Astrophysics Education and Public Outreach Update
Presented to the Astrophysics Subcommittee of the NAC

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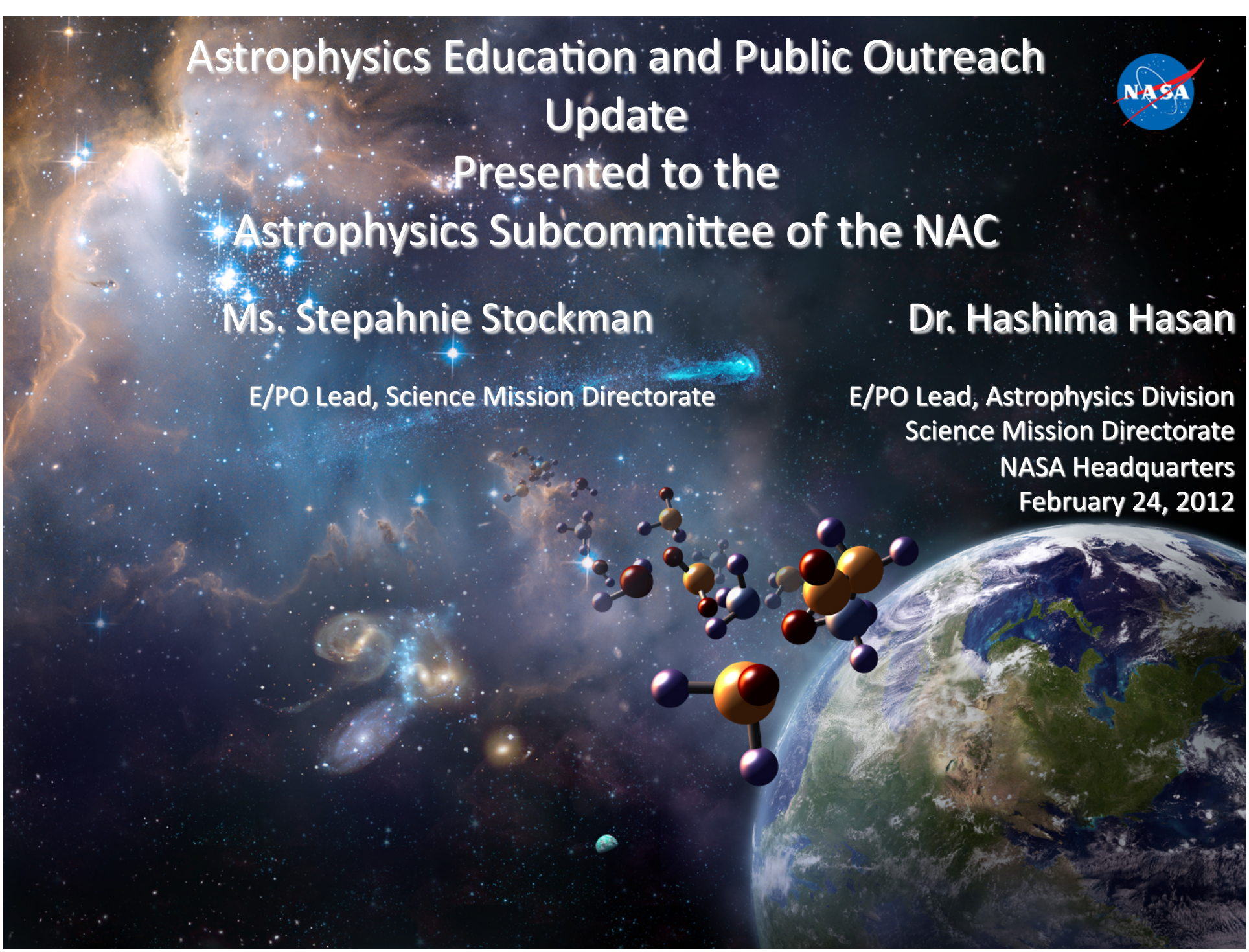

Astrophysics Division

Topics

- NASA and SMD E/PO
- Astrophysics Division Portfolio
- Astrophysics Science Education and Public Outreach Forum highlights
- Reaching audiences
  - K-12 formal education
  - Higher education
  - Informal education
  - Outreach

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NASA and SMD E/PO

- **NASA Portfolio Development Team**
  - Determining NASA Education Priorities based on Design Team recommendations and budget realities
  - Work is in progress and SMD E/PO is providing input
- **SMD EPO Issues**
  - Core SMD E/PO budget reduced by 30% for FY 13
  - First priority was to honor existing funding commitments to grantees and cooperative agreements
  - Mitigation strategy
    - No EPOESS call in ROSES 12
    - Cancellation of E/PO supplements program for ROSES Science Awardees
    - Scaling back other E/PO services

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Astrophysics E/PO Portfolio

- **Astrophysics Science Education and Public Outreach Forum (SEPOF)**
- **Program Offices:** *Develop thematic initiatives reflecting the science and technology of the individual missions and the overall thematic elements of the program.*
  - PCOS and COR Program Offices are developing coordinated approach to PCOS and COR science E/PO
  - Exoplanet Exploration Program Office has an established E/PO program which has been updated to reflect the current program
  - Provide infrastructure for smaller E/PO efforts
- **Flight Missions**
  - Every mission is required to have an E/PO plan
  - Oversight provided by HQ Program Scientist, Program Executive, Astrophysics E/PO Lead
- **Education and Public Outreach for Earth and Space Science (EPOESS)**
  - Competed through ROSES and funded by SMD
  - Oversight provided by SMD and Astrophysics E/PO Lead

Astrophysics Science Education and Public Outreach (E/PO) Forum

The Astrophysics Forum helps NASA Astrophysics E/PO teams and scientists *work together effectively and efficiently* in sharing the science, the story, and the adventure of NASA's Astrophysics missions and research programs with educators, students, and the public.

Recent highlights include:

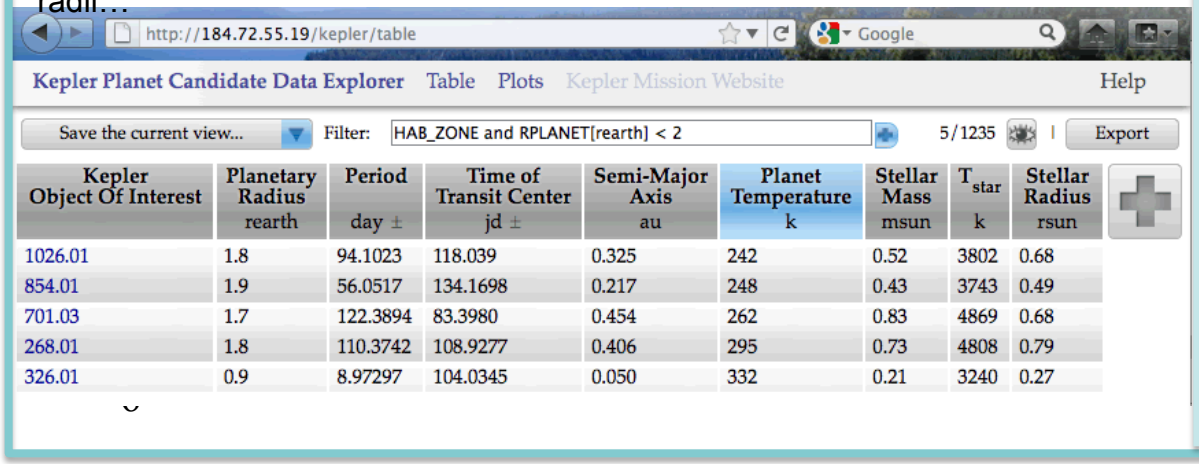
- **Compilation of brochure ("sampler") and coordination of splinter meeting at AAS-Austin** to support scientists in locating and incorporating NASA Astrophysics E/PO materials into their own education and outreach activities.
- **Community retreat and follow-on meeting at AAS-Austin** to catalyze collaboration among Astrophysics E/PO teams in areas of strategic importance to SMD (online professional development for classroom educators; engaging girls in science; use of social media; use of NASA Astrophysics data in education; higher education; scientist participation in education and public outreach).
- **Coordination of NASA's Multiwavelength Universe**, a 2-week online course for classroom educators on the properties of the electromagnetic spectrum and how NASA uses a variety of telescopes to observe the universe.
- **Compilation of Cosmology Resource Guide** of materials that community college instructors (and their students) can use to learn about the latest developments in modern cosmology.
- **Coordination of Astro4Girls** activities to engage girls in science at public libraries during Women's History Month in March in collaboration with the American Library Association.
- **Plenary session** on best practices in engaging girls and young women in science and science careers organized in collaboration with the National Girls Collaborative Project, held during the **Astronomical Society of the Pacific "Connecting People to Science" national conference**, July 2011**.**
- **Coordination of Astrophysics mission** participation in the **Association of Science-Technology Centers** annual conference and the upcoming **USA Science and Engineering Festival**.
- **Analysis of 163 educational activities** developed by NASA SMD Astrophysics E/PO programs with respect to alignment with AAAS education benchmarks.

The Astrophysics Forum is a partnership between the Space Telescope Science Institute, Adler Planetarium, Astronomical Society of the Pacific, and Johns Hopkins University.

Kepler Planet Candidate Data Explorer http://184.72.55.19/kepler/

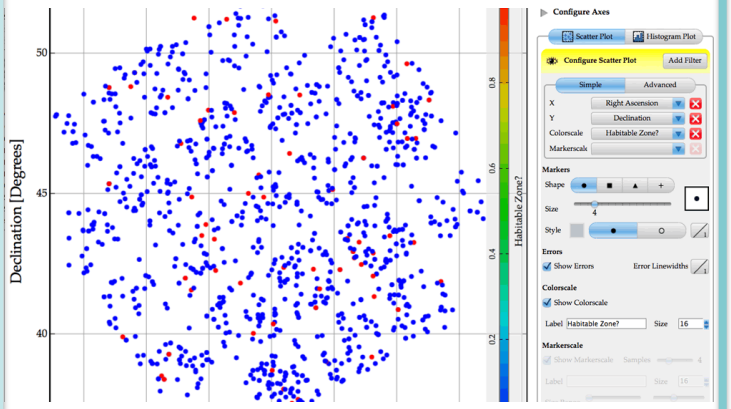
New tools for displaying and manipulating Kepler planet candidate data
a Kepler and Exoplanet Program E/PO collaboration

Explorer Table: Filter set for candidates in habitable zone, less than 2 Earth radii…

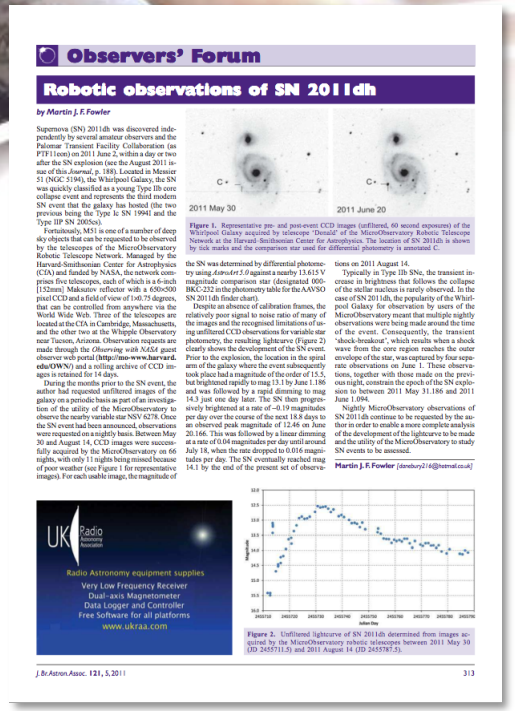


Kepler Object Of Interest	Planetary Radius rearth	Period day ±	Time of Transit Center jd ±	Semi-Major Axis au	Planet Temperature k	Stellar Mass msun	T_{star} k	Stellar Radius rsun
1026.01	1.8	94.1023	118.039	0.325	242	0.52	3802	0.68
854.01	1.9	56.0517	134.1698	0.217	248	0.43	3743	0.49
701.03	1.7	122.3894	83.3980	0.454	262	0.83	4869	0.68
268.01	1.8	110.3742	108.9277	0.406	295	0.73	4808	0.79
326.01	0.9	8.97297	104.0345	0.050	332	0.21	3240	0.27

Plot of RA vs Dec, candidates in habitable zone in red



Amateur Astronomer uses *Observing with NASA* to detect a Supernova



Observers' Forum

Robotic observations of SN 2011dh

by Martin J. F. Fowler

Supernova (SN) 2011dh was discovered independently by several amateur observers and the Palomar Transient Facility Collaboration (as PTF1 1cen) on 2011 June 2, within a day or two after the SN explosion (see the August 2011 issue of this *Journal*, p. 188). Located in Messier 51 (NGC 5194), the Whirlpool Galaxy, the SN was quickly classified as a young Type Ib core collapse event and represents the third modern SN event that the galaxy has hosted (the two previous being the Type Ic SN 1994I and the Type IIP SN 2005cs).

Fortuitously, M51 is one of a number of deep sky objects that can be requested to be observed by the telescopes of the MicroObservatory Robotic Telescope Network. Managed by the Harvard-Smithsonian Center for Astrophysics (CfA) and funded by NASA, the network comprises five telescopes, each of which is a 6-inch [152mm] Maksutov reflector with a 650×500 pixel CCD and a field of view of 1×0.75 degrees, that can be controlled from anywhere via the World Wide Web. Three of the telescopes are located at the CfA in Cambridge, Massachusetts, and the other two at the Whipple Observatory near Tucson, Arizona. Observation requests are made through the *Observing with NASA* guest observer web portal (http://mo-www.harvard.edu/OWN/) and a rolling archive of CCD images is retained for 14 days.

During the months prior to the SN event, the author had requested unfiltered images of the galaxy on a periodic basis as part of an investigation of the utility of the MicroObservatory to observe the nearby variable star NSV 6278. Once the SN event had been announced, observations were requested on a nightly basis. Between May 30 and August 14, CCD images were successfully acquired by the MicroObservatory on 66 nights, with only 11 nights being missed because of poor weather (see Figure 1 for representative images). For each usable image, the magnitude of the SN was determined by differential photometry using *AstroArt 5.0* against a nearby 13.615 V magnitude comparison star (designated 005-BKC-232 in the photometry table for the AAVSO SN 2011dh finder chart).

Despite an absence of calibration frames, the relatively poor signal to noise ratio of many of the images and the recognised limitations of using unfiltered CCD observations for variable star photometry, the resulting lightcurve (Figure 2) clearly shows the development of the SN event. Prior to the explosion, the location in the spiral arm of the galaxy where the event subsequently took place had a magnitude of the order of 15.5, but brightened rapidly to mag 13.1 by June 1.186 and was followed by a rapid dimming to mag 14.3 just one day later. The SN then progressively brightened at a rate of ~0.19 magnitudes per day over the course of the next 18.8 days to an observed peak magnitude of 12.46 on June 20.166. This was followed by a linear dimming at a rate of 0.04 magnitudes per day until around July 18, when the rate dropped to 0.016 magnitudes per day. The SN eventually reached mag 14.1 by the end of the present set of observations on 2011 August 14.

Typically in Type Ib SNe, the transient increase in brightness that follows the collapse of the stellar nucleus is rarely observed. In the case of SN 2011dh, the popularity of the Whirlpool Galaxy for observation by users of the MicroObservatory meant that multiple nightly observations were being made around the time of the event. Consequently, the transient 'shock-breakout', which results when a shock wave from the core region reaches the outer envelope of the star, was captured by four separate observations on June 1. These observations, together with those made on the previous night, constrain the epoch of the SN explosion to between 2011 May 31.186 and 2011 June 1.094.

Nightly MicroObservatory observations of SN 2011dh continue to be requested by the author in order to enable a more complete analysis of the development of the lightcurve to be made and the utility of the MicroObservatory to study SN events to be assessed.

Martin J. F. Fowler [dmebury216@btinternet.co.uk]

Figure 1. Representative pre- and post-event CCD images (unfiltered, 60 second exposures) of the Whirlpool Galaxy acquired by telescope 'Donald' of the MicroObservatory Robotic Telescope Network at the Harvard–Smithsonian Center for Astrophysics. The location of SN 2011dh is shown by tick marks and the comparison star used for differential photometry is annotated C.

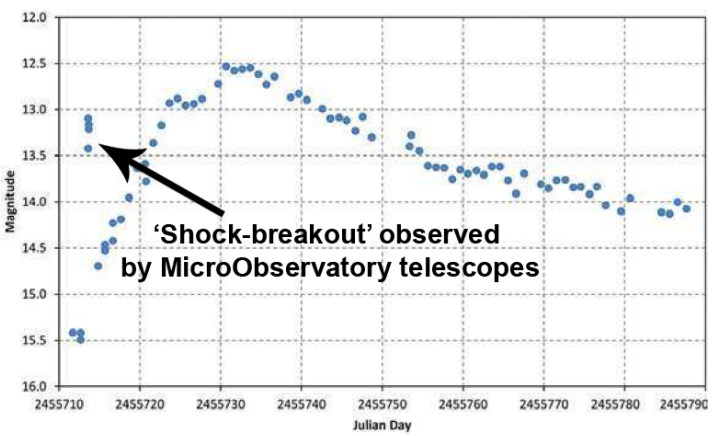


Figure 2. Unfiltered lightcurve of SN 2011dh determined from images acquired by the MicroObservatory robotic telescopes between 2011 May 30 (JD 2455711.5) and 2011 August 14 (JD 2455787.5).

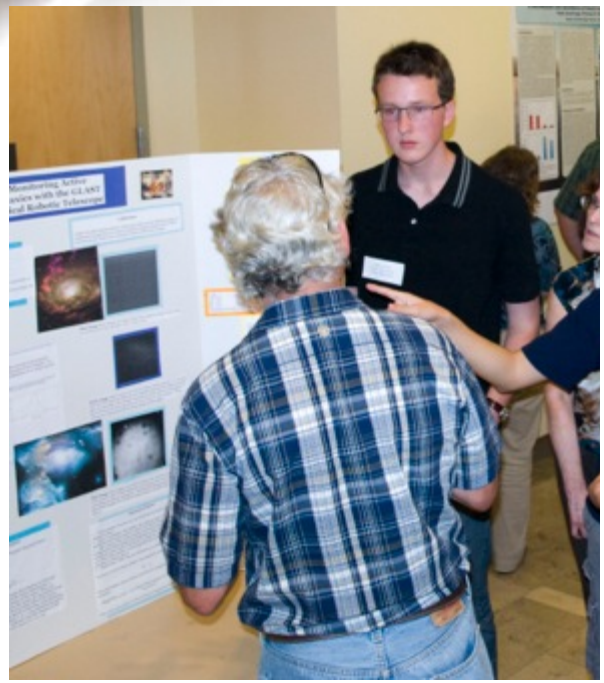
This summer, amateur astronomer Martin J. Fowler used the *Observing with NASA* portal to the MicroObservatory robotic telescope network to request several images of the Whirlpool galaxy. He used these observations along with several images from the image archive to create a detailed lightcurve of the progression of the Supernova event SN 2011dh. Since the MicroObservatory telescopes take images so often, his lightcurve includes the difficult to observe 'shock-breakout,' or the initial light given off when the core of the star collapses. He published his results in the October 2011 Journal of the British Astronomical Association. The author is now studying the recent supernova in M101 by requesting images through the *Observing with NASA* website.

http://www.MicroObservatory.org

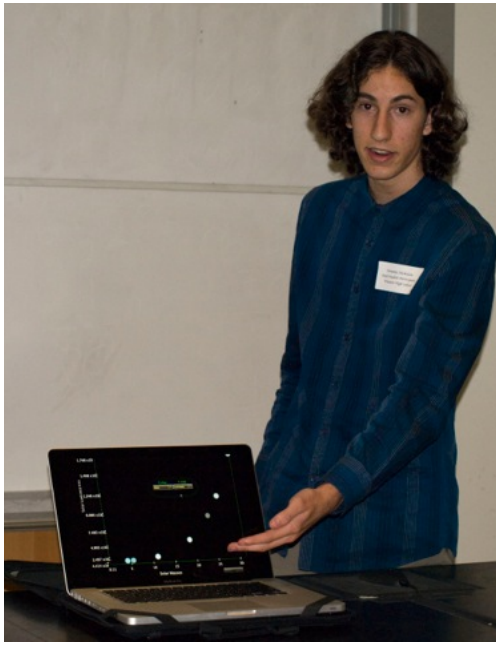
Sonoma State University Summer High School Interns Program

September 19, 2011

Sonoma State University E/PO sponsored four summer high-school interns. The project was partially funded by the Sonoma County Office of Education and by California Space Grant.

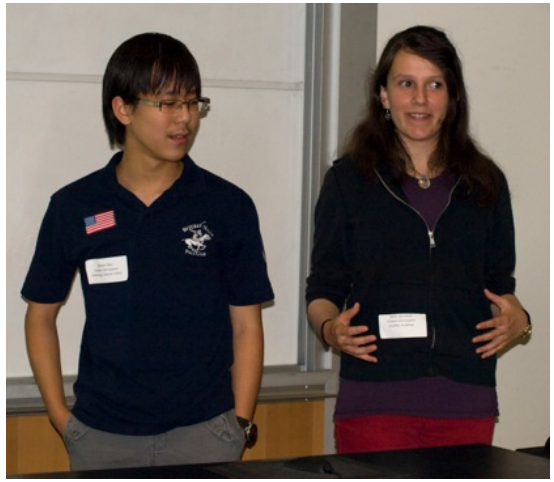


Dillon Jackson was sponsored by the Sonoma County Office of Education. He analyzed AGN data from GORT, our robotic telescope.



Dominic Nicholson worked with Kevin John, and wrote a Flash computer interactive for the online Cosmology curriculum.

Adrian Chan and Anna Aaronson were volunteers (as they were rising juniors) working with Dr. Kevin McLin. They also learned how to use our analyze data from GORT.



http://www.sonoma.edu/scitech/hs

STScI at Expanding Your Horizons Career Discovery Day – Oct 2011

As part of a long-term partnership between STScI's Office of Public Outreach (OPO) and Stevenson University, OPO's Education team was invited to participate in Stevenson University's "Expanding Your Horizons: Career Discovery Day" that took place on October 2nd. The purpose of this one-day conference is to bring together middle school girls to participate in engaging and challenging hands-on science, technology, math, and engineering (STEM) activities led by women in STEM professions. OPO's Jessica Harris, in partnership with Education Specialist Dan McCallister, developed and presented an astronomy-related workshop entitled "Exploring the Universe Beyond Our Eyes." In this workshop students, participated in inquiry-based activities that led them to discover that there is more to light than meets the eye. Students also learned how light and space telescopes are used as tools in astronomy to further our understanding of the universe. This annual event is sponsored by Stevenson University and the Baltimore branch of the American Association of University Women. The EYH Network, is a non-profit membership organization of educators, scientists, mathematicians, parents, community leaders, and government and corporate representatives. Currently Expanding Your Horizons conferences are held in 31 states and in Euro

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FROM EARTH TO THE *Solar System*

- The bilingual (English/Spanish) NASA EPOESS-funded From Earth to the Solar System (FETTSS) traveling exhibit was on display at a library in Puerto Rico for October 2011.
- Throughout October supporting FETTSS activities organized by/with Universidad de Puerto Rico included:
  - a film series and a conference series, including visiting astronomer Dr. Amelia Ortiz Gil from Spain.
  - a "Planet Festival" with daytime observing (October 15)
  - Visiting local school groups
  - Volunteer college students (including two visually impaired students) assisting at the exhibit and talking with visitors.
  - Exhibit guide/handouts in Spanish

-Chandra X-ray Center/SAO

SOFIA Joining Forces, September 2011

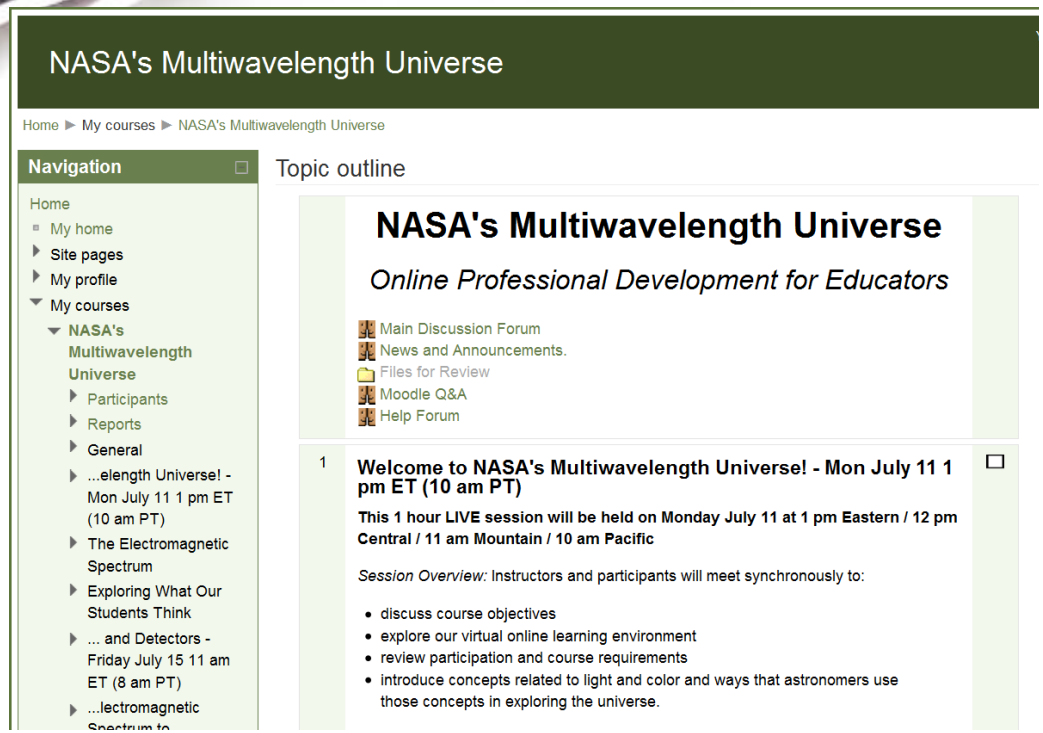
(Top, left to right:) NASA SMD Chief Scientist & SOFIA Program Scientist Paul Hertz, Associate Administrator for Education Leland Melvin, Deputy Administrator Lori Garver, and SOFIA Airborne Astronomy Ambassador Mary Blessing (Herndon, Virginia). (Bottom:) SOFIA pilot Manny Antimisiaris engages Quantico students in the

Joint Forces Base Andrews, NASA, and the White House collaborated on September 22 to provide an outreach event for military families and students in the Washington area, featuring NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA). NASA Deputy Administrator Lori Garver, Associate Administrator for Education Leland Melvin, SMD Chief Scientist & SOFIA Program Scientist Paul Hertz, and SOFIA Airborne Astronomy Ambassador Mary Blessing (a high school teacher who flew on SOFIA in May 2011) spoke regarding SOFIA's importance as a national education & public outreach asset as well as a national and international research facility. Later during the day, NASA Administrator Charlie Bolden visited SOFIA and helped entertain the crowd during a security lock-down. The Joining Forces event was attended by 200 children and teachers from the school at Marine Corps Base Quantico, as well as some Andrews, NASA and German Aerospace Center (DLR) staff, families, and friends.

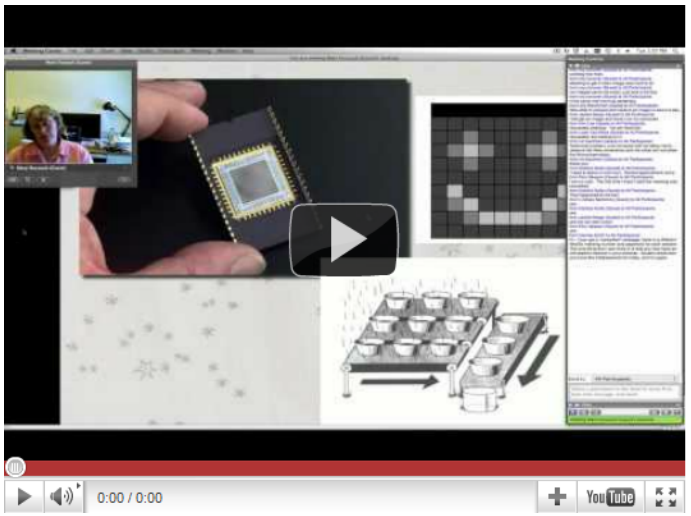
NASA's Multi-wavelength Universe

July 11- 22, 2011

Sonoma State University E/PO hosted the website for this on-line two-week professional development course for teachers.



There were four "live" synchronous sessions and four independent-study asynchronous sessions in the course.



The live sessions were captured and posted for viewing at later times.

This course was developed through a collaboration organized by the Astrophysics Forum. Lynn Cominsky and Mary Dussault were the primary instructors.

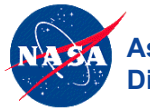
23 teachers participated: 8 for academic credit, 7 for continuing education credit, and 8 as auditors. Credits were offered through SSU's Education department.

http://universe.sonoma.edu/cosmo/course/view.php?id=2

Connecting Scientists with NASA SMD Astrophysics E/PO
American Astronomical Society Meeting – Jan 12 2012 – Austin, TX

18 NASA SMD Astrophysics E/PO community members and 2 SMD E/PO program officers hosted a “splinter session” at the Austin AAS meeting to engage attendees in SMD E/PO. Nearly 40 astronomers and educators learned about NASA SMD-funded Astrophysics E/PO resources, SMD E/PO funding opportunities, and specific possibilities to collaborate with Astrophysics mission/programs, and SMD ROSES E/PO activities. Attendees evaluated the session strongly as meeting their expectations, indicated they would like to have follow-up contact with organizers, and plan to use at least one E/PO resource from the session. The session was coordinated by the SMD Astrophysics Science E/PO Forum.

Back-Up Slides



Astrophysics
Division

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