### The Summer Science Program

# **Universal Times**

#### October 2011

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Vol. 30

SSP

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# APPLICATIONS HIT NEW RECORD, UP 111% IN TWO YEARS

Interest in SSP from students worldwide continues to grow. Last winter 667 would-be SSPers submitted applications, up 25% over last year (despite an earlier deadline) and more than double the 2009 total.

Prior to 2003, SSP had never exceeded 100 applications since NSF funding ended in 1981. The low point — only 35 applications — came in 1996.

Why the big increase?

External tailwinds in our favor include demographics (the "baby boom echo"), and the growth of internet searching (our name helps). Plus, we now have cooperative agreements in place



667 applications make a mighty impressive stack.

with the admissions folks at Caltech (since 2004) and MIT (since 2009).

Are these hordes of applicants mostly qualified?

Unequivocally yes. For example, test scores: 2011 applicants reported a median math PSAT in the 99th percentile. All admitted students had completed either calculus or physics; 74% had taken both.

While the bigger pool makes more work for the volunteers reading applications (see list on page 5), it also gives us great latitude to "shape the class" by admitting students who will be the best fit. It's a "class A problem"!

# ACADEMIC DIRECTORS REPORTS

# SSP at Westmont College by Martin Mason

This summer we succeeded at providing the core SSP experience in a shorter, 37-day schedule. All 36 students completed the near-earth asteroid (NEA) orbit determination, using a program they created in the VPython programming language.

In addition, each of the teams did significant additional analysis including generating an ephemeris for a fourth observation of their asteroid from their orbital elements, and comparing the predicted position to their asteroid's measured position to check their orbital elements. All students had completed their OD programs by Wednesday of the fifth week. Most also performed the light travel-time and parallax corrections.

# SSP at New Mexico Tech by Bill Andersen

I am pleased to report a successful 9<sup>th</sup> SSP at New Mexico Tech. This year all students accepted into the program had strong preparation and performed well academically. And, this group of students was the best behaved in my four years at SSP. There were no incidents compromising health or safety. In particular, we avoided our "tradition" of major injuries on the slip & slide during SOTS.

For each team's first observation, they wrote their own code to find the centroid and RA/Dec of the asteroid, without recourse to these features built into TheSkyX software. After that, they were allowed to use TheSky. My philosophy is the pedagogy must not contaminate the science. It would be very

## 2011ERS SAY

"Growing up in a state where expectations are quite low, I have been pushed by SSP because its expectations were so high."

-Chiann-Ling Yeh

*"SSP is not like high school at all. Here, everyone helps each other."* 

-Anthony Mark

"Here you meet people from all over the world that are both just like you and nothing like you; where in only three hours of lecture, you discover a whole new world—or even parallel universes."

-Maria Gutierrez

# "IT'S THE PEOPLE"



Students and faculty of SSP 2011 at Westmont College



Students and faculty of SSP 2011 at New Mexico Tech

# 2011 FACULTY

#### Westmont Campus

Academic Director: Martin Mason Associate AD: Michael Faison Site Director: Anna Heinz '98

Lead TA: Sean Mattingly '03 Senior TA: Mary Masterman '05 TA: Dougal Sutherland '06 TA: Rebecca Rapf '07

Trustee Liaison: David Pierce

#### **New Mexico Tech Campus**

Academic Director: William Andersen Associate AD: Brian Woodahl Site Director: Leslie Clark

Lead TA: Benjamin Knudsen '06 Senior TA: Rachel Wagner-Kaiser '05 TA: Michelle Chang '06 TA: Aaron Bauer '06

Trustee Liaison: Eric Korevaar '76

# COLLEGE CLASSES OF 2015

Caltech	Lin Cheng, Connie Hsueh, Hannah Klion, Lander Martin, Aleena Patel		
Cambridge Univ.	Neil Satra		
Colorado School of Mines	Reed Sanchez		
Columbia Univ.	Elena Wolner		
Cornell Univ.	Rohit Ramanathan, Xue Wang		
Duke Univ.	Lloyd Zhao		
Harvard College	Sim Brandon, Ariel Camperi, Alpkaan Celik, Ian Choi, Paul Harris, Nicholas Induni, Tara Jain, Max Lu, Parsons Megan, Oprescu Miruna, Wei-Husan Ting		
Harvey Mudd	Calvin Maldonado, Nabil Zaman		
Michigan State Univ.	Mariah Gilman		
МІТ	Strahinja Ciric, Sara Falcone, Michael Kelessoglou, Sinha Kirin, Sophia Li, Jeffrey Sperling, Sarah Vente, Ari Vogel, Tina Wang, Michael Xu, Linda Xu, Jiaming Zeng		
Northeastern Univ.	Amery Cong		
Northwestern Univ.	Yujin Maeng		
Princeton Univ.	Vivian Wang		
Rice Univ.	Crystal Olalde		
Stanford Univ.	Omkar Joshi		
Swarthmore College	Jennifer Walsh		
UC Berkeley	Oswal Abhishek, Nat Hendel, Xuan Nguyen		
UC Davis	Veronica Rico		
UC Santa Barbara	Reilly Raab		
UCLA	Vishnu Sundaresan		
Univ. of Barcelona	Raimon Luna		
Univ. of Central Florida	Sabrina Gutierrez		
Univ. of Chicago	Charles Pena		
Univ. of Pennsylvania	Lucas Pena		
Univ. Texas Austin	James Schulman		
US Air Force Academy	Juedeman Dylan		
Vanderbilt	Akash Umakantha		
Virginia Tech	Rochelle Silverman		
Washington Univ.	Kaixi Huang		
Williams College	Olivia Pham		
Yale Univ.	Jianan Huang, Miranda Kephart, Anand Khare, Tierney Lar- son, Mason Liang, Joyce Shi, Catherine Wang		



Something Other Than Science happens at Westmont.

# **TRUSTEE ELECTION RESULTS**

The third election of SSP Trustees was held this spring by online ballot, emailed to all alumni and former faculty for whom we have email addresses. (If you didn't get one, email sspalum@ssp.org.) Results were announced at Reunion Day. Three incumbents were re-elected: **Amy Barr '94**, **Scott Pace '75**, and **Tom Steiman-Cameron** (faculty '91-'92)



One of those "hand-waving" lectures from Dr. Faison



The Big Moment: turning in the team OD report to Prof. Mason



Waiting for solar noon at Griffith, with alumni and Dr. Krupp



In the dome with the Tak 'scope



Dapper dressing for dinner

#### Page 3

### **SSP** AT WESTMONT COLLEGE - AD REPORT

#### (Continued from page 1)

For one of the NEAs, Gauss's method failed, so four students collaborated on an improved five-observation method of Laplace. Specifically, they used three sets of observations on the same night to get an accurate value of the first derivative of rho hat, and then used larger time spacing for the 2nd derivative.

We chose target NEAs which are potentially hazardous or poorly measured to date. This, coupled with the shorter schedule and students no longer relying on their eyes to determine the centroids of their stars and asteroids, necessitated an increased emphasis on image processing.

In order for students to do the image processing, centroiding and Least Squares Plate Reduction (LSPR) program, statistics and relatively sophisticated programming techniques had to be taught early in the program.

Student teams spent the first

two weeks developing mathematical and computational techniques to take the raw images from the CCD and create calibrated images by removing gain and bias from those images, and then programming a least squares plate solution program to obtain the coordinates of the asteroid and comparing their position values to published values. In their last three weeks they continued to take and measure digital images, programmed the orbital determination and ephemeris generating programs, and wrote their team reports.

Associate AD Dr. Michael Faison and Site Director Anna Heinz '98 brought several years of past SSP experience to their jobs. We relied heavily as always on our excellent teaching assistants, an all-alumni TA corps who lent a strong sense of continuity: Sean Mattingly '03, Mary Masterman '05, Dougal Sutherland '06, and Becky Rapf '07. I appreciate their hard work.

Observing at the Westmont campus is more challenging than in Ojai. Although the weather was better this year than the last, about a third of nights were still partially or completely unsuitable due to fog or poor seeing with the rest effected by condensation. This especially impacted the late groups, as the fog tended to roll in around midnight, which meant observing was scheduled until 3 am on at least one and often two telescopes almost every night of the program. Dr. Faison and I led late sessions on Westmont's 24" telescope three nights a week, while the TAs led teams on SSP's own Meade 14".

The tremendous support of Westmont faculty Warren Rogers '76 and Tom Whittemore solved many equipment / facility issues and helped everything run smoothly.

After two successful summers at Westmont College, we are "settled in" and hoping for many more to come!

### SSP AT NEW MEXICO TECH - AD REPORT

#### (Continued from page 1)

difficult if not impossible for a student's own code to calculate asteroid positions as accurately as TheSky, which will automatically use up to 80 reference stars!

SSP is an opportunity for students to understand how real science works, so my instructions were intentionally vague. I said that whatever their OD results, I wanted to hear their story; if their OD succeeded, great, if not, I wanted to hear their ideas as to why. For extra realism, I gave them the *American Institute of Physics Style Manual.* 

Ten teams produced orbital elements from their observations; the other two were assigned asteroids with difficult orbits. 1999 HFI's high inclination caused the Gaussian method to fail. Team 2 traced the failure to a solution of linear equations for Earth-asteroid distances. The NEA Seleucus was also interesting. One team could not solve for the orbit using their data, but their codes converged successfully using the data of the other Seleucus team. I believe an open-ended approach reflects real research better than simply looking at whether a team got the "right answer". In fact, nine individuals specifically stated that their OD program did not work. I will emphasize their scientific integrity in my recommendation letters for them.

Submission of observations to the Minor Planet Center was voluntary, but all twelve teams chose to do the extra work to put their data into MPC format. In most cases the match to MPC ephemerides is better than 0.1 arcseconds, much more accurate than we could ever get using film and measuring engines.

All of our guest lecturers earned invitations to return. The EMRTC folks blew up a 1,000 lb. warhead for us – that's just extra nice. Other free time filled up with swing dancing, the "assassin" game, ultimate Frisbee, and touch football. The July 4 fireworks and picnic were excellent as usual.

Tech's Dr. Dan Klinglesmith continues to be a major asset to SSP. He fixed a CCD-computer communication problem and a sheared drive shaft on the dome slit. We need to name something after this guy! PhD candidate Jason Speight also helped in important ways, and Tech's John Shipman lectured on Python.

I offer heartfelt gratitude to Site Director Leslie Clark and Associate AD Brian Woodahl and to our great Teaching Assistants: Ben Knudsen '06, Rachel Wagner-Kaiser '05, Michelle Chang '06, and Aaron Bauer. '06 The efforts and support of my six colleagues were essential to our success. I sometimes felt that they carried me upon their shoulders.

U	ni	ve	rsal	l Tin	nes

### **DONATION FORM**

You can help inspire 72 gifted teenagers to reach their amazing potentials. Return this form with your check, or donate online using a credit card at www.ssp.org/donate. Send any questions to sspalum@ssp.org.

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Send corrections to your mailing or email addresses to sspalum@ssp.org, or mark on the back of this form.

## **2011 GUEST LECTURE SERIES**

WESTMONT	NM TECH
Dr. Bryan Penprase, Pomona College - "Quasar Absorption Lines and how they Sample the Formation of Stars and Ele- ments in the Early Universe"	John W. Briggs '76, HUT Observatory - "Antarctic Odyssey: Winter-over at South Pole Station"
Dr. Warren Rogers '76, Westmont Col- lege - "Nuclear Astrophysics and the Ori- gin of the Elements"	<b>Dr. Tyrone Hayes</b> , UC Berkeley - "From Silent Spring to Silent Night"
Dr. Larry Sverdrup, Trex Enterprises Corporation - "Mad? Science!"	Dr. Sherry Nelson, Univ. of New Mexico - "What makes us human: Insights from the fossil record"
Dr. Jonathan Coopersmith, Texas A&M University - "Why is Spaceflight Still So Expensive?"	Dr. Penelope Boston, New Mexico Tech - "Caves: Exploring Life Underground from Earth to Mars and Beyond"
<b>Dr. Sigrid Close</b> , Stanford - "Asteroids and Space Situational Awareness"	Dr. Larry Sverdrup, Trex Enterprises Corporation - "Mad? Science!"
Dr. Paul Pottinger, Univ. of Washington Medical Center - "Parasitic Infections: Impact, Neglect, and Opportunities"	<b>Dr. Michael Dubson '73</b> , Univ. of Colorado at Boulder - "Physics vs. Lawyers: An Airline Crash Investigation"
Dr. Cherie Briggs, UC Santa Barbara - "Fungal Disease in Frogs of the Sierra Nevada"	Dr. Eileen V. Ryan, Magdalena Ridge Ob- servatory - "Follow up and Characteriza- tion of Potentially Hazardous Asteroids using the MRO 2.4m Telescope"
<b>Dr. Omer Blaes</b> , UC Santa Barbara - "Astrophysics of Black Holes"	Dr. Henry Roe '91, Lowell Observatory - "Titan's Methane Monsoon"
Mika McKinnon '00, Univ. of British Co- lumbia - "Disaster Science Fiction"	Nirupam Roy, National Radio Astronomy Observatory - Closing Address

2011ERS SAY

"The learning is fast and exciting, but the people have a \*truly\* profound impact. They are open. They are innovative. They dream big. They are passionate."

-Priya Kalluri

"SSP has confirmed in my mind that I want to spend the rest of my life studying physics. It has also helped me realize just how fantastic every single person around me is."

-Samuel Holo

The Guest Speaker Series is underwritten by Sandia National Lab / Lockheed Martin



The Summer Science Program Business Office: 108 Whiteberry Dr Cary, NC 27519

### PARENTS SAY

"SSP has transformed my daughter, and provided her with valuable life lessons she now has in her backpack as she continues on her journey in life."

-Randall Stephens "The program gave Ajit confidence to rise to any academic challenge he faces, and tremendous motivation for the future. He returned charged and enthused."

—Jay Mahajan

# **PRESIDENT'S LETTER**

#### By Dr. Susan Jerian '79, President, SSP Board of Trustees

The SSP class of 2011 has the distinction of being the first to contain an equal number of female and male students at both campuses. When I visited campus on Reunion Day and saw the energetic, enthusiastic, and collaborative young men and women, it was hard to image that for its first ten years, SSP only admitted male students. In my year (1979), which was SSP's 21st, there were only 8 female students.

Today SSP embraces diversity of all kinds. That includes breaking down barriers that have discouraged women from entering Science, Technology, Engineering and Math (aka "STEM"). Women have played critical roles in the progress that we have enjoyed since alumni management began in 2000. While we still struggle to find women to fill the lecturing faculty positions (and referrals are welcome!), most years half of the Teaching Assistants, and both Site Directors, are women. The guest speaker series now includes 3-4 women at each campus; they also serve as role models. Your Board of Trustees includes six women, including principal officers past, present, and future.

Women alumni have supported SSP through their donations, expertise, and hard work. Here are three examples of many. Trustee Amy Barr '94 (TA '99,'00,'02), was instrumental in bringing NASA's Lunar Science Institute (and substantial funding) to SSP. Trustee Noël Bahktian '00 (TA '05) serves as head of the Alumni Relations Committee; she recently became a Trustee. Barrie Trinkle '77 (TA '82) served on the Board for five years and has continued to give generously of her time every spring to help with admissions.

Finally, consider the example of Erika DeBenedictis '08. Following SSP she won first place and \$100,000 at the 2010 Intel ISEF for her interplanetary navigation project; as a Caltech freshman last fall was invited to meet Pres. Obama at the White House; and to top it off was named by *Glamour* magazine as one of "20 Amazing Young Women Who Are Already Changing the World." Indeed!

Dr. Jerian is founder and president of OncoRD Inc., a pharmaceutical industry consulting firm.