

# PRIMEFOCUS

Tri-Valley Stargazers



January 2012



## Meeting Info

### What:

Images of Extrasolar Planets

### Who:

Dr. Bruce Macintosh

### When:

January 20, 2012  
Doors open at 7:00 p.m.  
Lecture at 7:30 p.m.

### Where:

Unitarian Universalist  
Church in Livermore  
1893 N. Vasco Road

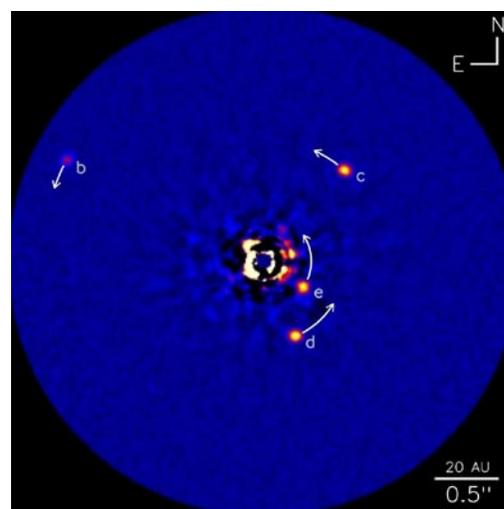
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## January Meeting

### Images of Extrasolar Planets

Over the past 15 years, more than a thousand extrasolar planets have been detected, revolutionizing our understanding of other solar systems. However, almost all of these have been seen indirectly, through their gravitational tug on the parent star, or through the tiny dimination in the star as the planet transits across it. Although these techniques are powerful, they are also limited - only planets close to the star can be seen. Direct imaging is an important new technique - actually seeing the planet separate from the star - that is sensitive to completely different planets. Using the 10-m W.M. Keck II telescope, with adaptive optics to correct for blurring of the star by the Earth's atmosphere, and advanced image processing, our group was able to image four massive planets orbiting the young star HR8799, as seen above, the first-ever pictures of a solar system outside our own. I'll describe the techniques used, the properties of the planets, and what this tells us about planet formation. I will also discuss the future of this field. The next major step will be a new instrument - the Gemini Planet Imager (GPI) - designed specifically for this mission- that will be able to block and control starlight to allow giant planets to be imaged around dozens of nearby or young stars. Finally, in the next decade, a specialized space telescope could be powerful enough even to see a planet like Earth orbiting a nearby sunlike star.



Caption: Image of HR8799. Credit: NRC-HIA, Christian Marois, and the W.M. Keck Observatory.

Bruce Macintosh is an astronomer in the optics group at the Lawrence Livermore National Laboratory. He has worked on applying LLNL's expertise in adaptive optics to scientific problems, particularly astronomy, and was a founding member and associate director of the NSF Center for Adaptive Optics. His primary research interest is the direct detection and characterization of extrasolar planets. He co-lead the team that produced the first-ever images of a multi-planet system orbiting a nearby star using the Keck and Gemini telescopes to image three giant planets orbiting the young star HR8799. Dr. Macintosh is Principal Investigator for the Gemini Planet Imager, a next-generation instrument that will be able to directly image dozens of planets around nearby stars.

## News & Notes

### 2012 TVS Meeting Dates

The following lists the TVS meeting dates for 2012. The lecture meetings are on the third Friday of the month, with the Board meetings on the Monday following the lecture meeting.

Lecture Meeting	Board Meeting	Prime Focus Deadline
Jan. 20	Jan. 23	Dec. 30
Feb. 17	Feb. 20	Jan. 27
Mar. 16	Mar. 19	Feb. 24
Apr. 20	Apr. 23	Mar. 30
May 18	May 21	Apr. 27
Jun. 15	Jun. 18	May. 25
Jul. 20	Jul. 23	Jun. 29
Aug. 17	Aug. 20	Jul. 27
Sep. 21	Sep. 24	Aug. 31
Oct. 19	Oct. 22	Sep. 28
Nov. 16	Nov. 19	Oct. 26
Dec. 21	Dec. 24	Nov. 30

### Money Matters

Treasurer David Feindel indicates that as of November 20, 2011 the TVS account balances are:

Checking	\$5,163.15
CD #1	\$3,765.19
CD #2	\$2,657.34

### TVS Program Director Position Needs To be Filled

TVS needs to fill the Program Director position, a critical club position, as Jim Alves has stepped down. The Program Director is responsible for booking monthly speakers for the club meetings. Jim has attempted to book as many speakers as possible for 2012 and develop leads for future speakers. He will also be available to assist in transitioning someone into the role of Program Coordinator, including providing contact information, examples of communications, etc. If you would like to take on this important club position, please contact Jim and/or any TVS officer or board member.

## Journal Club by Ken Sperber

More like a Brief History of Saxon-Norman Conflict

This past Christmas holiday, Karen and I spent a couple of weeks in England. After visiting friends in Reading, we explored the Reading Museum (<http://www.readingmuseum.org.uk/>). Despite having been to Reading many times over the years, including living there for a year, I'd never visited the Reading Museum, which presents a history of the region from the time of it's first occupation.

Among the many treasures at the museum is a copy of the Bayeux Tapestry. The Bayeux Tapestry depicts the events leading up to, and including the Battle of Hastings that occurred in 1066AD. Like the original Tapestry, which is displayed at a museum in Bayeux, Normandy, the copy is about 70 meters long and 50cm high. The copy was produced in the 1880's in Staffordshire over the course of one year by 35 women, who each signed the segment she had embroidered. The origin of the original tapestry is debated, with some suggesting that it was commissioned by Bishop Odo, half-brother of William the Conqueror, and made in England in the 1070's. However, French legend suggests that it was commissioned by Queen Matilda, William the Conqueror's wife.



Caption: Segment of the copy of the Bayeux Tapestry that depicts the sighting of the comet of 1066AD (Halley's Comet). Photo: Ken Sperber

In about 1064AD, King Edward the Confessor, then about 60 years old, and with no clear heir to the throne, dispatched his brother-in-law, Harold, Earl of Wessex, to Normandy to tell William, Duke of Normandy, that he has been chosen as heir to the English throne (Edward's mother was William's great aunt). After landing at the wrong location, Harold was taken prisoner by Guy, Count of Ponthieu. Eventually, Harold was released to William the Conqueror, with whom he joined in a campaign against Conan II, Duke of Brittany. For his efforts, Harold was possibly knighted by William, to whom he also made an oath of allegiance. This may have been done under duress, as Harold was trying to negotiate the release of his two nephews, anti-Norman hostages of William. Harold himself may have been prisoner of William in all but name.

After Harold's return to England, King Edward the Confessor died in January 1066. Edward's last words were reportedly: "I commend my wife to your care and with her my whole kingdom." Whether this happened or not, Harold claimed the

**Header Image:** The Gemini North Telescope Dome on March 22, 2008. Photo: Karen Harris.

## Journal Club (continued)

throne of England, and was crowned at Westminster Abbey (which Edward had built). Soon thereafter Halley's Comet made an appearance in the night sky, which was taken as a portent of bad luck by the Saxons.

Upon hearing the news of Harold's ascension to the throne, William the Conqueror raised a fighting force, built boats, and sailed to England. The ensuing battle scenes are depicted on the tapestry, including the use of bow and arrows and battle axes as instruments of death. At one point it was believed that William had been killed, but he raised his protective mask and showed himself to his men to rally their spirits. With a final all or nothing charge, the Saxon troops were overwhelmed, and Harold was killed. His death is depicted as occurring due to an arrow shot through his eye, and then being hacked to death. In all, Harold held the throne for less than one year. This, coupled with the coincidence of the passage of Halley's Comet, reinforced the mystical belief that comets are the harbinger's of bad luck, along with other celestial phenomena, such as eclipses.

The above narrative may not be entirely historically accurate, as I pieced much of the information together from numerous websites. Among the many websites I used, <http://hastings1066.com/> was a nice resource that contained beautiful images of the complete tapestry. Other sources I used included: <http://www.medievalists.net/2009/06/11/the-bayeux-tapestry/>, and [http://en.wikipedia.org/wiki/Bayeux\\_Tapestry](http://en.wikipedia.org/wiki/Bayeux_Tapestry). [http://www.youtube.com/watch?src\\_vid=bDaB-NNyM8o&annotation\\_id=annotation\\_559561&feature=iv&v=LtGoBZ4D4\\_E](http://www.youtube.com/watch?src_vid=bDaB-NNyM8o&annotation_id=annotation_559561&feature=iv&v=LtGoBZ4D4_E) provides a fun animated tour of the tapestry.

## Calendar of Events

### January 18, 7:00pm

**What:** Scott, Amundsen and Science: A 100th Anniversary Retrospective on Antarctic Science  
**Who:** Ed Larson, Pepperdine University  
**Where:** SETI Headquarters, 189 N. Bernardo Ave., Mountainview  
**Cost:** Free

Marking the 100th anniversary of teams led by Roald Amundsen and Robert Scott reaching the South Pole, science historian Edward Larson will reexamine their so-called Race to the Pole in light of their objectives. Amundsen and his men focused exclusively on reaching the pole and succeeded brilliantly. Scott and his men had multiple objectives, which included conducting a broad array of scientific research by teams of researchers that fanned out across the region. Larson will retell the story of these expeditions in context and contrast it with the conventional wisdom about them.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### January 21, 11:00am

**What:** The Quest for the Higgs Boson at Large Hadron Collider  
**Who:** Dr. Beate Heinemann, UC Berkeley  
**Where:** UC Berkeley, Evans Hall, Room 10  
**Cost:** Free

The Large Hadron Collider (LHC) was built in the past decade near Geneva at the border of Switzerland and France, and is now operating since last year at the world's highest energy. A primary objective of the LHC is to either discover or dispute the so-called Higgs boson. The Higgs boson was first hypothesized nearly 50 years ago in 1964 in order to find a

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#### **Officers**

##### **President:**

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[cg@fx4m.com](mailto:cg@fx4m.com)  
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##### **Vice-President:**

unfilled

##### **Treasurer:**

David Feindel  
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##### **Secretary:**

Jill Evanko

#### **Volunteer Positions**

##### **Librarian:**

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925-361-7435

##### **Program Director:**

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##### **Loaner Scope Manager:**

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##### **Key Master:**

Chuck Grant

#### **Public Star Party Chair:**

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#### **Historian:**

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#### **Mentor:**

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#### **Refreshment Coordinator:**

Laurie Grefsheim

#### **Web & E-mail**

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[tvs@trivalleystargazers.org](mailto:tvs@trivalleystargazers.org)

#### **Eyes on the Skies**

Eyes on the Skies is a robotic solar telescope run by Mike Rushford ([rushford@eyes-on-the-skies.org](mailto:rushford@eyes-on-the-skies.org)). You may access it by visiting [www.eyes-on-the-skies.org](http://www.eyes-on-the-skies.org).

#### **TVS E-Group**

So how do you join the TVS e-group, you ask? Just send an e-mail message to the TVS e-mail address ([trivalleystargazers@gmail.com](mailto:trivalleystargazers@gmail.com)) asking to join the group. Make sure you specify the e-mail address you want to use to read and post to the group.

## Calendar of Events (continued)

mechanism by which all particles that make up the matter in our Universe acquire mass. Just in the last year the LHC has made significant progress in its search for the Higgs boson. Particularly at the end of 2011 initial search results were observed that show tantalizing hints that a discovery might be very near which received a broad echo within the scientific community and the popular press. In my lecture will describe the LHC and its experiments, the relevance of the Higgs boson and the current state of the experimental searches.

For more information see: <http://scienceatcal.berkeley.edu/lectures>

### January 25, Noon - 1:00pm

**What:** A Guide to Lakefront Vacationing on Titan: Hydro Carbon Lakes and their Role in the Methane Cycle.  
**Who:** Alex Hayes, UC Berkeley  
**Where:** SETI Headquarters, 189 N. Bernardo Ave., Mountainview  
**Cost:** Free

Observations of Titan's polar regions reveal hydrocarbon lakes with morphologies and scales similar to terrestrial counterparts. The global distribution, topography, and seasonal variability of these lacustrine features are used to study volatile transport in Titan's hydrologic cycle. This seminar will review recent observations made by the Cassini RADAR and discuss the constraints they place on the nature of the lakes, their role in Titan's methane cycle, and their evolution over both seasonal and orbital time scales.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### February 6, 7:30pm

**What:** SOFIA: Astronomy from the Stratosphere  
**Who:** Dr. Erick Young, Science Mission and Operations Director, SOFIA Science Center  
**Where:** California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA  
**Cost:** Adults \$12, Seniors \$10, Academy members \$6. Reserve a Space Online or call 800-794-7576

As SOFIA Science Mission Operations Director, Young directs, supervises, and provides technical and management guidance for the combined Universities Space Research Association (USRA) and Deutsches SOFIA Institute (DSI) staff. He also manages the airborne observatory's equipment, instruments, support facilities, and infrastructure. SOFIA is a highly modified Boeing 747SP airplane that carries a 2.5-meter telescope. Flying above 40,000 ft, this NASA observatory conducts infrared observations impossible from ground-based locations. In this presentation, Dr. Young will cover the development, results, and future of this unique facility.

See <http://www.calacademy.org/events/lectures/> for lecture

and reservation information.

### February 8, Noon - 1:00pm

**What:** Past Climate Change from the Tropics to the Poles: New Information from Corals and Sediment Cores  
**Who:** Rob Dunbar, Stanford University  
**Where:** SETI Headquarters, 189 N. Bernardo Ave., Mountainview  
**Cost:** Free

Details of this talk are unavailable.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### February 15, Noon - 1:00pm

**What:** Mysteries of the Oscillations of Gas Accreting Onto Black Holes, Neutron Stars, and White Dwarfs  
**Who:** Bob Wagoner, Stanford University  
**Where:** SETI Headquarters, 189 N. Bernardo Ave., Mountainview  
**Cost:** Free

Dr. Wagoner will survey the QPOs (quasi-periodic oscillations) seen in the luminosity fluctuation power spectra of compact objects accreting from a binary companion star. There is little understanding of the different frequency relationships in these systems. Dr. Wagoner will focus on the theory and observations of black holes, and compare the predictions of their spin via diskoseismology with those from two other methods.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

## CRESCENT MOONS 2012

By Bob Sills

The calculations of visibility are based on an algorithm by B.D. Yallop, along with a later paper on crescent-moon visibility by Roy E. Hoffman. The table is calculated for Castro Valley, but applies (with minor changes to sunset times) to any location in the Bay Area.

This table lists the dates on which the waxing crescent moon should first be visible in the Bay Area. You need a good horizon (to the west, northwest, or southwest, depending on time of year), and there is a limited window for seeing the moon (between the time it first becomes visible as the sky darkens, and the time it sets).

Often, the crescent moon first becomes visible about 15 to 25 minutes after sunset. In every case, the moon will be much easier to spot the next day. Sunset times are PST or PDT, as appropriate.

Age = age of moon in hours (i.e., time since New Moon)

	Sunset	Age	Prediction
1/23/12	5:22	18.1	difficult
2/22/12	5:54	28.2	easy
3/23/12	7:23	36.4	easy
4/22/12	7:51	44.3	easy
5/21/12	8:17	27.9	difficult
6/20/12	8:33	44.6	probably easy
7/20/12	8:26	47.4	easy
8/19/12	7:55	59.4	easy
9/17/12	7:12	48.4	easy
10/16/12	6:29	37.8	easy
11/14/12	4:57	27.2	probably easy
12/14/12	4:51	41.0	easy

Youngest easy moons of year: 2/22, 11/14

Youngest challenging moon of year: 1/23

## What's Up by Ken Sperber (adapted from S&T and The Year in Space)

All times Pacific Standard Time.

### January

- 13- Fri- Asteroid 433 Eros visible in small telescopes through February 20 (see p. 52 of S&T February 2012)
- 16 Mon **Last-Quarter Moon (1:08am)**
- 19 Thu Antares to lower-right of the Moon (Dawn)
- 19 Thu Algol at minimum brightness for ~2 hours centered on 9:15pm
- 22 Sun **New Moon (11:39pm; S&T wrong)**
- 22 Sun Algol at minimum brightness for ~2 hours centered on 6:05pm
- 25-26 Wed- Venus within 8 degrees of the crescent Moon (Dusk)
- 29-30 Sun- Jupiter within 8 degrees of the crescent Moon (Evening)
- 30 Mon **First-Quarter Moon (8:10pm)**

### February

- 1 Wed The Moon is seen between the Pleiades and the Hyades
- 7 Tue **Full Moon (1:54pm)**
- 9 Thu Mars rises to the left of the Moon (see p. 48 of S&T February 2012)
- 9-23 Thu- Zodiacal light visible in the west beginning about 80 minutes after sunset
- 11 Sat Algol at minimum brightness for ~2 hours centered on 7:30pm
- 14 Tue **Last-Quarter Moon (9:04am)**
- 21 Tue **New Moon (2:35pm)**



## Dawn Takes a Closer Look

By Dr. Marc Rayman

Dawn is the first space mission with an itinerary that includes orbiting two separate solar system destinations. It is also the only spacecraft ever to orbit an object in the main asteroid belt between Mars and Jupiter. The spacecraft accomplishes this feat using ion propulsion, a technology first proven in space on the highly successful Deep Space 1 mission, part of NASA's New Millennium program.

Launched in September 2007, Dawn arrived at protoplanet Vesta in July 2011. It will orbit and study Vesta until July 2012, when it will leave orbit for dwarf planet Ceres, also in the asteroid belt.

Dawn can maneuver to the orbit best suited for conducting each of its scientific observations. After months mapping this alien world from higher altitudes, Dawn spiraled closer to Vesta to attain a low altitude orbit, the better to study Vesta's composition and map its complicated gravity field.

Changing and refining Dawn's orbit of this massive, irregular, heterogeneous body is one of the most complicated parts of the mission. In addition, to meet all the scientific objectives, the orientation of this orbit needs to change.

These differing orientations are a crucial element of the strategy for gathering the most scientifically valuable data on Vesta. It generally requires a great deal of maneuvering to change the plane of a spacecraft's orbit. The ion propulsion system allows the probe to fly from one orbit to another without the penalty of carrying a massive supply of propellant. Indeed, one of the reasons that traveling from Earth to Vesta (and later Ceres) requires ion propulsion is the challenge of tilting the orbit around the sun.

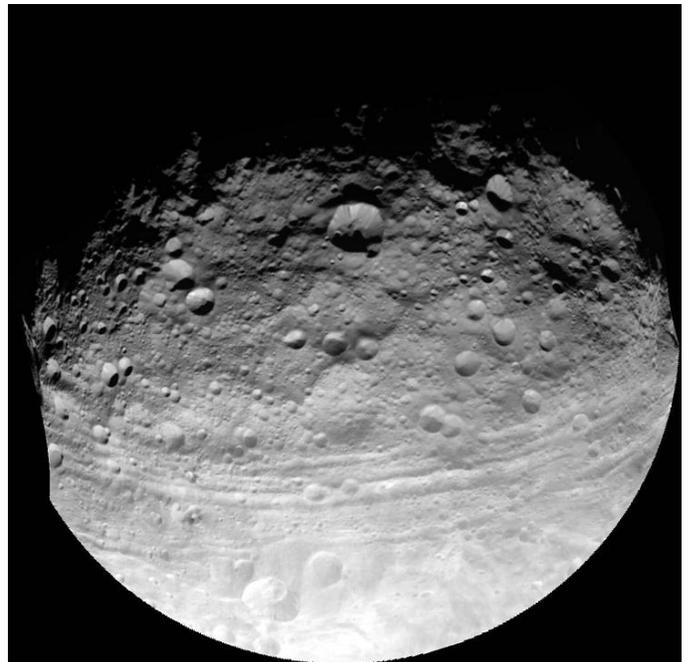
Although the ion propulsion system accomplishes the majority of the orbit change, Dawn's navigators are enlisting Vesta itself. Some of the ion thrusting was designed in part to put the spacecraft in certain locations from which Vesta would twist its orbit toward the target angle for the low-altitude orbit. As Dawn rotates and the world underneath it revolves, the spacecraft feels a changing pull. There is always a tug downward, but because of Vesta's heterogeneous interior structure, sometimes there is also a slight force to one side or another. With their knowledge of the gravity field, the mission team plotted a course that took advantage of these variations to get a free ride.

The flight plan is a complex affair of carefully timed thrusting and coasting. Very far from home, the spacecraft is making excellent progress in its expedition at a fascinating world that, until a few months ago, had never seen a probe from Earth.

Keep up with Dawn's progress by following the Chief

Engineer's (yours truly's) journal at <http://dawn.jpl.nasa.gov/mission/journal.asp>. And check out the illustrated story in verse of "Professor Starr's Dream Trip: Or, how a little technology goes a long way," at <http://spaceplace.nasa.gov/story-prof-starr>.

This article was provided courtesy of the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.



Caption: This full view of the giant asteroid Vesta was taken by NASA's Dawn spacecraft, as part of a rotation characterization sequence on July 24, 2011, at a distance of 5,200 kilometers (3,200 miles). Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Tri-Valley Stargazers  
P.O. Box 2476  
Livermore, CA 94551



## PRIMEFOCUS

### Tri-Valley Stargazers Membership Application

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function.

Name \_\_\_\_\_ Phone \_\_\_\_\_ e-mail \_\_\_\_\_

Address \_\_\_\_\_

Do not release my: \_\_\_\_\_ address, \_\_\_\_\_ phone, or \_\_\_\_\_ e-mail information to other TVS members.

- Membership category: \_\_\_\_\_ \$5 Student.  
\_\_\_\_\_ \$30 Basic. You will receive e-mail notification when the PDF version of Prime Focus is available for download off the TVS web site.  
\_\_\_\_\_ \$10 Hidden Hill Observatory (H2O) yearly access fee. You need to be a key holder to access the site.  
\_\_\_\_\_ \$20 H2O key holder fee. (A refundable key deposit—key property of TVS).  
\_\_\_\_\_ \$40 Patron Membership. Must be a member for at least a year and a key holder.  
\_\_\_\_\_ \$34 One year subscription to Astronomy magazine.  
\_\_\_\_\_ \$60 Two year subscription to Astronomy magazine.  
\_\_\_\_\_ \$32.95 One year subscription to Sky & Telescope magazine. Note: Subscription to S&T is for new subscribers only. Existing subscribers please renew directly through S&T.  
\$ \_\_\_\_\_ Tax deductible contribution to Tri-Valley Stargazers.  
\$ \_\_\_\_\_ TOTAL – Return to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551

Membership information: Term is one calendar year, January through December. Student members must be less than 18 years old or still in high school.