1-1-2011

Arkansas Physics Times, January 2011

Society of Physics Students (American Institute of Physics)

Arkansas Physics Times
'THE TRUTH SHALL MAKE YE FRET'

Individual Highlights:

Wanted: Antimatter

Kristin Kovach

For nearly every known particle of matter in the universe there exists an antimatter counterpart. Protons have antiprotons, electrons have antielectrons (or positrons), neutrons have antineutrons, and etc... Since the late 1920s, physicists have been studying these antiparticles, and only recently, in 1995, was the first antiatom created in the form of antihydrogen.

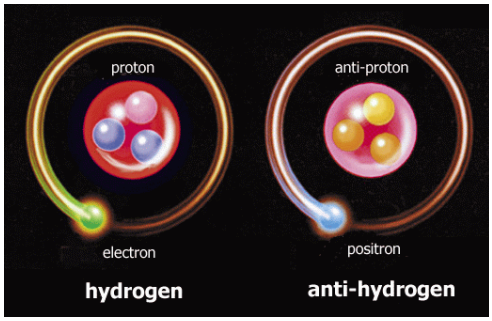
However, studying antihydrogen atoms posed quite a challenge, since matter and antimatter annihilate one another upon contact. Not only does the antimatter only exist for *billionths* of a second, but most of the antimatter created is too "hot" to be captured, that is, too energetic. With the problems identified, physicists began to develop a trap that could suspend the antimatter in a vacuum as well as slow it down enough to be captured.

Antiparticles have been around for decades, and they are contained and somewhat controlled through their very strong charges using electric and magnetic fields. However, an antihydrogen atom is neutral in charge, and thus cannot be contained using an electric field. Luckily, these antihydrogen atoms, like their hydrogen counterparts, have a magnetic moment. An extremely strong magnet could hold an antihydrogen atom within its magnetic field.

With this theory in mind, physicists at CERN used a decelerator, which can slow antimatter down by making it more "cold" and therefore more controllable, on November 17, 2010 to mix millions of antiprotons and positrons together in a vacuum. With an extremely strong magnet, they captured 38 antihydrogen atoms for two-tenths of a second before releasing them.

For the first time, physicists have captured antimatter and held it for a (relatively) long time. From here, physicists hope to capture more antimatter for longer periods, so that they can study it in depth for the first time. Hopefully, this will help solve one of the mysteries of the origin of our universe in the process. The mystery being; why matter and not antimatter seems to have won as the most prominent ingredient in our universe.

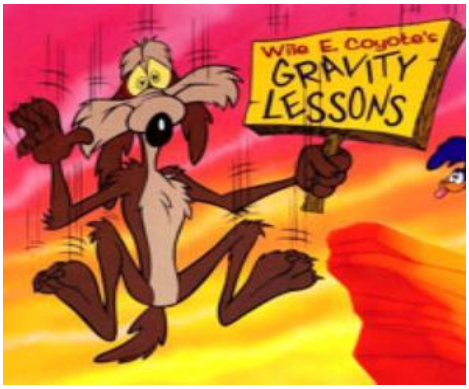
For more information:
http://press.web.cern.ch/livefromcern/antimatter/
http://www.livescience.com/strangenews/antimatter-trap-cern-physics-101206.html



The World of Cartoon Physics

Joshua Bacon

What is it that makes a cartoon feel like it's not a cartoon? How is it we can watch a cartoon and forget that we're watching a cartoon? The answer may surprise you. When watching a cartoon, where animators have left out "cartoon physics", showing the physics we encounter in everyday life we find it easier to be drawn into the story line. This occurs not only for cartoons, but for any movie or television program. In my research of this topic I watched countless shows and movies.

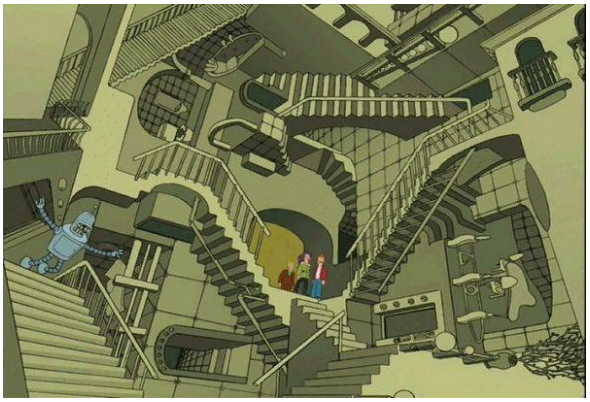


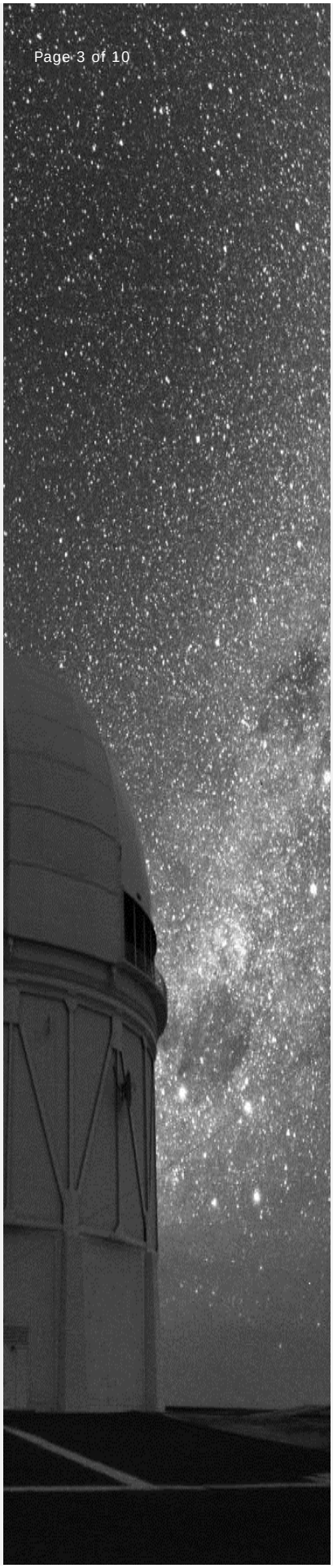
I found that programs oriented towards children and younger audiences were full of physical flaws. The most blatant flaw I noticed was that objects did not obey the law of gravity. I also considered several of the blockbuster films produced in the last few decades. The consistent aspect I found was that the way the characters and objects interacted was very realistic. Not only was the physics realistic, but it was also consistently realistic throughout the film. Consistent and realistic physical interactions on screen allow the viewer to become part of the world being created. This is one of the reasons behind Pixar's success – they have hired several people with physics backgrounds to be animators and layout artists.

Now that we have this knowledge that good physics leads to good movies and TV, what should we do with it? The answer is simple. We should use this to create better programming for children and better films. Many people spend too much time in the virtual world of television and not in the real world, but it is real world experiences that create a better sense of physics. If we bring better physics to their world, they will be better prepared for science courses and better prepared to tackle the world around them.

Pixar:
Ed Catmull - Current President, PhD Physics
Tony Derose - Currently leading a group of 6 research physicists at Pixar, BS Physics, PhD Computer Science

Futurama:
David X. Cohen- BS Physics, PhD Mathematics
Ken Keeler - PhD Mathematics
Jeff Westbrook – PhD Computer Science





Student Astronomical Society has Lift-off

Cameron Cook

In the amazing cartoon-world of *Hey Arnold* it's been 76 years, but Grandpa remembers the sight just like it was yesterday. As a young boy, he'd seen Halley's Comet with his old man, and now he wanted to share it with his grandson. Eager to partake in the viewing, Arnold tries desperately to see the icy rock. The most prominent feature of the object is the tail followed by the coma, formed from the evaporation of ice and the ionization of dust. When the comet comes within viewing distance in the last minutes of the episode, Arnold yells out "Hey everyone! Turn out your lights!" Nothing. Then… one after another… room lights go out, then the street lights, and finally a giant light illuminating the water tower turns off. Perfect. One look into the telescope and he sees a stunning Halley's Comet making its voyage past Earth.

Unfortunately, this episode of *Hey Arnold* doesn't mirror what happens in reality. Astronomers constantly fight unnecessary light to see the beauty of space. Sometimes they must help each other. Other times, they simply prefer to mingle and have fun. In times like this, it's nice to have some sort of fellowship. This year the Student Astronomical Society (SAS) got off to a great start with the joint effort of Outreach Officer Ameé Salois, Treasurer Kim Zoldak, and President Cameron Cook.

In September SAS hosted its first star party on the roof of Kimpel. Thanks to Dr. Claud Lacy who provided access to the roof as well as his 10" Meade LX200 SCT Telescope and also Kim for providing the Space Center's 10" Dobsonian Reflector, the partygoers had plenty of access to the night sky. There was a great turnout and, despite the city lights and atmospheric haze, we were able to grab some great views of the waxing gibbous moon and Jupiter with its four moons. There were even some newcomers to astronomy. A few people on the street joined us on the roof to see what all the excitement was about, and they turned out to be potential freshman to the University. Hopefully, they'll be joining the organization next year. Overall, everyone seemed to enjoy the event.

A couple months later, I got a phone call from Kim. She sounded super excited. Turns out she received a call from Scott Roberts, manager of Explore Scientific and he's interested in working with SAS to increase public outreach. Scott is close friends with David Levy, co-discoverer of the Shoemaker-Levy comet, and Buzz Aldrin. One week later, members of SAS sat in the Explore Scientific conference room in Bentonville. There was a telescope outside, but the main focus was getting to know Scott and for him to get to know us. We also participated in an amazing video-conference with David Levy.

Tons of excitement follows; with the new friendship of Explore Scientific SAS can reach more people and become more involved in the community. Now, the members have the spring semester to look forward to. There should be many more meetings with Scott Roberts and also a trip to Devil's Den for a more outdoorsy and secluded star party for members. See you next semester!

Astronomy Across Borders

Aisha Mahmoud

The Dr. Remeis Observatory in Bamberg, Germany distributed several postcards promoting the research conducted at their institution. The fronts of the cards have gorgeous color images of individual galaxies and the backs have information on the project with a link to the observatory's website. I took more than my fair share of cards and have since given one to each of the people that I have come to know during my travels.

The reaction of one person in particular really made me appreciate that I grabbed the cards. While I was visiting the Saadian Tombs in Marrakesh, Morocco, I hired a Berber driver for all five days. He was adorable and enthusiastic, although his poor English and my difficulty understanding the Moroccan Arabic dialect made communication very difficult. Nonetheless, we ate lunch together each day and were able to carry small conversations. I told him about my bizarre ethnic background and that I was traveling to Morocco for holidays while working as an astronomer for a German observatory. He said "*enta shatra!*", *"smart lady!"*, I smiled and blushed. He wrote down the Berber alphabet in my notebook and taught me several words, as he practiced his English.

During our first lunch together, I gave him one of the postcards to help explain what an "astronomer" is. The card had the image of a gorgeous spiral galaxy dancing on the front and I wrote my name on the back. He seemed fascinated as he smiled and laughed and happily stashed the card into his long-sleeved shirt pocket.

It was impossible to explain the details of the image and the reality that we live in a similar galaxy called the Milky Way, but I didn't really need to say anything... he was thrilled! Every time I looked back at him, after marveling at another ancient Moroccan building, I found him admiring the image of the distant galaxy. Wonderful!

No matter what part of this earth we happened to be born in, or what language we were taught to speak by our parents, we all see the moon rise and fall each day and we all share the wonder of bright stars in the night sky.

Unfortunately, I am out of those beautiful postcards, so now I am left to using hand gestures and drawings to explain the universe to people I meet that don't speak English (or Spanish).

Shakespeare's Science

AJ Salois

From the beginning of human history celestial events have taken an important role of inspiration through its many mysteries. An increased understanding of the stars has allowed astrological beliefs to become less common in our modern day society. However, for many Elizabethans daily activities and decisions were determined by the positioning of celestial bodies, regularly using astrological techniques in lieu of astronomical understanding. Shakespearean plays portray the Elizabethan mindset and the way in which it affected the society. Gloucester, from *King Lear*, is a strong believer in the effects of the orbs. In act 1.2 Gloucester remarks, "These late eclipses in the sun and moon portend no good to us...Love cools, friendship falls off, brothers divide; in cities, mutinies; in countries, discord; in palaces, treason; and the bond cracked twixt son and father." (Bevington)

Elizabethan understanding of the Heavens and the objects held within it take a key role in the understanding of Nature and the perceived actions or inactions of the gods in Shakespearean plays. With little understanding of the physical reasons behind the motions of the heavens it became easy to choose the heavens as the habitat of the gods who remain as mysterious as the heavens. This allows planetary influences to be blamed for the degradation of familial relations rather than the inadequacies of the family members themselves. Constellations and planets are used to explain the obviously immoral actions of moral people.

A number of amazing astronomical events occurred within a short time period surrounding the rise of Shakespeare. In 1572 a star exploded (SN 1572), and its explosion was so brilliant that it could be seen vividly in the night sky. Tycho Brahe observed this explosion and began to wonder how a new star could form if the stars were set permanently in the sky. The idea of a sphere of fixed stars beyond the planets began to crumble (Levy 65).

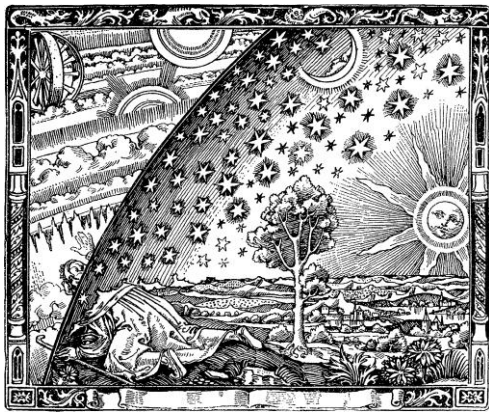


Figure 1: The Flammarion Woodcut

According to historical records documenting eclipses, England did not witness any eclipses between 1547 and 1598. Then in 1601 three major solar eclipses were seen in England within a short time period (Levy 67). After so many years without any eclipses, a succession of three such major eclipses would have had a large impact on the thoughts of many people and their concerns for the future. According to Aristotle, comets were a part of the atmosphere. In 1577 a great comet was witnessed, again by Brahe, leading him to suggest that comets lay within orbit beyond the moon. Brahe furthered the opinion that the sky existed as a changing entity.

Figure 2: 16th Century Astronomers

Among so many fantastic astronomical events, Queen Elizabeth was even seen to disobey her advisors recommendations with hopes to see the comet of 1582 and a supernova in 1604 (SN 1604, figure 3) (Levy 65). Beliefs in astrology intertwined with those of the "old" astronomy and gave Queen Elizabeth's advisors reasons to recommend that she not witness these events because they were thought to be terrible omens. Within Shakespeare's plays the battle between the "old" astronomy and the "new" is evident; not only between characters waging the war between astronomy and astrology, but also in the way that Shakespeare uses astronomical events to portray major themes.

Upon experiencing these amazing sights, perhaps Shakespeare began to consider the future of mankind, allowing him to delve into the deepest questions of existence and challenging the world throughout their presentation in *King Lear*. Shakespeare's questioning throughout this play coincides with the questioning current astronomical beliefs were undergoing at the time. Shown in figure 4, the pillars of the "old" astronomy created by Hipparchus and Ptolemy (shown by the names on the decaying pillars) are falling to pieces, yet the new pillars labeled Tycho Brahe and Copernicus, men of the "new" astronomy, supports the ceiling which represents the heavens.

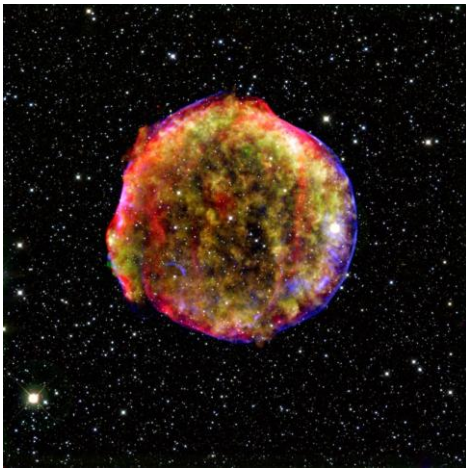


Figure 3: SN 1572, "Tycho's Nova"

Figure 4: Movement into the "New" Astronomy

In a similar manner, the Flammarion woodcut (figure 1) depicts man's investigative nature in the pursuit of understanding of the heavens as he pierces the starry barrier of the heavens. Shakespeare's plays, especially King Lear, depict man's nature to question his surroundings and the reasons for what he sees. At this pivotal point in the evolution of science and astronomy Shakespeare chose to make an important addition to King Lear displaying the parallelism between debates in astronomy and those in philosophical matters. An understanding of the current theories of astronomy, as well as ancient theories of astronomy, makes it impossible to put down Shakespeare's plays.

Further Information:

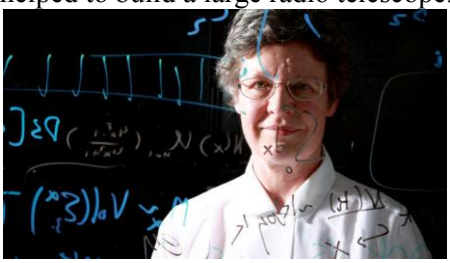
Bevington, D. (2009). *The Complete Works of Shakespeare* (6 ed.).
Levy, D. H. (2001). *Starry Night: Astronomers and Poets Read the Sky.* Amherst, New York: Prometheus Books.

Haunted Lab

The Burnell Journey

Berkeley Anderson

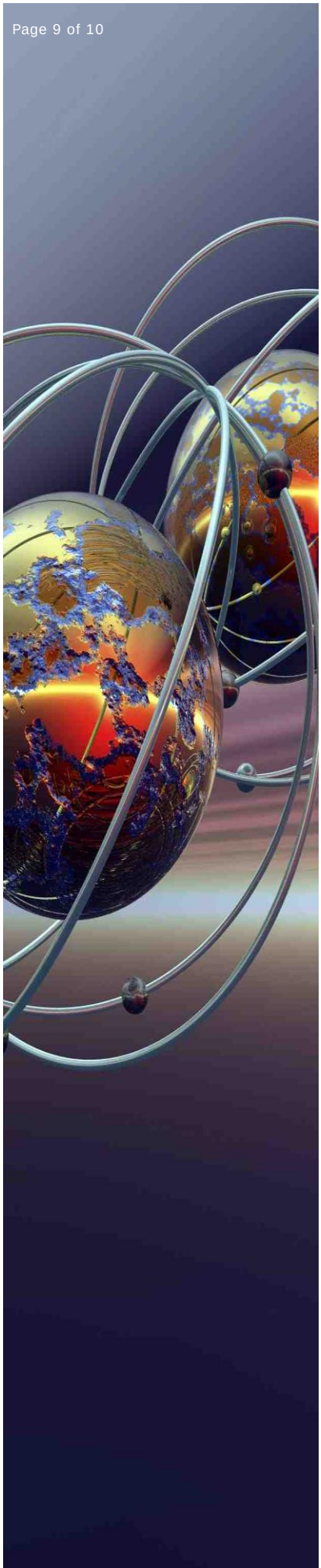
Dr. Jocelyn Bell Burnell was born in Belfast, Northern Ireland and grew up in a family who supported her pursuit of knowledge. Her father, an architect who helped design the Armagh Observatory, especially encouraged her love for astronomy. Although she initially failed to pass the British exams for upper level education at age 11 her parents sent her to a boarding school where, with the encouragement of her physics teacher, she cultivated a greater love for science (Gale). She graduated and attended the University of Glasgow where she got a B.S. in physics and then went on to get a Ph.D. in Radio Astronomy at Cambridge University in 1968. It was during that time that she helped to build a large radio telescope.



While doing research there with her research advisor, Anthony Hewing, she analyzed data collected from stars and "the interplanetary scintillation (twinkling) of compact radio waves" through radio telescopes (Caly Pol Ponoma). Radio waves were collected on paper in the form of lines. One of her main responsibilities for the project was to monitor and interpret these received radio transmissions once the telescope had become operational in July 1967. During the same year Burnell was analyzing data from the telescopes, she noticed an anomaly in the frequencies gathered. On the, over, 400 foot paper chart she noticed the pulsar which took up only about an inch on the chart. Pulsars are rotating neutron stars which emit a beam of high electromagnetic radiation (Gale). Since she could not account for the extra beams of radiation Burnell and Hewing initially titled pulsars "Little Green Men" (LGM), thereby attributing them to the possibility of extraterrestrial life. Later, Burnell proved the pulses could be attributed to stars because they changed position daily, in the same way the stars do. Although Burnell was responsible for discovering pulsars, her mentor, Hewing, received the Nobel Prize in physics instead of her. However, she did receive many other awards and medals from both British and American Scientific Institutions (PBS).

Today she continues her research in astrophysics and in an interview at NASA Burnell mentioned that she was currently researching "a pair of stars held together [in a binary system] …in the constellation of Cygnus, the Swan…known collectively, as Cygnus X-3" (Starchild Magazine).

1. "Gale - Free Resources - Women's History - Biographies - Susan Jocelyn Bell Burnell." *Gale - Home*.Web. 18 Dec. 2010. <http://www.gale.cengage.com/free_resources/whm/bio/bellburnell_s.htm>.
2. "Jocelyn Bell Burnell." *Cal Poly Pomona*.Cal Poloy Pomona Chapter of NASA.Web. 18 Dec. 2010. <http://www.csupomona.edu/~nova/scientists/articles/burn.html>.
3. PBS. "A Science Odyssey: People and Discoveries: Jocelyn Bell." *PBS: Public Broadcasting Service*. 1998. Web. 18 Dec. 2010. <http://www.pbs.org/wgbh/aso/databank/entries/babell.html>.
4. Star Child Magazine. "Jocelyn Bell Burnell."*StarChild: A Learning Center for Young Astronomers*. Star Child Magazine.Web. 18 Dec. 2010. <http://starchild.gsfc.nasa.gov/docs/StarChild/whos_who_level1/bell.html>.



Starlight, or your Light?

AJ Salois

The night sky is not only an aesthetic commodity but a heritage we must protect and pass on. As it fades we endanger not only a variety of animals (1), but also our own circadian rhythm (2). In *The first World Atlas of the Artificial Night Sky Brightness* it was found that 99% of the USA population and European Union live where the sky surpasses the level for polluted status (3). This issue is a matter human health.

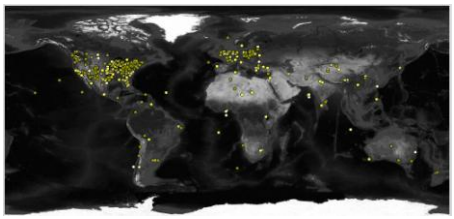


Figure 1: GaN results 2010

A study done by Itai Kloog found, "73% higher breast cancer incidence in the highest LAN [Light At Night] exposed communities compared to the lowest LAN exposed communities." (4) With slightly different lights it is possible to reduce light pollution significantly. Light pollution in the Mt. Megantic region of Quebec, Canada has been decreased 25%, with the efforts of ASTROLab and the observatory. It conserves 1.5 million kWh/year and has been named the first International Dark Sky Reserve in the World (5).

While all of these options exist, public knowledge is lacking. "...in most areas insufficient awareness of the problems that can arise from lighting at night still leads to poor control of upward emission and lighting amounts...Does the vista of a star-filled night sky matter only to astronomers?"

GLOBE at Night (GaN) began in 2006 as a citizen driven initiative to raise awareness of light pollution while also supplying scientists with a method of tracking light pollution across the globe. The first year (2006) of GLOBE at Night, delivered 3,990 observations worldwide. Last year, 2010, GaN boasted 17,805 observations. Each year the number of participants has grown.

Figure 2: Magnitude charts from online

Participation is a simple matter of finding the most widely known constellation, Orion, then comparing what is seen to the star charts provided online. Observations are easily recorded on the GaN website, www.globeatnight.org. These observations will help the world fight the increase of light pollution and provide future generations with dark, starry skies, and it is something you can help accomplish!

1. *Ecological light pollution.* **Longcore, Travis and Rich, Catherine.** 2004, Frontiers in Ecology and the Environment, pp. 191-198.
2. *Lighting for the human circadian clock: recent research indicates that lighting has become a public health issue.* **Pauley, Stephen M.** 4, 2004, Medical Hypotheses, Vol. 63, pp. 588-596.
3. *The first World Atlas of the artificial night sky brightness.* **Cinzano, P., Falchi, F. and Elvidge, C. D.** 2001, Monthly Notices of the Royal Astronomical Society, Vol. 328, pp. 689-707.
4. *Light at Night Co-Distributes with Incident Breast but not Lung Cancer in the Female Population of Israel.* **Kloog, Itai, et al.** 1, 2008, Chronobiology International, Vol. 25, pp. 65-81.
5. **ASTROLab.** Practical Guide for Lighting to reduce light pollution and save energy.

Master Qudoku

I	S	H	K	A				O	N	L	(1)	E		
	Y	F		G		B	I	N		S	E			(2)
L	A			N	O	(3)			I	K			G	P
	T	E	(4)		Y	G	K		H	P	F			
(5)		N		I	S	L						H	A	
S		(6)	I		E	A		B		Y	L			F
					B	K		P	F	E	I		(7)	L
E	P	L				(8)						T	B	G
F			A	L	T	S		G	B		(9)			
G			Y	O	(10)	F		L	P		S			E
	O	S						T	L	A		K		(11)
			O	T	G		A	E	K	(12)	N	P	L	
A	F			Y	L		(13)		S	O			E	T
			N	K	(14)	Y	F	S		G		I	O	
(15)		G		S	P	O				I	T	B	N	A

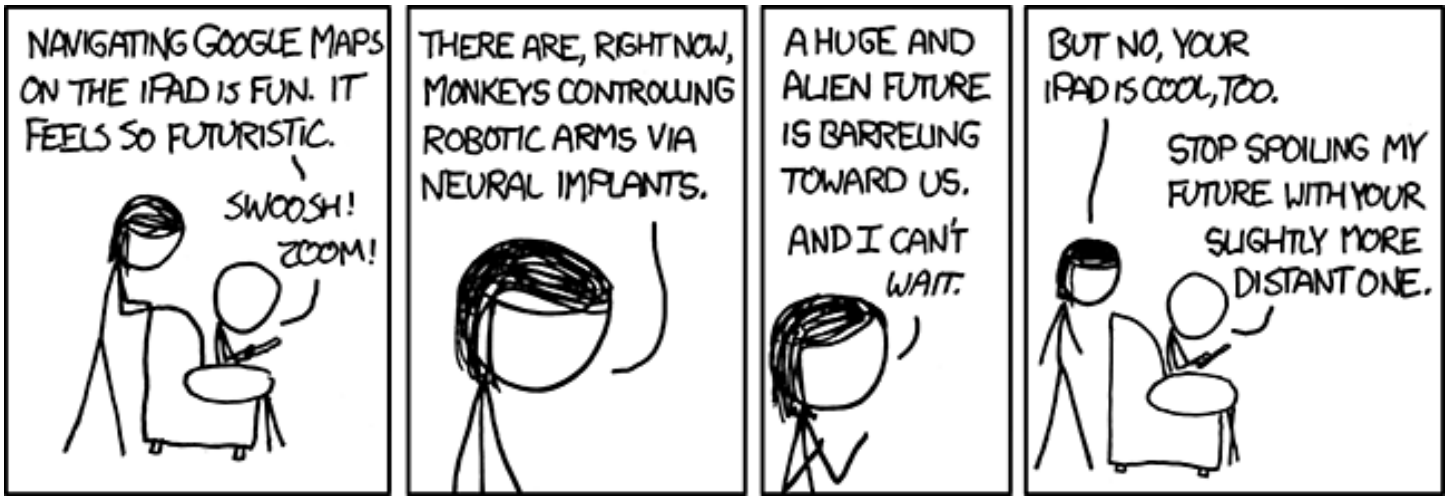
6	15	8	7	■	5	14	1	3						
8	10	6	3	10	6	8	2	10	14	4	4	11		
4	3	12	6	■	13	4	14	10	9					

FLAK BY OPEN SIGHT

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/2008/10/new-word-sudoku-puzzles-for-thursday.html

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



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