12-1-2009

Arkansas Physics Times, December 2009

Society of Physics Students (American Institute of Physics)

Arkansas Physics Times
'THE TRUTH SHALL MAKE YE FRET'

Upcoming events:

December 9th: Dead Day

December 9th, 12pm-1pm: Dead Day Potluck

December 10th-17th: Finals Week

Paper Contents:

The Orion Nebula

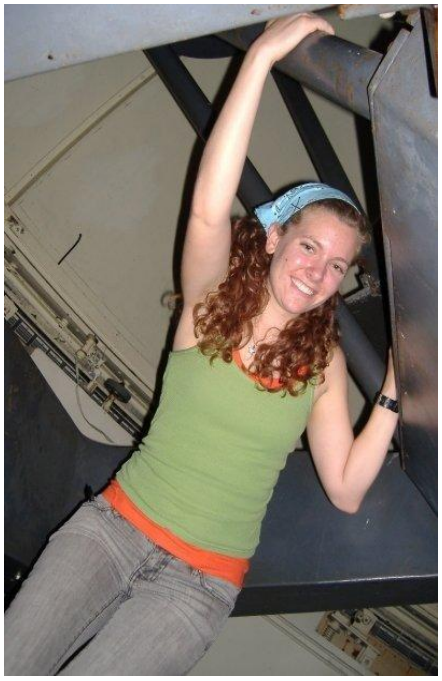
The World of Undergraduate Research

A number of Arkansas undergraduate physics students decided to study some pretty exciting things this summer (and one student even decided to leave the country!). Below you will find summaries, in their own words, of their adventures. Remember to talk to your professors about research opportunities and Research Experience for Undergraduates (REU). Next summer, this could be you!

Name: Joseph Snow
Program: William and Mary REU
Summary:
"At the college of William and Mary in Williamsburg, VA, Dr. David Armstrong and several others are making and testing drift chambers for use at the nearby national laboratory, Jefferson Lab. This summer I was using the software package ROOT to analyze and interpret data from the drift chambers that Dr. Armstrong's group was then constructing."

Name: Kristen Watson
Program: U of A REU
Summary:
"Since the early 1900's a phenomenon has been observed: the ice spike. Perhaps a better term is the ice pipe, as a hollow tube of ice forms through the surface of the ice. My goal is to build a freezer based on peltier coolers in order to observe ice spike formation in a controllable environment. At this stage, a freezer has successfully been built, and I hope to start producing ice spikes soon. Also, I am in the process of designing a new freezer that will be better suited for environmental control and analysis. The overall goal is to study the properties of ice spikes, to see if any relationships can be determined, and to see if control of spike formation is possible."

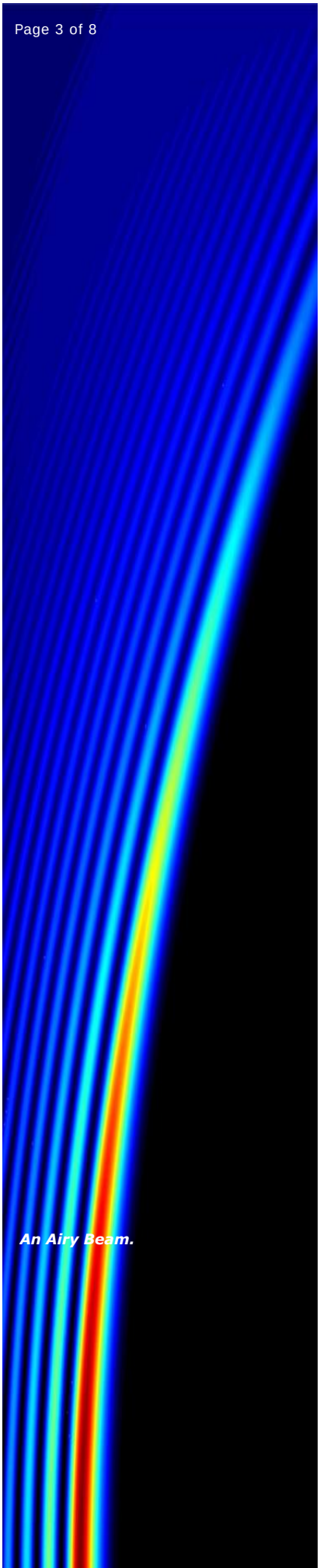
Name: Marshall Scott
Program: University of Arkansas REU
Summary:
"I investigated different solutions to the paraxial wave equation. Initially I studied the Hermite solution, which produced intensity patterns with rectangular symmetry. Then I moved on to the harder solutions. The Laguerre solution reveals a beam that has cylindrical symmetry and angular momentum and the last solution that I studied, the Airy solution, has the most interesting properties of all. The Airy solution describes a beam that curves as it propagates and is also non-diverging. The rest of my research revolved around studying the properties of airy beams and searching for other interesting properties that they might have."



Name: Ameé J. Salois
Program: McDonald Observatory REU
Summary:
"The summer began on a mountaintop. I spent 10 weeks looking at the stars every night through an 82'' telescope and studying the crystallization of pulsating white dwarf stars. By looking at the pulsations, or light intensity variations due to g-modes, I can actually determine what the interior of the star is like. This technique is called Astereoseismology, or seismology for the stars! This method gives us a great deal of useful information about matter at high temperatures and pressures."

Name: Matthew Naglak
Program: Humanities in Rome Semester Program
Summary:
"I spent the Fall 2008 semester living in Rome, Italy, studying ancient and modern Italian art and architecture as well as the Italian language. Learning Italian would prove vital as we spent months in a country where English was not the primary language. Class would meet Monday through Thursday and would consist of classroom instruction followed by real-life experience as we would travel around the city to see famous pieces of art and architecture, studying how they progress from ancient to modern. We also studied Italian Renaissance literature to see its progression from Dante through to Boccaccio.

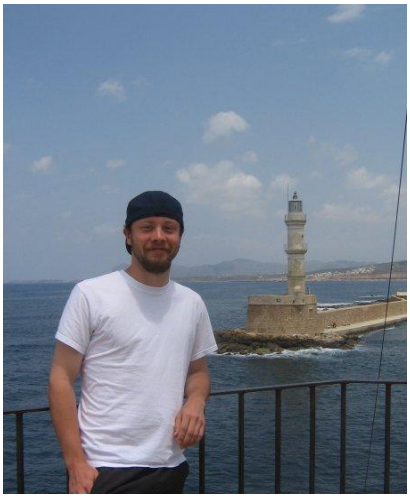
Tracks in a hydrogen bubble chamber.



An Airy Beam.

I lived in an apartment in an Italian neighborhood to gain the full experience of the Italian lifestyle, including riding public transportation around the city and buying food for dinner at a local shop. Here our language skills would be important, as we would be exploring and meeting people without anyone to help us translate the world around us. We quickly picked up key phrases and information, however, and the locals really seemed to enjoy speaking to us when we attempted to communicate in their language.

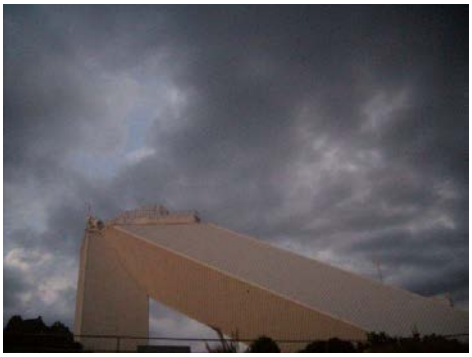
Every weekend we would be free from Friday through to Sunday. This allowed us free time to explore not only around Italy but also around the rest of Europe. Within Italy I travelled to Assisi, Capri, Naples, Sorrento, Milan, Pisa, and Lake Como on personal pleasure trips. Outside Italy I spent time in Ireland, France, Belgium, and Switzerland, thoroughly enjoying each new experience and culture as I encountered it. We were not only able to compare our new surroundings with that of America but also with that of the Italian world we had been living in. It was also at this point we realized how much Italian we were picking up, because in non-English, non-Italian countries it proved much more difficult for us to communicate. My semester abroad was a wonderful experience and I returned with an expanded worldview, having been introduced and immersed in cultures much different than my own. Returning to America allowed me to appreciate the differences in the ways of life of the different cultures, seeing positive and negative aspects in both. I enjoyed it very much and would definitely do it again if I had the opportunity, and would encourage others to experience it if they are able."



Twinkle, Twinkle Little Stars

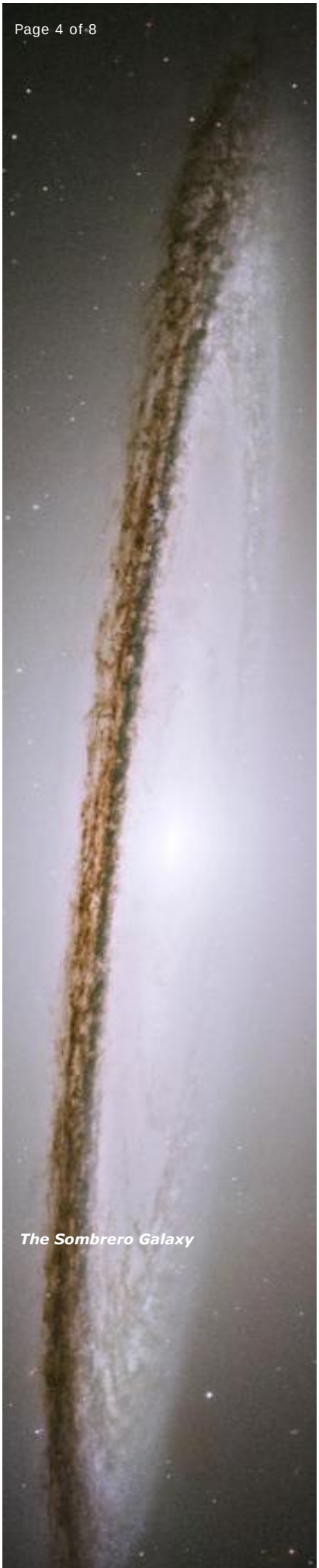
By: Aisha Mahmoud

While sitting inside the control room of a telescope, we are isolated from seeing exactly what's happening with the weather outside, except for when we venture out into the cold to check the sky. I like to go out and check fairly often, acclimate my eyes to the darkness, see the stars, but conditions can change rapidly enough that it's necessary to have weather monitoring devices working all the time. It can get very frustrating when during an observing run evil things like these clouds show up!

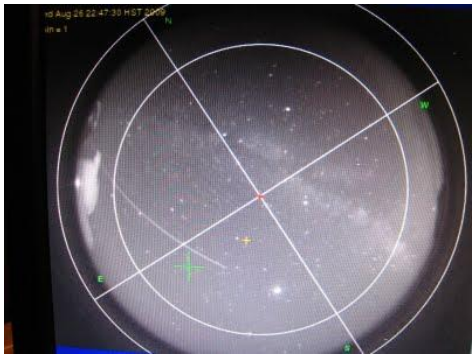


Gray Clouds scattered all over the skies can destroy an entire observing run. The telescope shown is the solar telescope at Kitt Peak, AZ.

Inside UKIRT's control room, there is a screen showing the real-time view from an all-sky camera. The image below shows that view. You can see the telescope on the left side and the Milky Way galaxy streaming across the sky!



The Sombrero Galaxy



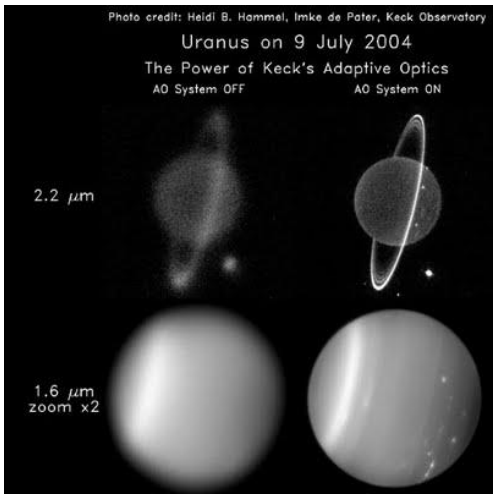
The green plus sign is where our telescope is pointing and the little yellow crosshairs show the position of a companion telescope. At the upper left, above the white telescope, you can see a fainter silver dome with a big line shooting out of it! That is the laser used by the GEMINI telescope adaptive optics system. The laser is clearly visible when one goes outside, and I think its great fun to watch it change positions!

So, what are adaptive optics and why do we shoot lasers into the sky? Photons of light from distant stars get shaken up as they pass thru the earth's atmosphere, causing them to "twinkle" to our eyes. The more the photons get shaken up, the bigger and "fuzzier" objects appear in a telescopic image (this is the major advantage of putting telescopes in space). If we can somehow determine the turbulence in the atmosphere as the photons pass thru it, we can correct for it and get sharper images of the stars!

Adaptive optics is a fascinating technique that has recently come into use by several major telescopes around the world to improve image sharpness. To correct for atmospheric distortions, a specific guide star, a quick computer to measure how the star "twinkles", and a special deformable mirror that sits inside the optical path of the telescope is used.

The computer measures the changing light coming from the guide star every millisecond or less, then rapidly sends signals to adjust the shape of the special mirror in order to immediately correct for the "twinkle." If there is no natural guide star bright enough to use in the part of the sky that you happen to be observing, you can create an artificial guide star with a laser called a "laser guide star".

Here's a nice example of how impressively the use of adaptive optics can improve image quality!



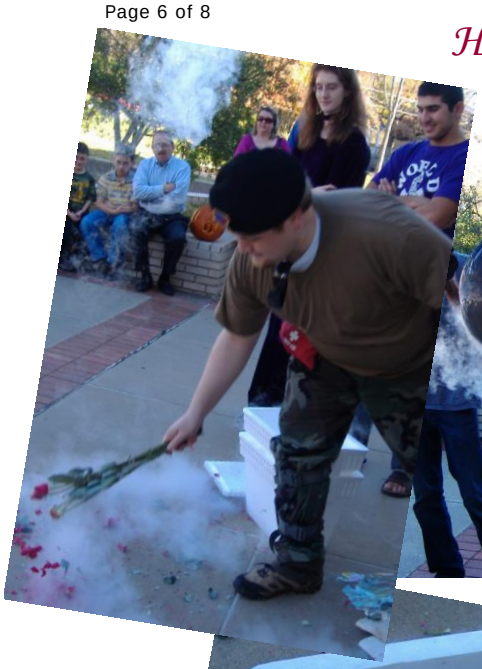
Pretty amazing difference, no? Adaptive optics systems are incredibly complicated to develop and produce, so not all telescopes use them, but they become more important as telescope mirror sizes increase.

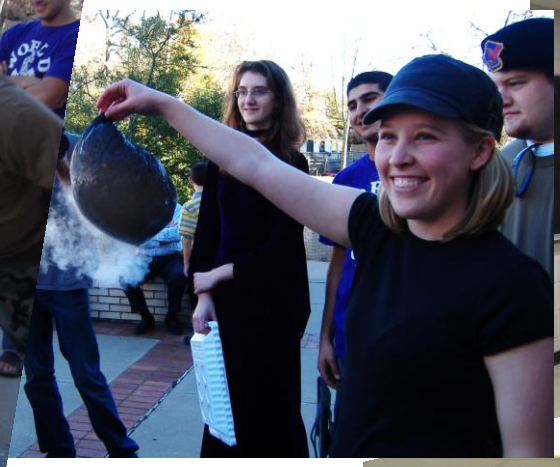
Now to go check the sky....

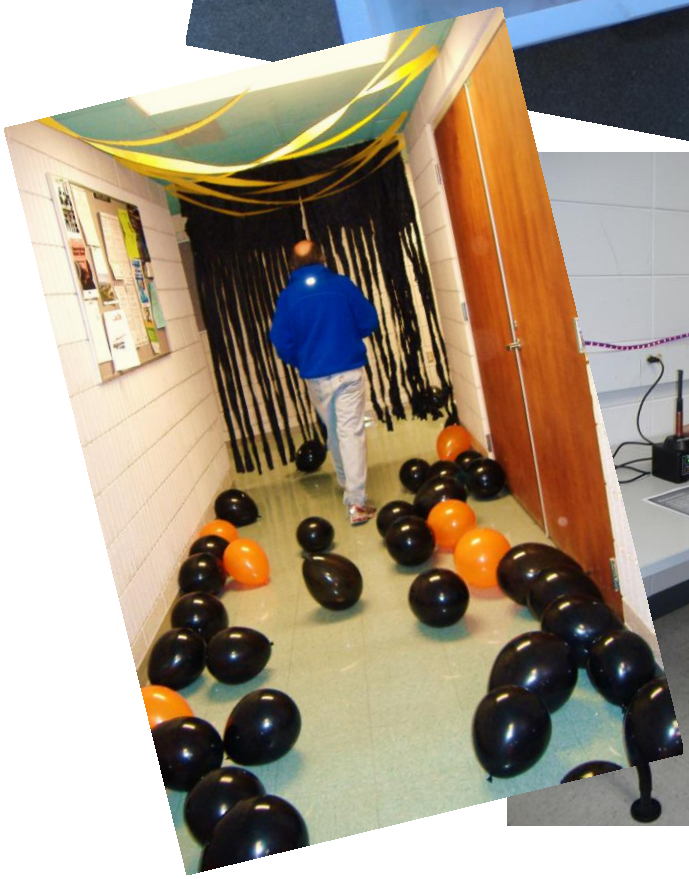
Second Star to the Right

Haunted Lab - Photos

Haunted Lab - Photos

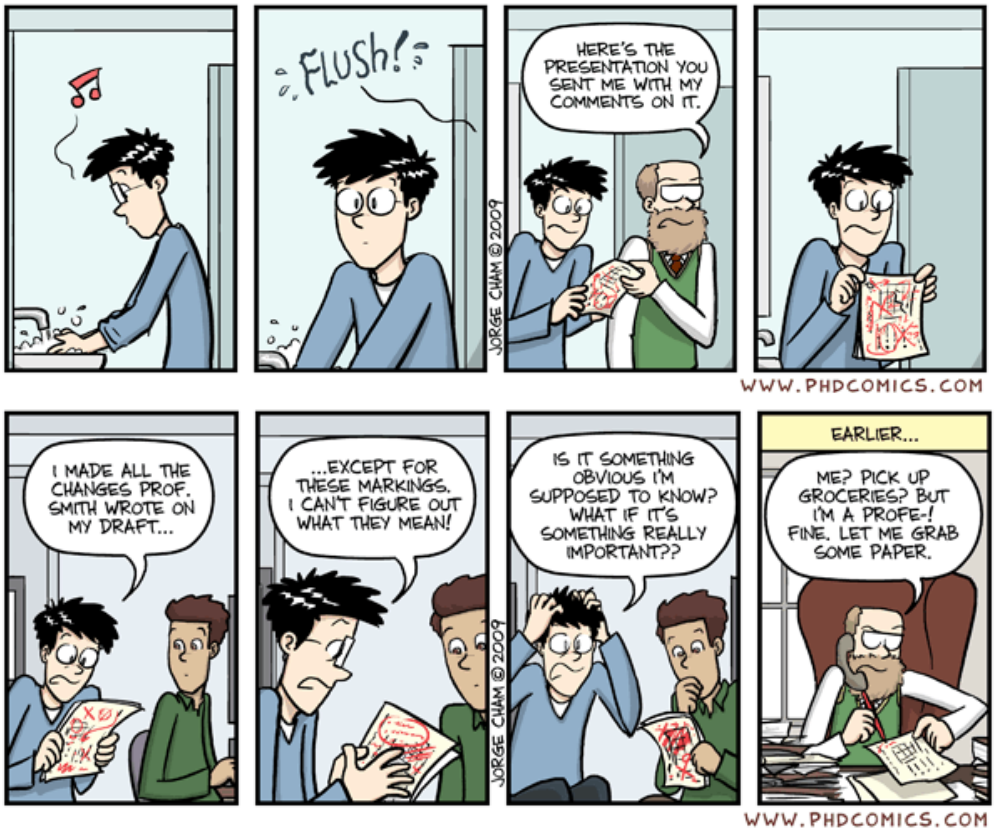






An Optics Table with Green Laser

Comic Time – PhD Comics



Monster Sudoku

2	7			E			D			4	B	1		0	
	E			9	C	0						F	3		
4		B	D		2	7		1					6		A
6				4		A		3	D	8			E	7	
8		D			A		5	0				C		4	
		4	1		B	3			8		7	5		F	
7			0	6	9									3	1
			6	F	0	8	2					7			
			A					2	4	5	F	D			
E	F									A	8	6			B
	5		2	8		F			0	1		A	4		
	1		7				A	9		E			F		8
	C	1			E	5	F		3		4				7
0		6					C		2	7		E	9		5
		2	5						1	0	6			B	
	D		E	0	6			5			A			2	3

Monster Daily SuDoku: Mon 23-Nov-2009 easy

Instructions:

Each row, column, and box must contain the numbers 0 – 9 and the letters A, B, C, D, E and F.

Good Luck!

Email asalois@uark.edu for the solution.

INBRE Conference Fun

This year at the University of Arkansas Chemistry Department's INBRE Conference the Physics Department brought all that they had. A number of students from across the state of Arkansas came to participate in the conference.

From the UofA Physics Department Rachel Lee, Aisha Mahmoud, and AJ Salois participated this year. Rachel Lee won 1st place in the Physics Poster Presentations and AJ Salois won 1st place in the Physics Oral Presentations.

Along with them a number of other Physics Students were honored:

Oral Presentations:
1st Place – Ameé Salois, University of Arkansas
2nd Place – Stephen Broughton, University of Arkansas at Pine Bluff

Poster Presentations:
1st Place – Rachel Lee, University of Arkansas
2nd Place – Gregory Lyons, Harding University
3rd Place – (shared) Robert Peden, Arkansas Tech University
3rd Place – (shared) Joshua Lieblong, University of Central Arkansas

Congratulations to all students that participated in this year's INBRE Conference.

Shown below: (L to R) Rachel Lee and AJ Salois with their award certificates.

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