Graduate Fellowship), Joseph Courtney (NSF Graduate Fellowship), Thomas Rembert (MIT REU), Thomas Ivanoff (Nebraska REU) and many SURF grant winners.



Riemannian Geometry and its Effect on Physics

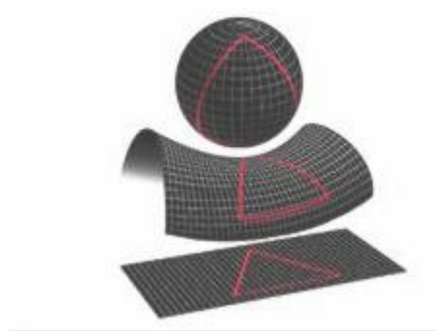
Wesley Clawson

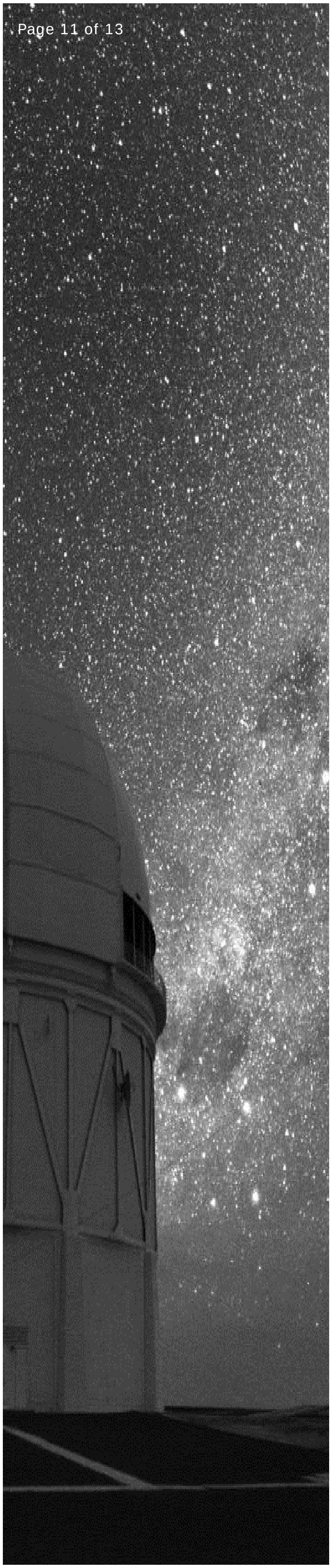
Albert Einstein developed one of the greatest theories in physics - the theory of general relativity. Knowing that Euclidean geometry would never sufficiently fit his description of space Einstein went looking for another way. "If all [accelerated] systems are equivalent, then Euclidean geometry cannot hold in all of them. To throw out geometry and keep [physical] laws is equivalent to describing thoughts without words. We must search for words before we can express thoughts."[1] Bernhard Riemann's theory, Riemannian geometry, was the system that Einstein called upon to develop his ideas of space mathematically.

Since *Euclid's Elements,* published about 300 BC, there has been a wide debate over Euclid's 5th postulate, the parallel line postulate, which states "If a line segment intersects two straight lines forming two interior angles on the same side that sum to less than two right angles, then the two lines, if extended indefinitely, meet on that side on which the angles sum to less than two right angles. "[1].

Hyperbolic geometry became a realized geometry around 1830 after both János Bolyai and Nikolai Ivanovich Lobachevsky independently published papers proving that hyperbolic geometry was a possibility (causing hyperbolic geometry to be formally called Bolyai-Lobachevsky geometry). In 1854 Bernhard Riemann lectured on his ideas about treating geometry as a space of points called manifolds and a way of measuring distances along a curved space using these manifolds. Riemannian geometry is considered a differential geometry, or a geometry that uses both integral and differentiable calculus to study the geometry on a plane or curved surface. Riemann's idea of manifolds is what makes the idea of studying a curved surface possible. Manifolds are a space in which if you zoom in far enough on a curved surface the surface resembles Euclidean space.

Riemannian geometry in particular deals with smooth manifolds, which differ from regular manifolds in the same way curves differ from smooth curves –they are similar enough to a linear space to have calculus applied to them. This new geometry allows one to take an n-dimensional curved space and view it as a changing Euclidean space; varying smoothly from point to point. With this new way of viewing space it was only a matter of time before something radical was done.





Einstein would have never discovered this way of thinking if it were not for his classmate and friend, Marcel Grossmann. Einstein went to Zurich and asked Grossmann to find a geometry that would help him in his theoretical quest and the next day Grossman presented Einstein with Riemannian geometry. Although Grossmann warned Einstein that this type of mathematics isn't something that physicists should meddle in, and they both searched for alternative ways, they concluded that Riemannian geometry was the only solution.

General Relativity is based on the concepts of manifolds, discussed earlier, that represent the four dimensional spacetime. Riemannian Geometry gave Einstein a way to measure these manifolds. Einstein knew the most important feature of General Relativity was that it should be the same for every reference frame; meaning that the structures he used needed to be independent of a coordinate system while still having an independent existence. These structures are called tensors. However the mathematics of tensor calculus is complex and deep.

Tensors allowed Einstein to apply calculus to a spacetime now measureable with Riemannian geometry. Once General Relativity had become a sound theory, it took many more years to completely validate it with experimentation. From then on the world of physics was changed forever, with General Relativity being the flagship for discovery for many years to come. Riemann's contribution to mathematics and geometry and Grossmann's knowledge of that geometry made it possible for Einstein to model spacetime mathematically; fulfilling his vision.

The real brilliance in this new geometry is that it not only holds in three-dimensional space, but also in any number of dimensions. Einstein took the ideas of these manifolds and their infinite dimensions and applied it to his physics and developed the four-dimensional space-time geometry that general relativity is based.

~~Sources:~~

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2. Ishiwara, J. "Einstein." Lecture. Tokyo-Tosho, Tokyo. 2011. Web.
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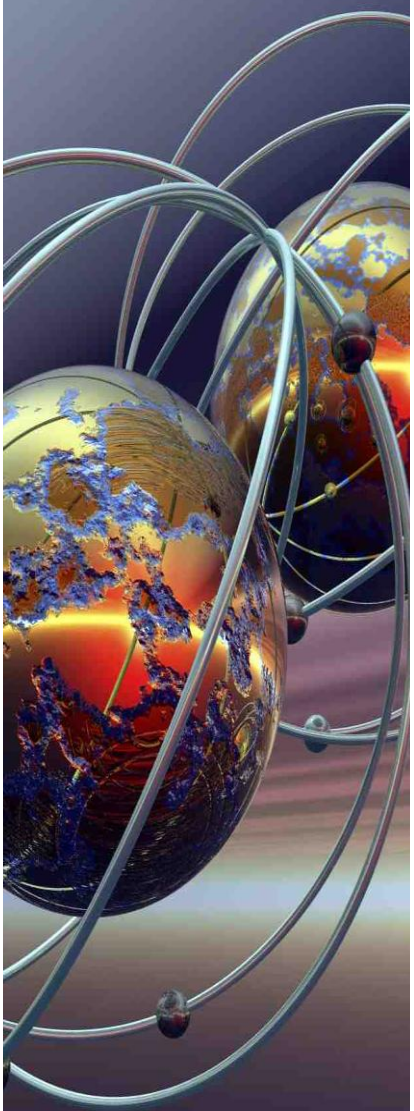


Graduation

Dr. John Stewart

The spring of 2011 produced another happy and successful crop of physics graduates. Robert Bell will attend medical school at UAMS. Joseph Courtney, double major chemistry, will attend graduate school at the University of Illinois in Chemistry (ranked 6th). John Ferguson plans to attend law school. Omar Salem, double major in chemistry, will attend medical school at UAMS. Jon Conley, double major in mechanical engineering, will attend graduate school in Mechanical Engineering at the University of Maryland. Yusuke Hirono will attend graduate school in physics at the University of Arkansas after turning down the University of Colorado-Boulder. Andrew Martin, double major in computer science, will enter graduate school at University of Southern California (USC), a top program, in Computer Science specializing in video game design. Kristin Watson, double major in chemistry, will attend graduate school in physics at the University of Chicago. Caleb Wright will attend graduate school in physics at Washington University in St. Louis. Elaine Christman will attend graduate school in physics at the University of Illinois. James Sloan, Fulbright Alternate, is awaiting the final decision on the Fulbright before making additional plans.. Clint Mash will attend graduate school in electrical engineering at the University of Arkansas. James Morris, double major in computer engineering, will attend graduate school in computer science at Rensselaer Polytechnic University. Rachel McClintok (BA) plans to farm in Ireland. Lorie Hess, Scott Flescher (BA), and Christine Audo will enter the MAT program in preparation for becoming teachers. Tunji Thomas plans to return to Africa and seek a job in industry. Alex Kareev will attend graduate school in the microEP program at the University of Arkansas. Ever Cavender (BA), Jonathan Gibson, and Alex Browning (BA) will work in industry. Nestor Figuroa will attend graduate school at the University of Arkansas in engineering.

Dr. Oliver and Stewart, Scott Flescher, Christine Audo, Clint Mash, Kristin Watson, and John Fergeson after Fulbright graduation.

Master Qudoku

C	E	I		O	Q		(1)	A	N			M	U	
T	R	A				L	P	Q	(2)	U	C		E	
M	L	V	(3)					O	Q	R	T	N	P	
Y				V	T	N	M			A			(4)	
Q	(5)				A	R			P		E			
	T	P		L		C		N	R	Y	Q	(6)		I
E	O	C	M		Y		A	L	(7)				N	
			V	E	(8)					T	M			
(9)	Y					P	V		I		L	E	T	U
L			O	I	R	T	(10)	Y		N		P	C	
		(11)	Q		O			V	A					T
				R	(12)		Y	P	T	C				M
	A	Q	E	N	M	O				(13)		C	V	P
	C		T	P		(14)	Q	I				A	Y	N
	V	T			I	M			L	Q		U	(15)	E

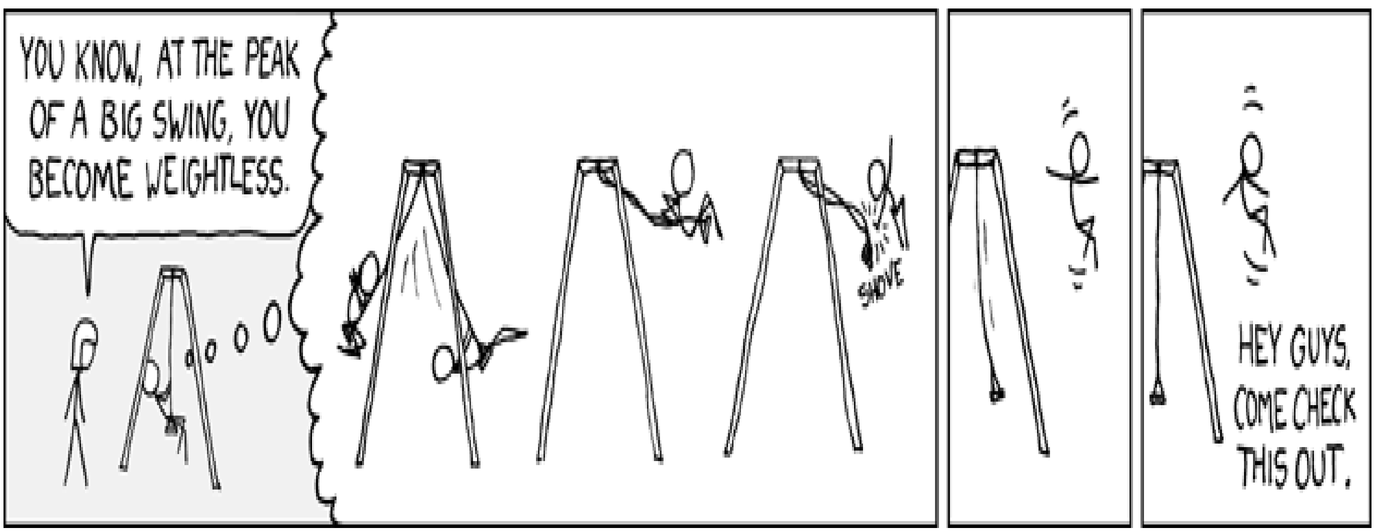
3	6	2	8	9	15	9	1	13	7	14	12	11
10	5	13	4	10	14							

CAMP VENTRILOQUY

15x15 Qudoku Word Puzzle
Each row, column, 3x5 rectangle and group of circled squares contain the letters in the anagram exactly once
Copy letters in circled cells to the matching numbered cell in the quote

Puzzle provided by:
http://magicwordsquare.blogspot.com/search/label/15x15

For answer see second puzzle:
http://magicwordsquare.blogspot.com/2008/10/solutions-to-thursdays-word-sudoku_10.html



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