the Webfooted Astronomer

The Seattle Astronomical Society

November 2005

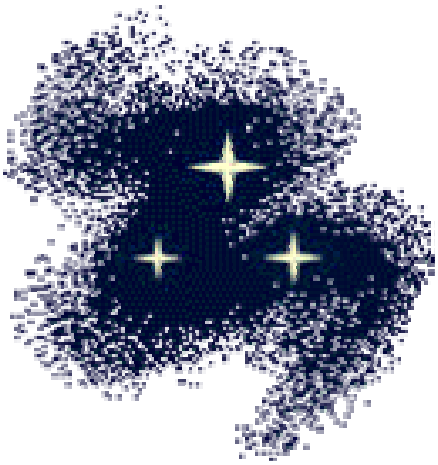
Special points of interest:

- Elections
- How Fast is the Universe Expanding?
- Anything That Can Go Wrong, Will… on Mars

November Meeting:

Acceleration of the Expansion of the Universe

Dr. Douglas A. Downing
Seattle Pacific University



Douglas Downing will discuss "Finding the distance to very distant galaxies, and the acceleration of the expansion of the universe." Visit Dr. Downing's home page at: http://myhome.spu.edu/ddowning/

We will also continue our short "Beginner's Topics."

Meeting Information

Wednesday, November 16
7:30 p.m.

Physics-Astronomy Building
Room A102
University of Washington
Seattle

Come early at 7 p.m. for coffee and snacks and to visit with your fellow members!

In this issue:

Seattle Astronomical Society

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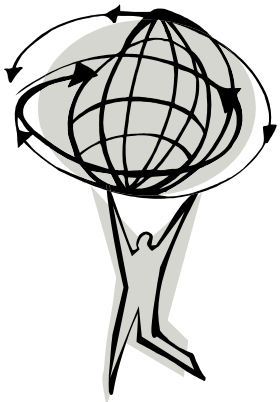


From the President's Desk…

Elections

By Thomas Vaughan

Elections

SAS Elections are scheduled for the next club meeting, November 16th. Here is the current slate of candidates:

- President: Thomas Vaughan
- VP Programs: Bruce Kelley
- VP Education: Burley Packwood
- VP Publicity: Greg Scheiderer
- VP Membership: *open*
- Treasurer: Scott Cameron

We are still looking for a VP of Membership! Janice Edwards has filled this position with distinction for two years, but by club by-laws is not able to run again. A big thank-you to Janice: not only has she handled the regular duties of VP Membership, but she also led the way with a number of other activities such as promoting the SAS at the Seattle Public Library and the Pacific Science Center.

Save the date!
SAS Awards Banquet
Saturday
January 21st, 2006

If you are interested in the role of VP of Membership (or any position!) let me know, or show up at the meeting and be nominated.

Vice-President of Publicity

I am happy to annouce that Greg Scheiderer has stepped forward to serve as the VP of Publicity. For the moment, Greg is the acting-VP, but he is nominated for the position on the November SAS slate (above).

Greg has a lot of experience with public relations, including an article on the University of Puget Sound's Mars Exploration course which made national news. Welcome, Greg!

SAS Banquet 2006

Save the date: the SAS Awards Banquet is Saturday, January 21st, 2006, at Rock Salt on Lake Union (same venue as last year). We'll have details at the November meeting. We are looking for a Banquet Chair! The venue has been reserved, the main job is coordinating with Rock Salt and the SAS. Please let me know if you can help.

Dark Sky Site

We are still fundraising for the Dark Sky Site! Have you joined as a dark sky member? If not, please visit the website at http://www.seattleastro.org/dark-sky.html, and fill out a membership form.

Are you interested in the Dark Sky Site, but haven't contributed or joined due to other concerns? Let me know! The SAS Board wants to make the Dark Sky Site a reality.

Boeing Astronomers' Holiday Banquet

The Boeing Employees Astronomical Society is hosting a Holiday Banquet at the Museum of Flight on December 5th. If you are interested, please contact Dave Ingram (david.w.ingram@boeing.com, 253-773-4569), or see the information online at http://www.boeingastro.org/.

Happy Observing-

-Thomas

Stellar Facts

The Sun was born about 4.5 billion years ago. It is right now in it's middle-age and still have about 5 billion years to go.

Earthshine is the pale glow on the darkened portion of a crescent moon due to light reflected from Earth's day side.

Seattle Astronomical Society

Dark Sky Fundraising

Name	
Street Address	
City	
State	
Zip Code	
Phone Number	
Email Address	

Ways to contribute:

Contribution	Cost	Total
Dark Sky Membership (must also be an SAS member)	$250 membership fee. (+ $60/year) Only the membership fee is due at this time. Not tax-deductible.	
Donation	Tax-deductible.	

Only Dark Sky Members are able to use the site at-will. Once purchased, a Dark Sky Member can sell his/her membership to another SAS member. The new owner of the Dark Sky Membership will have to pay the yearly fees.

Dark Sky yearly fees will be charged once a dark sky site is acquired. You do *not* need to include yearly fees with this payment.

If a Dark Sky site is not acquired by January 2007, donations and membership fees will be returned, less a pro rata portion of expenses. The January 2007 date can be extended by the SAS Board if they feel a purchase is imminent.

Cut out and mail this form and payment to the Seattle Astronomical Society at:

Dark Sky Site, Seattle Astronomical Society, PO Box 31746, Seattle, WA 98103-1746

Not an SAS member? Fill out a membership form on page 15 or at http://www.seattleastro.org/membership.html

SAS October 2005 Club Meeting Minutes

Announcements:

This year's Banquet will again be held at Rock Salt on Lake Union restaurant. A banquet chair is still needed.

Elections will be held at the November general meeting – please contact any board member if you are interested in one of the club officer positions.

New member's meeting will be held at Karl Schroeder's house on 11/5. Karl can be contacted at KSchroe225@aol.com or (206) 362-7606

Books and RASC calendars will be available for sale at the November meeting.

Ed Barnes, who dutifully provided coffee and cookies for the last 30 years has retired from this detail. A new volunteer is sought to take over this important task.

Fund raising, membership sign-up is still underway for the club's Dark Sky Site initiative. Membership forms and information is available on the club's web site.

Mike Langley was awarded a Messier certificate by Burley Packwood.

Three new members were welcomed to the club.

Beginner's Topic, "Types of Telescopes", was presented by Bruce Kelley.

Meeting Topic: Jonathon Faye of Bear Creek Observatory on Astro-photography using digital SLR cameras.

Jonathon provided a very informative and in-depth look at using consumer DSLR cameras for astro-photography. A comparison was made between use of dedicated CCD cameras versus off-the-shelf DSLR cameras and the processes required and the pros and cons of both. Jonathon also provided an excellent description of software packages available for control of a telescope and DSLR camera and image processing.

Meeting was adjourned around 9:00PM.

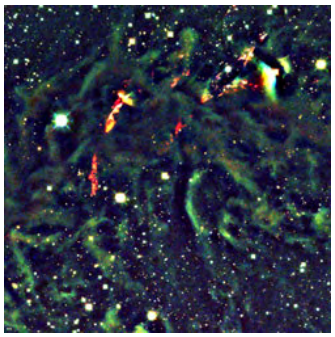
Space Bits

Mars. Image credit: NASA/JPL

Anything That Can Go Wrong, Will... on Mars

When you're exploring new territories, all kinds of things can go wrong. When you're exploring millions of kilometres away from Earth in an environment totally hostile to human life, these risks get deadly. NASA's Mars Exploration Program Analysis Group has put together a list of top risks for human Mars explorers, including the dust and potential biohazards. But one of the biggest risks is the lack of water - it's absolutely essential for a long-duration visit to the Red Planet.

Link: http://www.universetoday.com/am/publish/murphy_law_mars.html?31102005

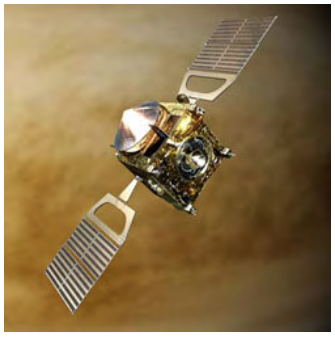


Cloudshine in L1448. Image credit: CfA

Cosmic Cloudshine

We only see material in the Universe when it's hot enough to glow, like stars, hot clouds of gas or galaxies. The material which isn't glowing is practically invisible. But astronomers from the Harvard Smithsonian Center for Astrophysics have developed a method to detect the reflected starlight bouncing off of normally dark clouds of material. This "cloudshine" allows astronomers to see the shape of a cloud forming nebula in tremendous detail.

Link: http://www.universetoday.com/am/publish/cosmic_cloudshine.html?3112005



Artist illustration of Venus Express.

Artist illustration of Venus Express.

Venus Mission Will Reveal Some Surprises

The European Space Agency's upcoming Venus Express mission to our planet's "evil twin" should reveal a planet of extremes, and more than a few surprises. One question revolves around the identity of a mysterious "unknown ultraviolet absorber", which seems to limit the amount of sunlight that reaches the planet's surface. Scientists are also hoping to find out if the planet still has active volcanoes. Venus Express is due to lift off from the Baikonur Cosmodrome on November 9th and arrive at Venus in April 2006. Link: http://www.universetoday.com/am/publish/venus_mission_surprises.html?4112005

November 2005

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2 ● UW Campus Observatory public viewing night	3 UW Astronomy Colloquium	4	5 Green Lake Star Party Paramount Park Star Party
6	7	8	9 ◑	10 UW Astronomy Colloquium	11	12
13	14	15	16 ○ SAS Meeting UW Campus Observatory public viewing night	17 UW Astronomy Colloquium	18	19 Amateur Telescope Makers SIG Meeting
20 Astrophotography/ Imaging SIG Meeting	21 SAS Board Meeting	22	23 ◐	24	25	26 Tiger Mountain/Poo Poo Point Star Party
27	28	29	30			

December 2005

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 ● UW Astronomy Colloquium	2	3 Green Lake Star Party Paramount Park Star Party
4	5	6	7	8 ◑ UW Astronomy Colloquium	9	10
11	12	13	14	15 ○	16 UW Campus Observatory public viewing night	17 Amateur Telescope Makers SIG Meeting
18	19 SAS Board Meeting	20	21 SAS Meeting	22	23 ◐	24
25	26	27	28	29	30	31 ● Tiger Mountain/Poo Poo Point Star Party

A Wrinkle in Space-Time

[By Trudy E. Bell]

When a massive star reaches the end of its life, it can explode into a supernova rivaling the brilliance of an entire galaxy. What's left of the star fades in weeks, but its outer layers expand through space as a turbulent cloud of gases. Astronomers see beautiful remnants from past supernovas all around the sky, one of the most famous being the Crab Nebula in Taurus.

When a star throws off nine-tenths of its mass in a supernova, however, it also throws off nine-tenths of its gravitational field.

Astronomers see the light from supernovas. Can they also somehow sense the sudden and dramatic change in the exploding star's *gravitational field*?

Yes, they believe they can. According to Einstein's general theory of relativity, changes in the star's gravitational field should propagate outward, just like light—indeed, at the speed of light.

Those propagating changes would be a gravitational wave.

Einstein said what we feel as a gravitational field arises from the fact that huge masses curve space and time. The more massive an object, the more it bends the three dimensions of space and the fourth dimension of time. And if a massive object's gravitational field changes suddenly—say, when a star explodes—it should kink or wrinkle the very geometry of space-time. Moreover, that wrinkle should propagate outward like ripples radiating outward in a pond from a thrown stone.

The frequency and timing of gravitational waves should reveal what's happening deep inside a supernova, in contrast to light, which is radiated from the surface. Thus, gravitational waves allow astronomers to peer inside the universe's most violent events—like doctors peer at patients' internal organs using CAT scans. The technique is not limited to supernovas: colliding neutron stars, black holes and other exotic objects may be revealed, too.

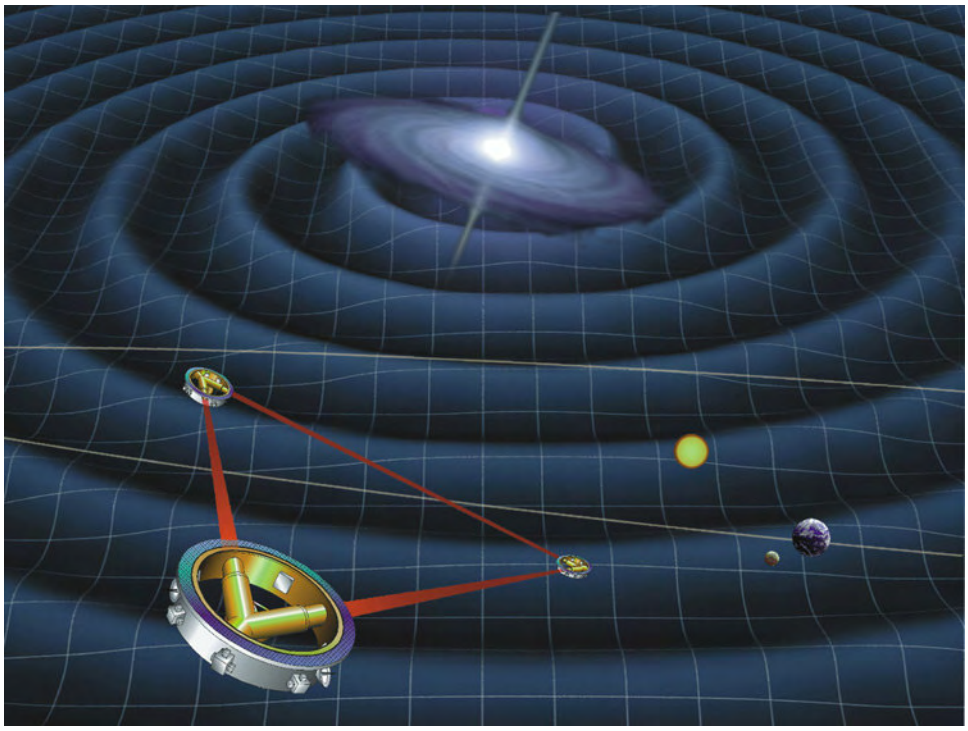
NASA and the European Space Agency are now building prototype equipment for the first space experiment to measure gravitational waves: the Laser Interferometer Space Antenna, or LISA.

LISA will look for patterns of compression and stretching in space-time that signal the passage of a gravitational wave. Three small spacecraft will fly in a triangular formation behind the Earth, each beaming a laser at the other two, continuously measuring their mutual separation. Although the three 'craft will be 5 million kilometers apart, they will monitor their separation to one *billionth* of a centimeter, smaller than an atom's diameter, which is the kind of precision needed to sense these elusive waves.

LISA is slated for launch around 2015.

To learn more about LISA, go to http://lisa.jpl.nasa.gov. Kids can learn about LISA and do a gravitational wave interactive crossword at http://spaceplace.nasa.gov/en/kids/lisaxword/lisaxword.shtml.

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



LISA's three spacecraft will be positioned at the corners of a triangle 5 million kilometers on a side and will be able to detect gravitational wave induced changes in their separation distance of as little as one billionth of a centimeter.

How Fast is the Universe Expanding?

[By D.N. Spergel, M. Bolte and W. Freedman]

Historical Overview

In the 1920s, Edwin Hubble, using the newly constructed 100" telescope at Mount Wilson Observatory, detected variable stars in several nebulae. Nebulae are diffuse objects whose nature was a topic of heated debate in the astronomical community: were they interstellar clouds in our own Milky Way galaxy, or whole galaxies outside our galaxy? This was a difficult question to answer because it is notoriously difficult to measure the distance to most astronomical bodies since there is no point of reference for comparison. Hubble's discovery was revolutionary because these variable stars had a characteristic pattern resembling a class of stars called Cepheid variables. Earlier, Henrietta Levitt, part of a group of female astronomers working at Harvard College Observatory, had shown there was a tight correlation between the period of a Cepheid variable star and its luminosity (intrinsic brightness). By knowing the luminosity of a source it is possible to measure the distance to that source by measuring how bright it appears to us: the dimmer it appears the farther away it is. Thus, by measuring the period of these stars (and hence their luminosity) and their apparent brightness, Hubble was able to show that these nebula were not clouds within our own Galaxy, but were external galaxies far beyond the edge of our own Galaxy.

Hubble's second revolutionary discovery was based on comparing his measurements of the Cepheid-based galaxy distance determinations with measurements of the relative velocities of these galaxies. He showed that more distant galaxies were moving away from us more rapidly:

$$\mathbf{v = H_o d}$$

where v is the speed at which a galaxy moves away from us, and d is its distance. The constant of proportionality H_o is now called the Hubble constant. The common unit of velocity used to measure the speed of a galaxy is km/sec, while the most common unit of for measuring the distance to nearby galaxies is called the Megaparsec (Mpc) which is equal to 3.26 million light years or 30,800,000,000,000,000,000 km! Thus the units of the Hubble constant are (km/sec)/Mpc.

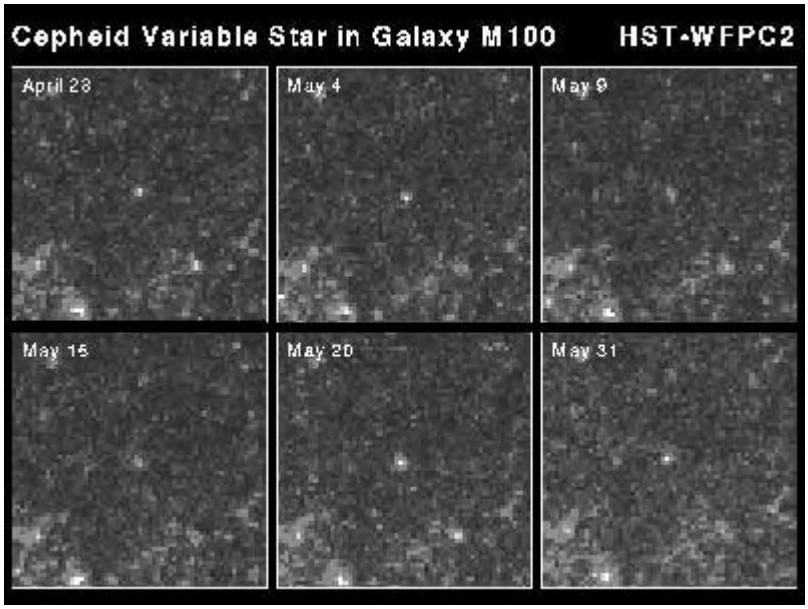
The universe was not static, but rather was expanding! This discovery marked the beginning of the modern age of cosmology. Today, Cepheid variables remain one of the best methods for measuring distances to galaxies and are vital to determining the expansion rate (the Hubble constant) and age of the universe.

What are Cepheid Variables?

The structure of all stars, including the Sun and Cepheid variable stars, is determined by the opacity of matter in the star. If the matter is very opaque, then it takes a long time for photons to diffuse out from the hot core of the star, and strong temperature and pressure gradients can develop in the star. If the matter is nearly transparent, then photons move easily through the star and erase any temperature gradient. Cepheid stars oscillate between two states: when the star is in its compact state, the helium in a layer of its atmosphere is singly ionized. Photons scatter off of the bound electron in the singly ionized helium atoms, thus, the layer is very opaque and large temperature and pressure gradients build up across the layer. These large pressures cause the layer (and the whole star) to expand. When the star is in its expanded state, the helium in

is much weaker pressure gradient across the layer. Without the pressure gradient to support the star against gravity, the layer (and the whole star) contracts and the star returns to its compressed state.

Cepheid variable stars have masses between five and twenty solar masses. The more massive stars are more luminous and have more extended envelopes. Because their envelopes are more extended and the density in their envelopes is lower, their variability period, which is proportional to the inverse square root of the density in the layer, is longer



Text Link to the HST press release describing this image.

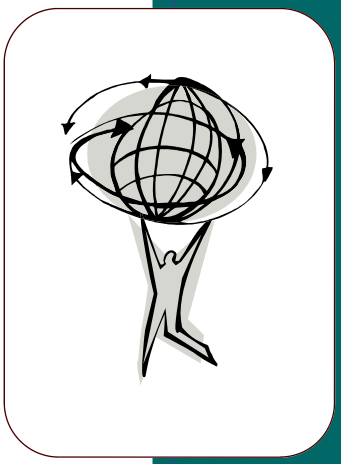
Difficulties in Using Cepheids

There have been a number of difficulties associated with using Cepheids as distance indicators. Until recently, astronomers used photographic plates to measure the fluxes from stars. The plates were highly non-linear and often produced faulty flux measurements. Since massive stars are short lived, they are always located near their dusty birthplaces. Dust absorbs light, particularly at blue wavelengths where most photographic images were taken, and if not properly corrected for, this dust absorption can lead to erroneous luminosity determinations. Finally, it has been very difficult to detect Cepheids in distant galaxies from the ground: Earth's fluctuating atmosphere makes it impossible to separate these stars from the diffuse light of their host galaxies.

Another historic difficulty with using Cepheids as distance indicators has been the problem of determining the distance to a sample of nearby Cepheids. In recent years, astronomers have developed several very reliable and independent methods of determining the distances to the Large Magellanic Cloud (LMC) and Small Magellanic Cloud (SMC), two of the nearby satellite galaxies of our own Milky Way Galaxy. Since the LMC and SMC contain large number of Cepheids, they can be used to calibrate the distance scale.

Read more at: http://map.gsfc.nasa.gov/m_uni/uni_101expand.html

We promise you the sun, moon and stars and we deliver...



The Seattle Astronomical Society is an organization created and sustained by people who share a common interest in the observational, educational, and social aspects of amateur astronomy. Established in 1948, the SAS is a diverse collection of over 200 individuals. A variety of programs and activities is presented by the SAS throughout the year. Monthly meetings feature speakers on a wide range of topics, from the Hubble Space Telescope to electronic imaging to personal observing experiences. The club holds public observing "star parties" at Green Lake every month, dark sky observing parties outside Seattle, plus such activities as meteor watches, public telescope and astronomy displays, National Astronomy Day, and an annual Awards Banquet.

The Seattle Astronomical Society

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☐	1 year of Sky and Telescope Magazine (optional)	$33.00
☐	1 year of Astronomy Magazine (optional)	$34.00
☐	Donation (optional)	$_____
	Total amount enclosed:	$_____

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