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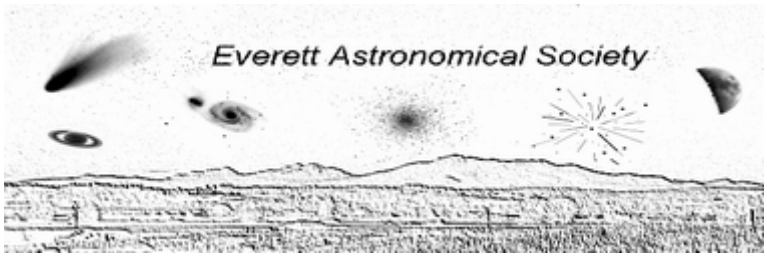
Volume MMVII. No. 2



The Stargazer

February 2007

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Web assistance: Cody Gibson	(425) 348-1608	sircody01 at comcast.net	*See EAS website at:*
		(change 'at' to @ to send email)	http://members.tripod.com/everett_astronomy

EAS BUSINESS…

NEXT EAS MEETING – SATURDAY FEBRUARY 17TH AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

★★★ THIS MONTH'S MEETING PROGRAM: ★★★

'Hubble – 15 years of Discovery' – the full official ESA documentary of the Hubble Space Telescope mission and its amazing images and discoveries, during 15 since it was launched. Includes – The Hubble Story, Planetary Tales, The Lives of Stars, Cosmic Collisions, Monsters in Space, Gravitational Illusions, and The Birth and Death of the Universe.

Map to library - http://www.epls.org/about/mlmap.htm

2702 Hoyt Avenue
Everett, WA 98201

Directions to library - http://www.epls.org/about/mldirect.htm

★ STAR PARTY INFO ★

Upcoming EAS star party schedule: (also see the regional star parties listed in the 'Astro Calendar for 2007')

Saturday Feb 17 - (evening after EAS meeting) weather permitting.

EAS member Ron Tam has offered a flexible opportunity to EAS members to come to his home north of Snohomish for observing on clear weekend evenings and for EAS starparties. Anyone wishing to do so needs to contact him in advance and confirm available dates, and let him know if plans change**. "***Our place is open for star parties any Saturday except weekends of the Full Moon. People can call to get weather conditions or to confirm that there is a star party. Our phone number is (360) 568-5152. They can e-mail me too (tam1951@nwlink.com) but I don't check my email daily. They can email me for directions if they never have been out here."*

Listed below are proposed dates for **planned EAS star parties** at my [Ron Tam's] place, depending upon the weather, of course.

Feb 18 - Sunday, (next day is Presidents Day Holiday)
Mar 24 - Saturday, (evening after EAS meeting)
Apr 14 - Saturday, (evening after EAS meeting)
May 19 - Saturday
Jun 16 - Saturday
Jul 07 - Saturday
Aug 11 - Saturday
Sep 08 - Saturday
Sep 19 - Saturday
Oct 13 - Saturday
Nov 10 - Saturday

Other dates may be available, but these coincide with times around the new moon, and any conflicts we may have.

PacSci Astronomy Weekend in North Cascades - July 13-15

This July, Pacific Science Center is excited to offer a weekend of astronomy and natural discovery for its members. Educators from Pacific Science Center and the North Cascades Institute are teaming up to offer a variety of hands-on, family-friendly educational programs. During the day, there will be astronomy classes, guided nature hikes and canoe trips on nearby Diablo Lake. And then at night, discover the night sky like you've never seen it before. We hope you'll join us for a great weekend. July 13-15, North Cascades Environmental Learning Center North Cascades National Park. More information including pricing, detailed program, and reservation forms available shortly, so please check back at Pacific Science Center's website. **http://www.pacsci.org/travel/astronomy_weekend.html**

People should also join and send mail to the mail list *everett_astronomy@topica.com* to coordinate spur-of-the-moment observing get-togethers, on nights when the sky clears. We try to hold informal close-in star parties each month during the spring, summer, and fall months on a weekend near the New moon at a member's property or a local park. (call Jim Bielaga at (425) 337-4384 for info or check the EAS website.) Members contact Jim Bielaga for scope borrowing.

$$ - FINANCIAL HEALTH - $$

The club maintains a $950+ balance. We try to keep approximately a $500 balance to allow for contingencies. .

CLUB SCOPES

SCOPE	LOAN STATUS
10-INCH WARD DOBSONIAN	ON LOAN
10-INCH SONOTUBE DOBSONIAN	AVAILABLE
8-INCH DOBSONIAN	AVAILABLE

EAS members: contact VP James Bielaga at (425) 337-4384 or jamesbielaga at aol.com to borrow a scope.

EAS MEMBER NEWS

Attention EAS Members – 10% Discount for all Everett Astronomical Society Members at Aurora Astro Products

"Show your club membership card at Jim Bielaga's new astronomy store 'Aurora Astro Products' and receive a 10% discount on all purchases. This is an exclusive discount to E.A.S. members only.

I am proud to be able to offer this discount to Everett club members, and thanks for the support you have shown me on opening my new store. Also I have made great friends and learned a lot being a club member since 1991.

- Clear Skies, Jim Bielaga"

Aurora Astro Products
11419 19th Avenue SE #A102
Everett, WA 98208
425-337-4384
www.auroraastro.com
Open Monday - Friday 9:00 am to 6:00 pm
Saturday 10:00 am to 5:00 pm
Over 37 product dealerships, and growing

Astronomy Day 2007 – April 20 and 21st

Friday Apr 20 – Dusk - Astronomy Day Observing Star party at Harborview Park http://www.everettwa.org/default.aspx?ID=539

Saturday Apr 21 – 10:00- 5:00 – Displays, Presentations, and Events at Everett Library Auditorium

Saturday Apr 21 - Dusk - Astronomy Day Observing Star party at Harborview Park http://www.everettwa.org/default.aspx?ID=539

http://www.astroleague.org/al/astroday/factsheet.html

EAS members – please mark your calendars for this event !

Does Anyone know about the history of the EAS ???

The Northwest Region of the Astronomical League (NWRAL) is putting together a new website and needs the following information from each club of the NWRAL. The EAS is looking for any information from members about the early history. Please contact Mark Folkerts if you have any info that could be of help. NRWAL would like a brief history of the club

- Club established date
- Who started the club
- When club joined the Astronomical League.

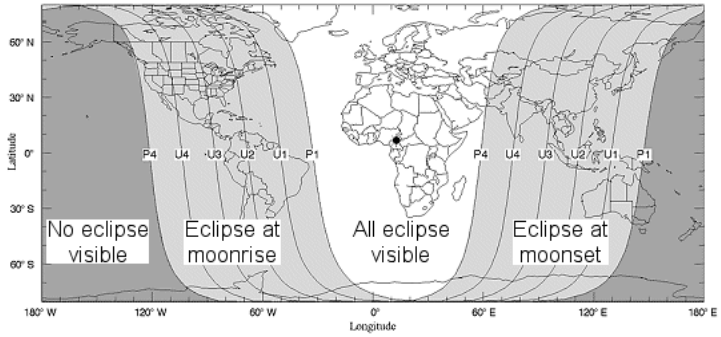
ASTRO CALENDAR FOR 2007

February 2007

Feb 07 - Mercury Greatest Eastern Elongation – see it evening sky this week!
Feb 10 - Saturn at opposition – now at its best for the year, rising at dusk
Feb 17 - EAS February Meeting – 3:00 PM – Everett Public Library
Feb 17 - Saturday, EAS star party at Tam's (evening after EAS meeting)
Feb 18 - Sunday, EAS star party at Tam's (next day is Presidents Day)
Feb 18 - Chinese New Year - Gung Hay Fat Choy !
Feb 23 - 20th Anniversary (1987), Supernova 1987A Explosion

March 2007

Mar 03 - Total Lunar Eclipse visible at moonrise



Mar 08 - 30th Anniversary (1977), Discovery of Uranus' Rings
Mar 11 - Daylight Saving - Set Clock Ahead 1 Hour (USA)
Mar 15 - Asteroid 99942 Aphophis Closest Approach To Earth (.865 AU)
Mar 18 - Best weekend for Messier Marathons
Mar 21 - Vernal Equinox, 00:07 UT
Mar 24 - EAS March Meeting – 3:00 PM – Everett Public Library
Mar 24 - Saturday, EAS Star party at Tam's (evening after EAS meeting)

April 2007

Apr 08 - Easter Sunday
Apr 16-22 - Astronomy Week - Bringing Astronomy to the People
Apr 14 - EAS March Meeting 3:00 PM – Everett Public Library
Apr 14 - Saturday, EAS Star party at Ron Tam's - after EAS meeting
Apr 20 - Astronomy Day – Friday Star party at Harborview Park
Apr 21 - Astronomy Day – Saturday Star party at Harborview Park
Apr 21 - Astronomy Day Saturday events at Everett Library
http://www.astroleague.org/al/astroday/factsheet.html
Apr 19-22 - OAS Camp Delaney Spring Star Party - http://www.olympicastronomicalsociety.com/Documents/CAMP%20DELANY%20V2.pdf
Apr 22 - Lyrids Meteor Shower Peak

May 2007

May 05 - Eta Aquarids Meteor Shower Peak
May 13-20 - Texas Star Party - http://www.texasstarparty.org/
May 17 - Comet 2P Encke Closest Approach to Earth (0.507 AU)

May 19 - Saturday, EAS Star party at Ron Tam's
May 25-28 - Riverside Telescope Makers Conf. - http://www.rtmc-inc.org/
May 26-28 - Fire In The Sky (WAC launch & star party)
http://www.washingtonaerospace.org/launches.php
May 28 – Memorial Day Holiday

June 2007

Jun 01 - Asteroid 4 Vesta Closest Approach To Earth (1.144 AU)
Jun 06 - Jupiter at opposition
Jun 9-16 Grand Canyon Star Party -
http://www.tucsonastronomy.org/gcsp.html
Jun 14-17 Rocky Mountain Star Stare - http://www.rmss.org/
Jun 16 - Saturday, EAS Star party at Ron Tam's
Jun 18 - Dwarf Planet 134340 Pluto Closest Approach To Earth (30.2AU)
Jun 20 - Summer Solstice, 20:24 UT
Jun 22-24 - Klickitat County Star Party - http://www.klickitatstarparty.net/
June 30 - Blue Moon (2nd Full Moon of month)

July 2007

Jul 04 - 4th of July Holiday
Jul 07 - Earth At Aphelion (1.017 AU from Sun)
Jul 07 - Saturday, EAS Star party at Ron Tam's
Jul 9-16 - Shingletown Star Party - http://www.shingletownstarparty.net/
Jul 11-14 Golden State Star Party at Mt Lassen NP
http://www.goldenstatestarparty.org/
Jul 13-15 - PacSci Astronomy Weekend in North Cascades
http://www.pacsci.org/travel/astronomy_weekend.html
Jul 12-14 - Table Mountain Star Party - http://www.tmspa.com/
Jul 13-15 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Jul 14 - OAS Hurricane Ridge Star Party -
http://www.olympicastronomicalsociety.com/hurricane_ridge_star_parties.htm
Jul 29 - South Delta-Aquarids Meteor Shower Peak

August 2007

Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 3-4 - ALCON 2007 Portland Oregon - http://www.alconexpo.com/
Aug 06 - Southern Iota Aquarids Meteor Shower Peak
Aug 8-12 - Mt Bachelor Star Party - http://www.mbsp.org/
Aug 11 - Saturday, EAS Star party at Ron Tam's
Aug 11 - Silver Falls (OR) Star Party -
http://www.oregonstateparks.org/park_211.php
August 11 - ICAS Artist Point Lookout Star Party -
http://groups.msn.com/WashingtonICAS/memberonlyevents.msnw
Aug 11-19 Mt. Kobau Star Party - http://www.mksp.ca/
Aug 12 - Perseids Meteor Shower Peak
Aug 11 - OAS Hurricane Ridge Star Party -
http://www.olympicastronomicalsociety.com/hurricane_ridge_star_parties.htm
Aug 16-19 - Oregon Star Party - http://www.oregonstarparty.org/
Aug 24-26 - RASCal's Star Party - http://victoria.rasc.ca/events/StarParty/
Aug 25 - Northern Iota Aquarids Meteor Shower Peak
Aug 28 - Total Lunar Eclipse - entire eclipse visible

September 2007

Sep 03 - Labor Day Holiday
Sep 6-9 - OAS Camp Delaney Fall Star Party -
http://www.olympicastronomicalsociety.com/Documents/CAMP%20DELANY%20V2.pdf
Sep 08 - Saturday, EAS Star party at Ron Tam's
Sep 6-9 Alberta Star Party - http://calgary.rasc.ca/asp2007.htm
Sep 15 - ASTRONOMY DAY (For Fall too this year!) Star Party
Sep 14-16 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Idaho Star Party, September 9-11, 2005 Boise Astronomical Society
http://www.boiseastro.org/
Sep 19 - Saturday, EAS Star party at Ron Tam's
Sep 20-23 - Orion Nebula Star Party -
http://www.seattleastro.org/orionnebsp.html
Sep 23 - Autumnal Equinox (09:51 UT)
Merritt Star Quest - http://www.merrittastronomical.com/

October 2007

Oct 09 - Draconids Meteor Shower Peak
Oct 13 - Saturday, EAS Star party at Ron Tam's
Oct 14 - Dwarf Planet 136199 Eris Closest Approach To Earth (95.8AU)
Oct 12-14 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Oct 21 - Orionids Meteor Shower Peak
Oct 31 - Halloween

November 2007

Nov 03 - Taurids Meteor Shower Peak
Nov 04 - End Daylight Saving time - Set Clock Back 1 Hour (US)
Nov 10 - Saturday, EAS Star party at Ron Tam's
Nov 12 - Dwarf Planet Ceres Closest Approach To Earth (1.832 AU)
Nov 17 - Leonids Meteor Shower Peak
Nov 22 - Thanksgiving Holiday

December 2007

Dec 07 - 35th Anniv (1972), Apollo 17 Launch (Last Mission to Moon)
Dec 13 - Geminids Meteor Shower Peak
Dec 22 - Winter Solstice, 22:06 UT
Dec 22 - Ursids Meteor Shower Peak
Dec 24 - Mars at opposition
Dec 25 - Christmas Holiday

UW Astronomy Speakers Colloquium Schedule

The Astronomy Department weekly colloquium meets Thursdays at 4:00 pm in PAB A102 - the classroom part of the Physics/Astronomy Building complex, (or at 11:30 in C520). www.astro.washington.edu/dept/colloquium.html
Mar 31 - Megan Pickett, *'Rings, Rocks, & Ripples, A New Recipe for Jupiter'*
Apr 05 - 11:30 C520 Gordon Richards, '*The Galaxy-Dark Matter Connection'*
Apr 07 - 11:30 C520 Frank van den Bosch, '*The Galaxy-Dark Matter Connection'*
Apr 11 - 11:30 C520 Samir Salim, '*GALEX Meets SDSS: Star Formation in the Local Universe'*
Apr 12 - 11:30 C520 Jeffrey Newman, '*New Results from the DEEP2 Redshift Survey'*
Apr 14 - Hugh Hudson, '*Solar Flares in the New Millenium'*
Apr 21 - Naomi McClure-Griffiths, '*HI Supershells and the Galactic Ecosystem'*
Apr 22 - 11:30 C520 Michael Blanton, New York U (title TBA)
Apr 26 - 2:30 A118? Carolyn Porco, Space Science Institute, '*Highlights from Cassini's Imaging Adventures at Saturn'*
Apr 28 - Evan Skillman, U. Minnesota, TBA
May 5 - Keith Holsapple, U.W. Aero & Astro, '*Asteroid Spin Data: No Evidence of Rubble-Pile Structures'*
May 12 - Kristen Larson, WWU, '*Dust Maps: Characterizing Extinction and Reddening of Gas at High Galactic Lattitude'*
May 19 - Josh Grindlay, '*Chandra-HST Studies of Compact Objects and Binaries in Globular Clusters'*
May 26 - Paul Boynton, U.W. Astronomy *'Discovery of the CMBR: Looking Back 40 Years'*
Jun 02 - Jim Bell, Cornell , '*Spriit and Opportunity on Mars'*
Jun 09 - Anjum Mukadam, U.W. Astronomy, tba

ON THE AIRWAVES - KSER 90.7 - 'IT'S OVER YOUR HEAD'

"Our group of radio script writers now consists of EAS and SAS members Jim Ehrmin, Greg Donohue, and Ted Vosk, who are now regularly writing and helping to produce our **astronomy radio show**, "**It's Over Your Head"** on radio station **KSER, FM 90.7.** The six-minute segment is broadcast **every Wednesday morning at approximately 7:20 A.M.** and gives a weekly look at what's up in the sky over Snohomish County, with other information. If you are a listener to the program, show your support by giving the program director of KSER a call!" Web page with lots of archives and other info is available at http://www.itsoveryourhead.org/

KPLU 88.5 FM National Public Radio has daily broadcasts of "Star Date" by the McDonald Observatory of the University of Texas at Austin, Monday through Friday at about 6:05 pm. The short 2 minute radio show deals with current topics of interest in astronomy. The University of Washington TV broadcasts programs from NASA at 12:00 AM Monday

through Friday, 12:30 AM Saturday, and 1:30 AM Sunday on the Channel 27 cable station.

EAS MEMBERSHIP BENEFITS & INFORMATION

EAS Benefits -
Membership in the **Everett Astronomical Society** (EAS) includes invitations to all of the club meetings and star parties, plus the monthly newsletter, ***The Stargazer.*** Currently, a 10% discount is also being offered to EAS members for purchases at Aurora Astro Products in Everett

Magazine Discounts –
In addition you will be able subscribe to ***Sky and Telescope*** for $7 off the normal subscription rate, contact the treasurer (Carol Gore) for more information.
http://members.tripod.com/everett_astronomy/application.htm (**When renewing your subscription to *Sky & Telescope* you should send your S&T renewal form along with a check made out to Everett Astronomical Society to the EAS address.** The EAS treasurer Carol Gore will renew your *Sky and Telescope* subscription for you. **Astronomy** magazine offers a similar opportunity to club members.)

Membership in the Astronomical League -
EAS is a member of the **Astronomical League** and you will receive the Astronomical League's quarterly newsletter magazine, ***The Reflector***.

EAS Club Telescope Borrowing -
Being a member also allows you the use of the club's telescopes, including an award winning 10 inch Dobsonian mount reflector, a second 10" dob, or and 8" Dobsonian. Contact Jim Bielaga (425) 337-4384 to borrow a telescope.

10% Discount on Purchases at 'Aurora Astro Products' in Everett -
EAS members are currently offered a 10% discount for all purchases of any telescopes, accessories, or other items at Aurora Astro Products, when they show their EAS membership card.

EAS Library -
Membership will give you access to all the material in the lending library. The library, which is maintained by Mike Locke, consists of VCR tapes, DVDs, many books, magazines, and software titles. The EAS has a library of books, videotapes, and software for members to borrow. We always value any items you would like to donate to this library. You can contact a club officer or **Librarian Mike Locke**, phone (425) 259-5995, email mlocke at lioninc.com, to borrow or donate any materials. See list here: http://members.tripod.com/everett_astronomy/eas_library.htm

Joining or Renewing with the EAS -

EAS dues are $25 / year per family. Funds obtained from membership dues allows the EAS to publish the Stargazer newsletter, pay Astronomical League dues, pay insurance, host a web site, and maintain our library. If it has been a year since you paid your dues, please re-subscribe to keep the club financially solvent, and to continue to receive membership benefits.
http://members.tripod.com/everett_astronomy/application.htm

Send your annual dues renewals to the
Everett Astronomical Society
P.O. Box 12746, Everett, WA 98206.

OBSERVER'S INFORMATION…

LUNAR FACTS

Feb 24	First Quarter Moon
Mar 03	Full Moon (Lunar Eclipse at sunset)
Mar 12	Last Quarter Moon
Mar 19	New Moon
Mar 25	First Quarter Moon
Apr 02	Full Moon
Apr 10	Last Quarter Moon
Apr 17	New Moon
Apr 24	First Quarter Moon
May 02	Full Moon
May 10	Last Quarter Moon
May 16	New Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

The Lunar and Planetary Institute has created a digital version of the Lunar Orbiter Photographic Atlas of the Moon, and Consolidated Lunar Atlas available online at:
http://www.lpi.usra.edu/research/cla/menu.html
http://www.lpi.usra.edu/research/lunar_orbiter

UP IN THE SKY -- THE PLANETS

Object	Rises	Transits	Sets	Con	Mag
Sun	**7:18 am**	**12:23**	**17:29**	**Cap**	**-27.5**
Mercury	Daylight	Daylight	**18:56**	**Aqr**	**+1.0**
Venus **	Daylight	Daylight	**19:46**	**Aqr**	**-3.9**
Mars	**5:50 am**	Daylight	Daylight	**Sag**	**+1.6**
Jupiter	**3:16 am**	7:35 am	Daylight	**Oph**	**-1.9**
Saturn **	**16:56**	**0:14 am**	**7:28 am**	**Leo**	**+0.0**
Uranus	Daylight	Daylight	**19:06**	**Aqr**	**+5.8**
Neptune	7:10 am	Daylight	Daylight	Cap	+7.9
Pluto	**3:42 am**	Daylight	Daylight	**Sag**	**+14.0**

(times local time for Everett PST)

Observing Jupiter's Moons – Java tool
http://skytonight.com/observing/objects/javascript/jupiter

Transit times for Jupiter's Great Red Spot in 2007
http://skytonight.com/observing/objects/planets/3304091.html

NOAA SUN CALCULATOR

Need to know exactly what time the sun will set on Sept. 26, 2065? Or when it rose in 565 BC? How about the length of daylight a week from Tuesday in Albuquerque, N.M.? Just go to NOAA's solar calculator, now available on the Web. http://www.srrb.noaa.gov/highlights/sunrise/gen.html

INTERNATIONAL SPACE STATION – VISIBLE SEATTLE PASSES

ISS Visibility –
http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/SightingData/Seattle.html or also see link http://www.heavens-above.com/PassSummary.asp?lat=47.979&lng=-122.201&alt=0&loc=Everett&TZ=PST&satid=25544

CONSTELLATION OF THE MONTH: VELA

VELA: Vela (Vel), or the "Sail of Argo Navis", is a well-known and interesting constellation which borders on some of the more familiar southern constellations, including Antlia, Carina, Centaurus, Puppis, and Pyxis. There are no asterisms associated with this constellation. The central point of Vela is at RA=9h43m, and Dec.= -47 degrees; its overall brightness is ranked among the constellations at 4th, with a size-related calculation of about 15 (15.211) visible stars for each 100 square degrees of constellation area. Vela also contains 76 visible stars brighter than magnitude 5.5. Its midnight culmination date is February 13th, which makes it well placed for winter observing (especially in the Southern Hemisphere, where it would be summer); the grouping has no associated meteor showers nor Messier objects. This constellation ranks 32nd in size among the constellations (taking up 499.65 square degrees (or about 1.211% of the sky), and is completely visible from latitudes S of +33 degrees and completely invisible from latitudes N of +53 degrees. The solar conjunction date of this constellation is August 18th.

Vela is one of the three constellations into which Lacaille divided the ancient constellation of Argo Navis: the other two component constellations are Carina and Puppis. The Vela Pulsar is located within this constellation. The second such object to be observed optically, radio telescopes had however discovered it years before. This pulsar was observed optically in 1977, a full ten years after the discovery of the pulsar within the famous Crab Nebula. The Vela Pulsar is among the faintest luminous objects yet observed: it has a visual magnitude of 26, and an absolute magnitude estimated at approximately (and only!) 34.5!! The constellation of Vela also contains the only complete break in the Milky Way band of light (which marks the plain of our Galaxy). This area, an immense dark nebulae composed of dust and cold gas, is known as the "Great Rift".

Vela contains many objects of interest to astronomers. NGC 3132 is a bright planetary nebula, shining at photographic magnitude 8.2, with a "central star" shining at magnitude 10.1; this planetary is one of the brightest in the entire sky. This nebula is similar in many ways in appearance to the Ring Nebula in Lyra. Indeed, this planetary in Vela has been nicknamed the "Eight-Burst Nebula" because it has a complex structure suggestive of a group of oval rings stacked one atop the other at differing angles of tilt. An interesting point about this object concerns the "central star". Studies conducted almost 30 years ago show that this star is indeed not the star illuminating the object (something that a true central star does in a planetary); rather, a 16^{th} magnitude dwarf star, about 1.7" away from the 10^{th} magnitude "central" star, is the actual luminous object thought to excite the planetary shell gas to a state of fluorescence. Vela contains other objects of note as well: NGC 3201 (an 18.2' globular cluster glowing at magnitude 6.8); NGC 3228 (an open star cluster); IC 2488 (an open cluster with a combined photographic magnitude of 7.4); and the double star Delta Velorum, which is composed of a magnitude 2.1 yellow primary and a magnitude 5.1 (also yellowish) secondary star, separated by 2.6". Vela also contains IC 2391, the biggest and brightest (combined magnitude 2.5) open cluster in the constellation; IC 2395 (a smaller, rich open cluster containing 40 stars in an area only 8' across), with an integrated magnitude of 4.6 (naked eye); and NGC 2547, an open cluster with 80 stars located within an area about 20' across. NGC 2547 is also a naked eye object with a combined magnitude of 4.7, and contains a beautiful assortment of rings, chains, and arcs of stars as a visual treat. Try to enjoy the beautiful wonders – visual and telescopic – of this constellation, if you ever have the opportunity to visit more southern skies.

PLANETARY FOCUS

"Planetary Focus" is a periodic column that publishes occasionally in the EAS "Stargazer"; it last published for the combined December-January newsletter, and will return in March. See you then.

But Venus is very visible high in the southwest sky these nights, and Saturn is at its best for the year, so enjoy observing these planets this month.

YOUNG ASTRONOMER'S CORNER

Q: What is a neutron star?

A: A neutron star is the very dense remnant of a "dead" star. A pulsar is a rotating neutron star. After certain supernova explosions, a neutron star is formed. It is termed "dead" because no nuclear reactions are occurring in its core. With some supernova explosions, the core of the star survives, and this core begins to further collapse in upon itself. This results in a sphere only about 10 miles across: a neutron star. A very dense object, a teaspoon of material from a neutron star would weigh several million tons!!

Q: How long do stars live?

A: The size of a star determines how long it will live: the smaller the star, the longer it will live (or, another way of putting it, the bigger you are, the shorter your life!). Smaller stars combine hydrogen into helium very slowly; they can survive for trillions of years before all of the hydrogen in the core is used up. Medium sized stars like the Sun burn faster. The more massive the star, the greater the pressure in their cores, which causes nuclear reactions to occur more quickly. Such medium sized stars live for "only" a few billion years. The largest stars have the shortest lives. The burn the hottest and are also the brightest stars in our night skies; these die within "only" a few million years!

Q: What is the difference between a meteor and a meteorite?

A: Simply stated, it's all about location: one is up in the air and the other is on the ground!! A meteor is a (usually very small) space rock traveling through the Earth's atmosphere: these can be as small as grains of sand and still produce brilliant flashes of light as they are burned up in the Earth's atmosphere. A meteorite is the same material (a space rock), but usually big enough to have some remnant of it survive the atmospheric burning to actually make it to the Earth's ground (where some lucky rock-hound may find it some day!!). It's simple: once it hits the ground (if it is big enough to survive the atmosphere), a meteor becomes known as a meteorite!!

ASTRONOMY AND TELESCOPE "LINGO"

ASTRONOMY "LINGO": CLOCK STAR: A bright star, usually located near the celestial equator, with positions and proper motion very accurately known: because of this precision, these stars can be use for the exact determination of time, for the determination of error of observatory time keeping instruments, and for the correction of positional observation of other stars.

TELESCOPE "LINGO": OPTICAL PATHLENGTH: The distance (d), traveled by a light beam multiplied by the refractive index (n), of the medium through which the light has passed. If this light travels across more than one medium, then the pathlength is the sum (n1d1 + n2d2, etc……) for each medium. This fomula gives the effective pathlength in terms of the wavelength of light.

ASTRONOMY "FUN FACTS"

★★ Total eclipses of the Sun are dying a slow death. Because of tidal influences, the Moon is gradually spiraling farther and farther away from Earth: some day, the Moon's disk will be unable to completely block out the Sun's disk (the requirement for a total solar eclipse). An annular eclipse will always be visible, but solar eclipses are dying a slow death: but we still have time to enjoy them, as this ability of the Moon to completely block out the Sun will only die out a few billion years from now!!

★★ If the massive amount of gamma ray energy generated in the Sun's core reached the Sun's surface (photosphere) unchanged, the Sun would radiate as a "dark" Sun, generating "death rays" (deadly gamma rays) throughout the solar system and making life impossible. Currently, most gamma rays generated at the Sun's core are dissipated in their protracted journey to the photosphere, and become infrared, visible, and ultraviolet radiations that will heat, light, and burn us. These forms of electromagnetic radiation will not kill us (at least not yet….but who knows the ultimate

consequences of unchecked global warming and ozone depletion??).

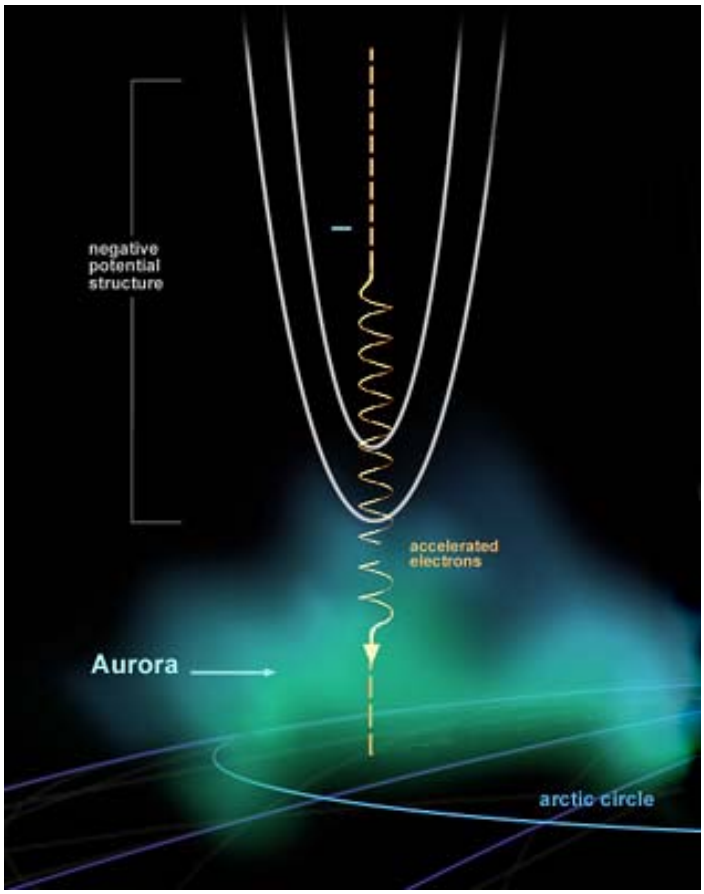
"MIRROR IMAGES"

"MIRROR" IMAGES": This column is primarily a bi-monthly column. It last published for the combined December-January newsletter, and will again publish in March with all new content. See you then!

ASTRONOMICAL NOTES -- ON & OFF THE WEB...

NEW INSIGHTS INTO ELECTRIC CIRCUITS OF POLAR LIGHTS

Giant electrical circuits power the magical open-air light show of the auroras, forming arcs in high-latitude regions like Scandinavia. New results obtained by the Cluster satellites provide a new insight into the source of the difference between the two types of electrical circuits currently known to be associated to the auroral arcs. The deep mechanisms that rule the creation of the beautiful auroras, or polar lights, have been the subject of studies that are keeping solar and plasma scientists busy since years. While early rockets and ground-observations have already provided a few important clues for the understanding of these phenomena, the real break-throughs in our knowledge have started with dedicated auroral satellites, such as S3-3, Dynamics Explorer, Viking, Freja and FAST, and have now come to full fruition with the multi-satellite mission Cluster.



The basic process generating auroras is similar to what happens in an old TV tube. In the TV tube, accelerated electrons hit the screen and make its phosphore glow; electrons in the atmosphere get accelerated in an 'acceleration region' situated between about 5000 and 8000 kilometers altitude, and rush down to the Earth's ionosphere -- a region of the upper atmosphere. Here, they crash into ionospheric atoms and molecules, transfer to them some of their energy and so cause them to glow, creating aurorae. It is well established that almost-static electric fields, parallel to the Earth's magnetic fields, play an important role in the acceleration of the electrons that cause the auroras to shine. The auroral electric circuits in the near-Earth space involve almost-static 'electric potential' structures through which electrons and ions are accelerated in opposite directions -- towards and away from Earth's atmosphere -- at high latitudes. It had been observed that these electric potential structures are mainly of two types -- symmetric (U-shaped) or asymmetric (S-shaped). In 2004, Prof. Gan Marklund noted that the U-shaped and the S-shaped structures typically occurred at the boundaries between magnetospheric regions with different properties. The former type (U-shaped) was found at a plasma boundary between the so-called 'central plasma sheet', situated in the magnetotail at equatorial latitudes, and the 'plasma sheet boundary layer', an adjacent area located at higher latitudes. The latter type (S-shaped) was found at the boundary between the 'plasma sheet boundary layer' and the polar cap, further up in latitude. Marklund was then in the condition to propose a model to explain this difference. The model suggested that both the asymmetric and symmetric shape of the potential structures, observed at the different plasma boundaries, depended on the specific conditions of the plasma (such as differences in plasma density) in the two regions surrounding the boundary. According to the 2001 observations, he concluded that the plasma conditions at the lower-latitude boundary (where U-shaped structures were observed) are in general more symmetric, while the ones at the polar cap boundary (where the S-shaped structures were observed) are more asymmetric. However, new Cluster measurements did not seem to be consistent with this picture. On 1 May 2003, one of the Cluster spacecraft crossed the auroral arc at high altitude in the Earth's magnetotail. As expected, it detected the presence of a U-shaped, symmetric potential structure when crossing the boundary between the 'central plasma sheet' and the 'plasma sheet boundary layer'. Only 16 minutes later a second Cluster spacecraft, moving roughly along the same orbit and crossing the same boundary, detected an asymmetric, S-shaped potential structure, 'typical' of the polar cap boundary and therefore unexpected in that region. However, within the 16-minute time frame between the crossing of the two spacecraft, the plasma density and the associated currents and fluxes of particles decreased significantly in the plasma sheet boundary layer. In this way this boundary ended up in resembling the asymmetric conditions typical of the polar cap boundary. So, the scientists interpreted that the 'reconfiguration' from a U-shaped to a S-shaped potential structure, and of the associated electric circuits that sustain the auroral arcs, reveal the change in the plasma conditions on the two sides of the boundary. The results represent a major step forward in understanding the auroral electrical circuits, but important questions still remain open, such as: how do the process that accelerate the electrons to form auroras get triggered and maintained? Cluster measurements in the 'acceleration' area to be performed in 2008 and 2009 should help us to find out. http://www.esa.int/esaCP/SEM0EZN2UXE_index_1.html

STUDY FINDS THAT A SINGLE IMPACT KILLED THE DINOSAURS

Data supports the single-impact theory in a controversial discussion. The dinosaurs, along with the majority of all other animal species on Earth, went extinct approximately 65 million years ago. Some scientists have said that the impact of a large meteorite in the Yucatan Peninsula, in what is today Mexico, caused the mass extinction, while others argue that there must

have been additional meteorite impacts or other stresses around the same time. A new study provides compelling evidence that "one and only one impact" caused the mass extinction, according to a researcher. "*The samples we found strongly support the single impact hypothesis*," said Ken MacLeod, lead investigator of the study. "*Our samples come from very complete, expanded sections without deposits related to large, direct effects of the impact - for example, landslides - that can shuffle the record, so we can resolve the sequence of events well. What we see is a unique layer composed of impact-related material precisely at the level of the disappearance of many species of marine plankton that were contemporaries of the youngest dinosaurs. We do not find any sedimentological or geochemical evidence for additional impacts above or below this level, as proposed in multiple impact scenarios*."

MacLeod and his co-investigators studied sediment recovered from the Demerara Rise in the Atlantic Ocean northeast of South America, about 4,500 km (approximately 2,800 miles) from the impact site on the Yucatan Peninsula. Sites closer to and farther from the impact site have been studied, but few intermediary sites such as this have been explored. Interpretation of samples from locations close to the crater are complicated by factors such as waves, earthquakes and landslides that likely followed the impact and would have reworked the sediment. Samples from farther away received little impact debris and often don't demonstrably contain a complete record of the mass extinction interval. The Demerara Rise samples, thus, provide an unusually clear picture of the events at the time of the mass extinction.

"*With our samples, there just aren't many complications to confuse interpretation. You could say that you're looking at textbook quality samples, and the textbook could be used for an introductory class*," MacLeod said. "*It's remarkable the degree to which our samples follow predictions given a mass extinction caused by a single impact. Sedimentological and paleontological complexities are minor, the right aged-material is present, and there is no support for multiple impacts or other stresses leading up to or following the deposition of material from the impact*."

The impact of a meteorite on the Yucatan Peninsula likely caused massive earthquakes and tsunamis. Dust from the impact entered the atmosphere and blocked sunlight, causing plants to die and animals to lose important sources of food. Temperatures probably cooled significantly around the globe before warming in the following centuries, wildfires on an unprecedented scale may have burned and acid rain might have poured down. MacLeod and many other scientists believe that these effects led to the relatively rapid extinction of most species on the planet. Some other scientists have argued that a single impact could not have caused the changes observed and say that the impact in the Yucatan predates the mass extinction by 300,000 years. http://munews.missouri.edu/NewsBureauSingleNews.cfm?newsid=12264

Scientist Discovers New Explanation for Pulsar's Spin

A researcher has developed a three-dimensional computer model that shows how pulsars obtain their spin, which could lead to a greater understanding of the processes that occur when stars die. Dr. John Blondin, along with colleague Anthony Mezzacappa, used the CRAY X1E supercomputer to develop a three-dimensional model of a pulsar's creation, and in the process discovered that conventional wisdom concerning the formation of these celestial objects wasn't correct. Pulsars are rapidly rotating neutron stars formed in supernova explosions, which occur when a massive star reaches the end of its life and explodes. The remaining matter is compressed into a dense, rapidly spinning mass -- a neutron star, or pulsar -- so-called because scientists first discovered them due to their regularly timed radio emissions. "*Picture something about the mass of the sun being pushed down to the size of a small American city*," Blondin says. "*That's what happens when a neutron star is formed*. "*We've known about pulsars since the 1960s*," Blondin continues. "*We can determine how fast they're spinning by how rapidly they pulse. It's like a searchlight on a lighthouse -- each time the pulsar spins, and emits a radio pulse directed toward earth, we pick up on it. The period between the pulses tells us how fast it's spinning*." Pulsars spin very rapidly -- 20 or more times per second. Scientists have assumed that the spin was caused by the conservation of angular momentum from a star that was spinning before it exploded. "Think about figure skaters," Blondin says. "*They start a spin with their arms and legs farther out from the body, and increase their rotation speed when they pull their limbs in more tightly. That's what the conservation of angular momentum is -- the idea that if you take a large object with a slight rotation and compress it down, the rotation speed will increase*." However, scientists had no idea if the stars that were producing the pulsars were even spinning to begin with. Blondin and his colleague decided to create a computer model of a supernova explosion using the new Cray X1E supercomputer at the National Center for Computational Sciences, the only computer with enough processing power to accomplish the task. The resultant model demonstrated that a pulsar's spin doesn't have anything to do with whether or not the star that created it was spinning; instead, the spin is created by the explosion itself. "*We modeled the shockwave, which starts deep inside the core of the star and then moves outward*," Blondin says. "*We discovered that as the shockwave gains both the momentum and the energy needed to blow outward and create the explosion, it starts spiraling all on its own, which starts the neutron star at the center of the star spinning in the opposite direction. None of the previous two-dimensional modeling of supernova explosions had picked up on this phenomena*." Blondin hopes that this new information about the creation of pulsars will lead to a greater understanding of supernova explosions. "*Supernova explosions produce many of the heavy elements found on the periodic chart, like gold*," he says. "*Understanding these explosions can help us to better understand our own planet and solar system*." Volume rendering of 3-D simulation of a pulsar's formation. http://news.ncsu.edu/releases/2007/jan/001_Pulsarformation.htm

Metal Ring Round White Dwarf Solves Missing Planets Puzzle

Astrophysicists have found an unusual ring of metal-rich gas orbiting very close around a white dwarf star. The presence of the ring helps solve a problem for astronomers who, up till now, have been puzzled by the apparent absence of planets around white dwarf stars. The research team led by Dr Boris Gsicke and Tom Marsh found this unusual gas disc around a relatively young white dwarf star called SDSS1228+1040. It is located in the constellation Virgo and it is around 463 light years distant from our solar system. The star became a white dwarf around 100 million years ago, and is still fairly hot with a surface temperature around 22,000 degrees.

The team observed double-peaked emission lines superimposed on the white dwarf's starlight caused by iron, magnesium and calcium from material in the vicinity of the star. This indicated that they were dealing with a disc of metal-gas orbiting close around the star (around 1.2 solar radii or roughly half a million miles). The observations also show that we are looking nearly edge-on to the ring around the white dwarf. The likely origin of the disc is an asteroid, of at least 50 kilometers in size, which approached close enough to the star to be broken up by tides generated from the

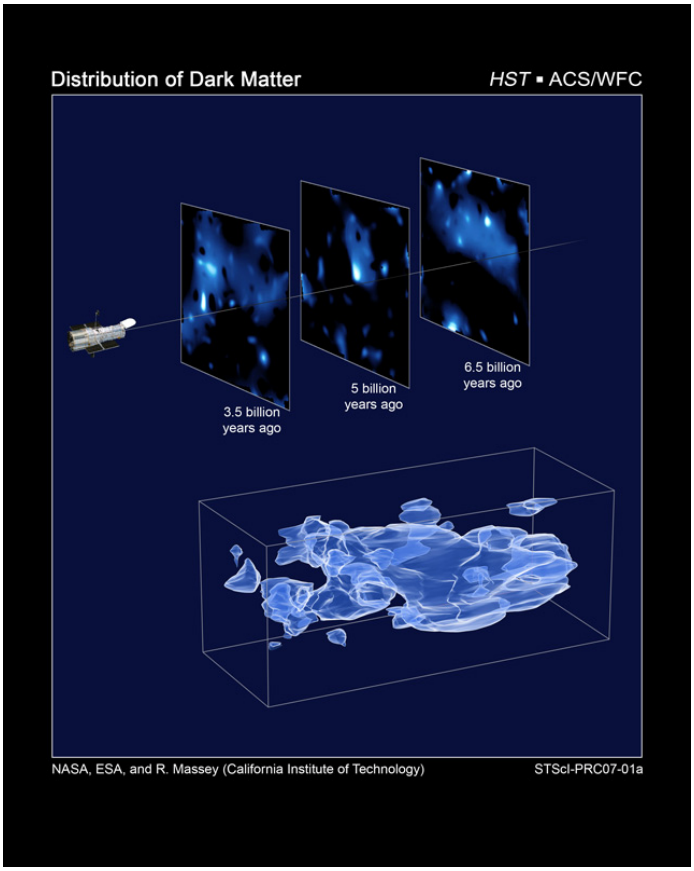
gravitational forces of the white dwarf. Those disrupted remains then entered a close orbit around the star and is evaporated by the radiation from the white dwarf. White dwarfs begin as a star similar to our sun (or a star up to 8 times bigger than our sun). Late in the star's life it swells into a red giant probably destroying any inner planets at orbits such as those of Mercury and Venus and pushing out other planets and asteroids to a more distant orbit than before. Here is a link to some simple diagrams explaining this: http://deneb.astro.warwick.ac.uk/phsdaj/public_html/SDSS1228+1040/

In the evolution of what is today a white dwarf, the progenitor of SDSS1228+1040 will have destroyed all planetary material out to a distance of 1000 solar radii (roughly 500 million miles), but asteroids still exist today at larger distances. To destabilize an asteroid from an orbit that far out, it needs the gravitational force of a larger object, such as a relatively massive planetesimal, or a genuine planet. While the presence of asteroids around white dwarf has been hypothesized before, the case of SDSS1228+1040 provides the first clear proof of the debris of a planetary disc around a white dwarf, and provides an example of what our own Solar system may look like in around 5 to 8 billion years.

This "metal" disc around SDSS1228+1040 appears to be relatively rare. Before their study, three white dwarfs, out of a study of a few hundred, were suggested to be surrounded by planetary debris material. However, in none of those three cases could a definite proof of an asteroid origin be made due to the lack of information on the geometry and the chemical abundance of the material found in the vicinity of these stars. As part of their study, the Warwick team investigated data for 500 additional white dwarfs without finding conclusive evidence for another system harboring such a disc. The rarity of such a ring made from a disrupted asteroid tells us that the majority of planetary systems may look quite different from our own Solar system. They may not have asteroid belts at all, or not as far out as it is the case in the Solar system, or they may not have planets at such great distances as Mars or Jupiter. This conclusion is consistent with the current knowledge on extrasolar planets found around others stars similar to the Sun, where the vast majority of the exo-planets are in very close orbits around their host stars. Image http://mms.warwick.ac.uk/mms/getMedia/813BAD2C89CDF30F004484FB1169F8B7.jpg Podcast interview http://www2.warwick.ac.uk/newsandevents/audio/?podcastItem=white_dwarf.mp3

HUBBLE MAPS COSMIC 3-D WEB OF "CLUMPY" DARK MATTER

An international team of astronomers using the Hubble Space Telescope has created the first three-dimensional map of the large-scale distribution of dark matter in the universe. Dark matter is an invisible form of matter whose total mass in the universe is more than five times that of "normal" matter (i.e., atoms). The nature of dark matter is still unknown. Its presence in the universe is inferred from its current influence within galaxies and clusters of galaxies, and the gravitational effect it has had on the evolution of structure in the universe. The first direct detection of dark matter was made this past year through observations of the Bullet Cluster of galaxies. This new map provides the best evidence to date that normal matter, largely in the form of galaxies, accumulates along the densest concentrations of dark matter.



The map reveals a loose network of filaments that grew over time and intersect in massive structures at the locations of clusters of galaxies. The map stretches halfway back to the beginning of the universe and shows how dark matter has grown increasingly "clumpy" as it collapses under gravity. The dark matter map was constructed by measuring the shapes of half a million faraway

galaxies. To reach Hubble, the light of the galaxies traveled through intervening dark matter. The dark matter deflected the light slightly as it traveled through space. Researchers used the observed, subtle distortion of the galaxies' shapes to reconstruct the distribution of intervening mass along Hubble's line of sight, a method called "weak gravitational lensing."

For astronomers, the challenge of mapping dark matter in the universe has been similar to mapping a city from nighttime aerial snapshots showing only streetlights. Dark matter is invisible, so only the luminous galaxies can be seen directly. These new map images are equivalent to seeing a city, its suburbs and country roads in daylight for the first time. Major arteries and intersections become evident, and a variety of neighborhoods are visible.

Mapping dark matter's distribution in space and time is fundamental to understanding how galaxies grew and clustered over billions of years. shed light on dark energy, a repulsive form of gravity that would have influenced how dark matter clumps. The research results were presented at the 209th meeting of the American Astronomical Society in Seattle, by Richard Massey and Nick Scoville. "*It's reassuring how well our map confirms the standard theories for structure formation*," said Massey. He calls dark matter the "scaffolding" inside of which stars and galaxies have been assembled over billions of years.

Researchers created the map using the Hubble's largest survey to date of the universe, the Cosmic Evolution Survey, otherwise known as COSMOS. The survey covers an area of sky nine times the area of the Earth's moon. This allows for the large-scale filamentary structure of dark matter to be evident. To add 3-D distance information, the Hubble observations were combined with multicolor data from powerful ground-based telescopes, Europe's Very Large Telescope in Chile, Japan's Subaru telescope in Hawaii, the U.S.'s Very Large Array radio telescope, New Mexico, as well as the European Space Agency's orbiting XMM-Newton X-ray telescope. http://hubblesite.org/news/2007/01

MAGELLANIC CLOUDS MAY BE JUST PASSING THROUGH

The Large Magellanic Cloud (LMC) and Small Magellanic Cloud (SMC) are two of the Milky Way's closest neighboring galaxies. Both are visible only in the southern hemisphere. By studying their orbits, astronomers can learn about both the histories of the Clouds and the structure of the Milky Way (from its influence on the Clouds' motions). Astronomers Nitya Kallivayalil and Charles Alcock and Roeland van der Marel have made the most accurate measurements to date of the three-dimensional velocities through space of the LMC and SMC. Their surprising results hold profound implications for both the Milky Way and its companions. "*We found that the velocities of the LMC and SMC are unexpectedly large -- almost twice those previously thought*," says Kallivayalil. The findings were presented at the 209th meeting of the American Astronomical Society in Seattle.

The radial velocities (motion along the line of sight) for both Clouds are well known and relatively easy to measure. Much more difficult to measure is the proper motion (motion across the sky), requiring extraordinary precision over the course of several years. Both proper motion and line-of-sight motion must be known to calculate the true 3-D velocity.

By making two sets of observations two years apart with the Hubble Space Telescope, Kallivayalil and her colleagues calculated accurate proper motions for the LMC and SMC. By combining proper motions and radial velocities, they found that the LMC speeds through space at 378 km/sec (235 miles/sec) while the SMC has a speed of 302 km/sec (188 miles/sec). There are two possible explanations for these high speeds:

1) The mass extent of the Milky Way is larger than previously thought. If the Clouds are gravitationally bound to the Milky Way, then the Milky Way must be much more massive than previous data suggested. The excess mass would pull on the Clouds, keeping them "close at hand."

2) The Magellanic Clouds are not gravitationally bound to the Milky Way. If previous calculations of the Milky Way's mass are accurate, then the Galaxy is not massive enough to hold onto its companions. In a few billion years, they will escape from the Milky Way. "*The Magellanic Clouds may not be true companions of the Milky Way*," explains Kallivayalil. "*Perhaps they are travelers just passing through the neighborhood*." The velocities of the Magellanic Clouds relative to each other also are surprisingly high. This suggests that the Magellanic Clouds may be coincidental companions and are not gravitationally bound to each other. Alternatively, their high velocities may explain why these two galaxies, if bound, did not merge with each other long ago.

Future measurements of the Magellanic Stream -- a long streamer of hydrogen gas trailing behind the Clouds -- may clarify the previous paths of the Clouds and their relationships with each other and with the Milky Way. "*Regardless of what future work finds, our study shows that we need to reassess the orbital histories of the Clouds*," says Kallivayalil. http://www.cfa.harvard.edu/press/pr0702image.html

GEOLOGISTS DISCOVER OUTER SPACE ORIGIN FOR EARTH'S MYSTERIOUS BLACK DIAMONDS

If indeed "a diamond is forever," the most primitive origins of Earth's so-called black diamonds were in deep, universal time, geologists have discovered. Black, or carbonado, diamonds, came from outer space, geologists have discovered, from none other than interstellar space. In a paper published by scientists Jozsef Garai and Stephen Haggerty, along with researchers Sandeep Rekhi and Mark Chance, is the claim that there is an extraterrestrial origin for the unique black diamonds, also called 'carbonado' diamonds. Infrared synchrotron radiation at Brookhaven National Laboratory was used to discover the diamonds' source. "*Trace elements critical to an 'ET' origin are nitrogen and hydrogen*," said Haggerty. The presence of hydrogen in the carbonado diamonds indicates an origin in a hydrogen-rich interstellar space, he and colleagues believe.

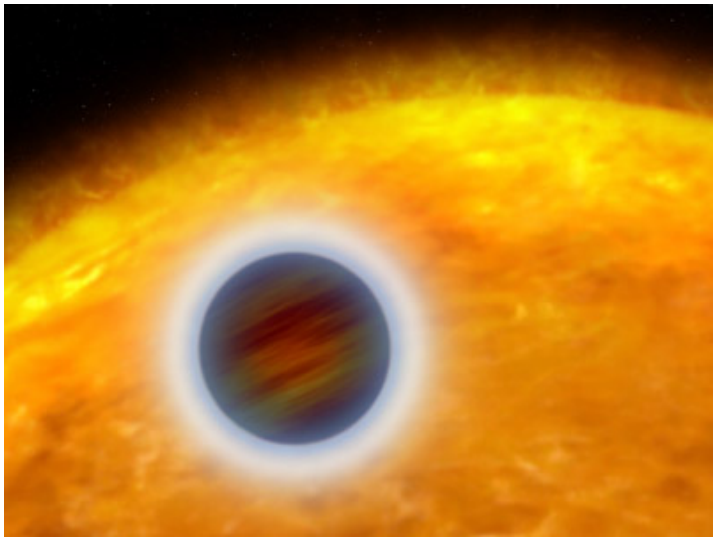
The term carbonado was coined by the Portuguese in Brazil in the mid-18th century; it's derived from its visual similarity to porous charcoal. Black diamonds are found only in Brazil and the Central African Republic. "*Conventional diamonds are mined from explosive volcanic rocks [kimberlites] that transport them from depths in excess of 100 kilometers to the Earth's surface in a very short amount of time*," said Sonia Esperanca. "*This process preserves the unique crystal structure that makes diamonds the hardest natural material known*."

From Australia to Siberia, from China to India, the geological settings of conventional diamonds are virtually identical, said Haggerty. None of them are compatible with the formation of black diamonds. Approximately 600 tons of conventional diamonds have been mined, traded, polished and adorned since 1900. "*But not a single black/carbonado diamond has been discovered in the world's mining fields*," Haggerty said. The new data support earlier research by Haggerty showing that carbonado diamonds formed in stellar supernovae explosions. Black diamonds were once the size of asteroids, a kilometer or more in diameter when they first landed on Earth. http://www.nsf.gov/news/mmg/media/images/carbonado_h.jpg

HUBBLE PROBES ALIEN WORLD'S ATMOSPHERE LAYER-CAKE STRUCTURE

Astronomers at the Lunar and Planetary Lab are the first to see structure in the atmosphere of a planet outside our solar system. The powerful vision of the Hubble Space Telescope has allowed astronomers to study for the first time the layer-cake structure of the atmosphere of a planet orbiting another star. Hubble discovered a dense upper layer of hot hydrogen gas where the super-hot planet's atmosphere is bleeding off into space. The planet, designated HD 209458b, is unlike any world in our solar system. It orbits so close to its star and gets so hot that its gas is streaming into space, making the planet appear to have a comet-like tail. This new research reveals the layer in the planet's upper atmosphere where the gas becomes so heated it escapes like steam rising from a boiler. "*The layer we studied is actually a transition zone where the temperature skyrockets from about 1,340 degrees Fahrenheit (1,000 Kelvin) to about 25,540 degrees (15,000 Kelvin), which is hotter than the Sun*," said Gilda Ballester, leader of the research team. "*With this detection we see the details of how a planet loses its atmosphere*." Also on the team were Ballester, David K. Sing, and Floyd Herbert.

Intense ultraviolet radiation from the host star heats the gas in the upper atmosphere, inflating the atmosphere like a balloon. The gas is so hot that it moves very fast and escapes the planet's gravitational pull at a rate of 10,000 tons a second, more than three times the rate of water flowing over Niagara Falls. The planet, however, will not wither away any time soon. Astronomers estimate its lifetime is more than 5 billion years. The scorched planet is a big puffy version of Jupiter. In fact, it is called a "hot Jupiter," a large gaseous planet orbiting very close to its parent star. Jupiter might even look like HD 209458b if it were close to the Sun, Ballester said. The planet completes an orbit around its star every 3.5 days. It orbits 4.7 million miles from its host, 20 times closer than the Earth is to the Sun. By comparison, Mercury, the closest planet to our Sun, is 10 times farther away from the Sun than HD 209458b is from its star. Unlike HD 209458b, Mercury is a small ball of iron with a rocky crust. "*This planet's extreme atmosphere could yield insights into the atmospheres of other hot Jupiters*," Ballester said.



Although HD 209458b does not have a twin in our solar system, it has plenty of relatives beyond our solar system. About 10 to 15 percent of the more than 200 known extrasolar planets are hot Jupiters. A recent Hubble survey netted 16 hot Jupiter candidates in the central region of our Milky Way Galaxy, suggesting that there may be billions of these gas-giant star huggers in our galaxy. HD 209458b is one of the most intensely studied extrasolar planets because it is one of the few known alien worlds that can be seen passing in front of, or transiting, its star, causing the star to dim slightly. In fact, the gas giant is the first such alien world discovered to transit its star. HD 209458b is 150 light-years from Earth in the constellation Pegasus. The transits allow astronomers to analyze the structure and chemical makeup of the gas giant's atmosphere by sampling the starlight that passes through the planet's atmosphere. The effect is similar to finding fingerprints on a window by watching how sunlight filters through the glass.

Previous Hubble observations revealed oxygen, carbon, and sodium in the planet's atmosphere, as well as a huge hydrogen upper atmosphere with a comet-like tail. These landmark studies provided the first detection of the chemical makeup of an extrasolar planet's atmosphere. Additional observations by the Spitzer Space Telescope captured the infrared glow from the planet's hot atmosphere. The new study by Ballester and her team is based on an analysis of archival observations made in 2003 with Hubble's Space Telescope Imaging Spectrograph by David Charbonneau. Ballester's team analyzed spectra from hot hydrogen atoms in the planet's upper atmosphere, a region not studied by Charbonneau's group.
http://hubblesite.org/news/2007/07
http://vega.lpl.arizona.edu/~gilda
http://hubblesite.org/news/2007/07
http://uanews.org/silk/request/ballester.jpg

The solar-type star, HD 209458, and its 'hot Jupiter" planet in transit are shown in simulated violet light. As in this illustration, the star would appear as a limb-darkened purple disk if seen in near-ultraviolet and violet light. The newly detected dense, narrow layer of hot hydrogen atoms is represented by the dark absorbing ring around the opaque planetary disk. The bulk of hydrogen atoms in the upper atmosphere, which forms an extensive cloud and also a comet-like tail, is shown in white. The absorbing layer was drawn at twice the altitude and 10 times the thickness to be more easily visible in this illustration, the rest of which has been drawn to scale. (Art credit: Loretta McKibben, UA Lunar and Planetary Lab).

PROTOPLANETARY DISK FOUND ENCIRCLING MIRA 'B'

Astronomers generally assume that the dusty disks where planets form are found around young stars in stellar nurseries. Now, for the first time, a protoplanetary disk has been found in the environment of a dying star. A team of astronomers reported at the winter meeting of the American Astronomical Society in Seattle that material from the dying star Mira A is being captured into a disk around Mira B, its companion. Michael Ireland and his coauthors, John Monnier, Peter Tuthill, and Richard Cohen, say that the finding implies that there should be many similar undiscovered systems in the solar neighborhood, providing a myriad of new places to look for young extrasolar planets. Located 350 light-years away in the constellation of Cetus, Mira (christened the "miracle star") first shook the foundations of the astronomy world 400 years ago with its changing brightness. Visible to the naked eye for about one month at a time, it becomes 1,000 times fainter and disappears from view, only to reappear again on an 11-month cycle. "*When looking at one of the most celebrated and well-studied stars in the galaxy, I was amazed to find something new and unexpected*," says Ireland. "*The discovery not only changes the way we think about a star that's important historically, but also how we'll look at similar stars in the future*."

Although Mira was once a star very similar to the sun, it is now in its death throes as it loses its dusty outer layers at a rate of one Earth-mass every seven years. If Mira were a single star, all this material would travel into outer space. However, like two out of every three star systems, Mira has a companion star that orbits around it, in this case with a period of about 1,000 years. This companion, Mira B, has a gravitational field that catches nearly one percent of the material lost from Mira A.

By using specialized high-contrast techniques at the 10-meter Keck I telescope in Hawaii and the 8-meter Gemini South telescope in Chile, Ireland's team discovered heat radiation coming not only from Mira B itself, but also from a location offset from Mira B by a distance equivalent to Saturn's orbit. "*Observing Mira in the infrared is like staring straight down the barrel of one of the brightest searchlights in the galaxy. It came as a real revelation to see this faint mote of dust, harboring all the possibilities of new worlds in formation, against the hostile environment of the Red Giant*," says Tuthill. Monnier agrees, saying "*Our new imaging method at Keck is revealing new details that were thought to be impossible to detect due to the blurring by atmospheric turbulence. In this case, the 'detail' we discovered is potentially a whole new class of planetary system in formation*." The intense radiation from Mira A, 5,000 times brighter than the sun, heats the edge of the disk to about Earth's temperature and causes it to glow in the infrared. The researchers were able to show that the material was indeed the edge of a disk and not just a "clump" in the wind from Mira A. By modeling the way that this system captures the outflow from Mira A, the researchers were also able to confirm that Mira B is simply an ordinary star like the sun, although about half as massive. The key part of this result is what will happen when Mira A finishes its death throes and becomes a white dwarf in about one million years. The disk-creating process will have finished and the disk itself will be capable of forming new planets. "*This discovery opens up a new way to search for young planets, by searching in double star systems that contain white dwarfs*," Ireland says. "*The expected abundance of these systems means that we can find planets that we know are young around stars like our sun*." Astronomers associate the death of a star with the death of its planetary system. Here, the opposite is happening. Ireland adds, "*An aging star is laying the foundation for a new generation of planets*." Similar systems could be discovered and studied by future instruments such as the Thirty-Meter Telescope. http://pr.caltech.edu/media/Press_Releases/PR12940.html

SOLAR SOUTH POLE FLYBY

"*We must always remember with gratitude and admiration the first sailors who steered their vessels through storms and mists, and increased our knowledge of the lands … in the South*."
-- Roald Amundsen

Less than one hundred years ago, the south pole of Earth was a land of utter mystery. Explorers labored mightily to get there, fighting scurvy, wind, disorientation and a fantastic almost-Martian cold. Until Roald Amundsen and Robert F. Scott reached the Pole in 1911 and 1912, it was terra incognita. The situation is much the same today—on the sun. "*The sun's south pole is uncharted territory*," says solar physicist Arik Posner. "*We can barely see it from Earth, and most of our sun-studying spacecraft are stationed over the sun's equator with a poor view of higher latitudes*." There is, however, one spacecraft that can travel over the sun's poles: Ulysses, a joint mission of NASA and the European Space Agency. And Ulysses is making a rare South Pole flyby. The 16-year-old Ulysses spacecraft reaches what could be considered a low point in its mission observing the sun – and solar scientists could not be happier. "*On February 7th, the spacecraft reaches a maximum heliographic latitude of 80 degrees S—almost directly above the South Pole*," says Posner who is the Ulysses Program Scientist for NASA. Solar physicists are thrilled. The spacecraft has reached maximum latitude in its exploration of the heliosphere, the bubble in space blown out by the solar wind. "*At max latitude we are actually passing below the sun looking almost directly up at its south pole from 329 million kilometers (204 million miles) away*," said Nigel Angold, Ulysses mission operations manager. "*The trajectory provides a perspective of the sun no other spacecraft can equal*." This unusual perspective is courtesy of the spacecraft's one-of-its-kind 6.3-year-long orbit around the sun. An orbit that swings Ulysses both over and under the sun's polar regions and as far out as the orbit of Jupiter.

Ulysses has flown over the sun's poles only twice before--in 1994-95 and 2000-01. The flybys were brief, but enough to prove that the poles are strange and interesting places. This passage between the sun's poles is the third in the 17 years of Ulysses operations. The first transit occurred during the previous sunspot minimum in 1994 to 1995, and the second during sunspot maximum in 2000 to 2001. The opportunity to repeat the scientific investigations during the ongoing solar minimum is important because the sun's magnetic field has changed significantly since the previous minimum.

"*Max latitude is the start of an important mission phase*," said Dr. Ed Smith, Ulysses project scientist. "*The spacecraft will soon begin accelerating as it transits from below the sun's south pole to its equator and then up and over its north pole. This trajectory provides us a ringside seat to all the solar processes we want to observe*." This phase of the mission is expected to return high priority scientific observations revealing the changing sun and its effect on space during the ongoing minimum in the 11-year sunspot cycle. During this portion of the mission, Ulysses will rapidly scan the sun's magnetic field, solar plasmas, solar radio noise, energetic particles, galactic cosmic rays and cosmic dust between the poles and the equator – imparting a more complete perspective of the sun's atmosphere. Understanding the Earth's nearest star and its processes is paramount, as the space weather created by the sun has a huge effect on the third rock from it and its inhabitants. The sun's gaseous outer atmosphere can create huge space storms. This violent space weather, in turn, can affect Earth's electrical grid, cell phone communications, the functioning of satellites and the operation of astronauts in orbit.

Consider the following:

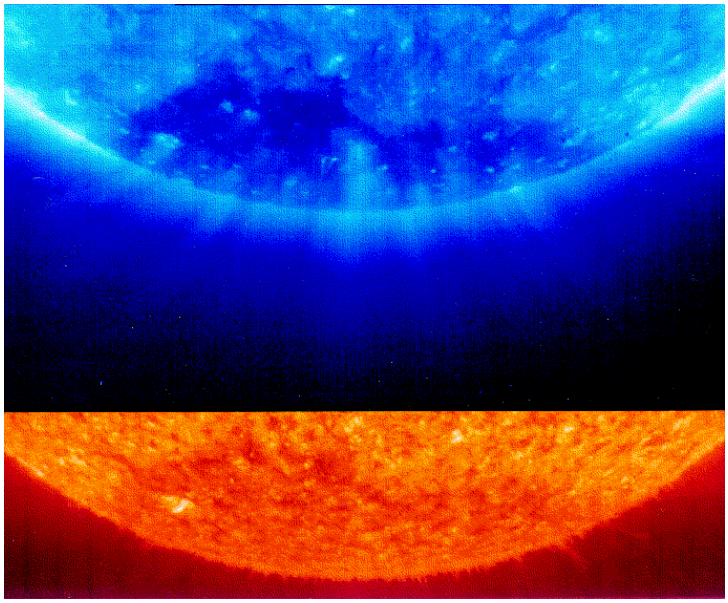
1. The sun's north magnetic north pole sticks out the south end of the sun. Magnetically, the sun is upside down! "*Most people don't know it, but we have the same situation here on Earth*," notes Posner. "*Our magnetic north pole sticks out of the geographic south pole*." Magnetically, Earth and sun have a lot in common. "*Both the sun's and Earth's magnetic poles are constantly on the move, and they occasionally do a complete flip, with N and S changing places*." This flipping happens every 11 years on the sun in synch with the sunspot cycle. It happens every 300,000 years or so on Earth in synch with--what? No one knows. "*Studying the polar magnetic field of the sun might give us some clues about the magnetic field of our own planet*."

2. There are holes over the sun's poles--"coronal holes." These are places where the sun's magnetic field opens up and allows solar wind to escape. "*Flying over the sun's poles, you get slapped in the face by a hot, million mph stream of protons and electrons*," he says. Ulysses is experiencing and studying this polar wind right now. (Note: Earth has a polar hole, too--the ozone hole. The chemistry of the ozone hole is totally unrelated to

the magneto-physics of coronal holes, but says Posner, "*it is interesting that so many poles seem to have holes*.")

3. Just as the sun's polar magnetic field allows solar wind out, it also allows galactic cosmic rays in. Could the space above the sun's poles be a place where we can sample interstellar matter without actually leaving the solar system? "*That's what we thought before our first polar flyby in 1994*," recalls Posner. "*But we were wrong. Something is keeping cosmic rays out of the sun's polar regions. The current flyby gives us a chance to investigate this phenomenon."*

4. Another mystery: There is evidence from earlier flybys that the north pole and the south pole of the sun have different temperatures. "*We're not sure why this should be*," says Posner, "*and we're anxious to learn if it is still the case*." Today's south polar flyby will be followed by a north polar flyby in early 2008, allowing a direct north vs. south comparison.

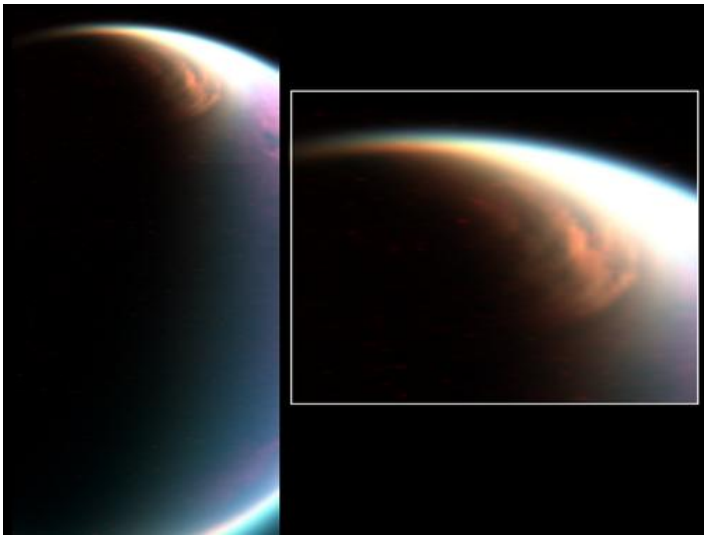


Above: The sun's south polar coronal hole. Solar wind flows out of the dark region in this false-color UV image. Credit: SOHO.

In a sense, Ulysses is more like Richard E. Byrd than Amundsen or Scott. In November 1929, Byrd flew over Earth's south pole in a Ford Trimotor airplane named the 'Floyd Bennett'. The plane barely gained enough altitude to overfly the high polar plateau, clearing some mountain peaks and glaciers by little more than a few hundred feet. Compasses were useless for direction-finding so close to the magnetic pole, and there were few landmarks in the white expanse below. Nevertheless, he managed to guide the plane straight to latitude 90 S. Like Byrd, Ulysses is a flier. "*The spacecraft is gliding 300 million km (2 AU) above the sun's 'Antarctic.' That's a safe distance and a good place to sample the sun's polar winds and magnetic fields*." In the long run, however, Ulysses will follow Scott: "*Had we lived I should have had a tale to tell of hardihood, endurance and courage*…," Scott wrote shortly before his entire party perished from cold. They reached the pole, famously chasing Amundsen, but never made it home again. Ulysses will never come home either, eventually perishing in the cold of space when its internal power sources fail.

MAMMOTH CLOUD ENGULFING TITAN'S NORTH POLE

A giant cloud half the size of the United States has been imaged on Saturn's moon Titan by the Cassini spacecraft. The cloud may be responsible for the material that fills the lakes discovered last year by Cassini's radar instrument. Cloaked by winter's shadow, this cloud has now come into view as winter turns to spring. The cloud extends down to 60 degrees north latitude, is roughly 2,400 kilometers (1,490 miles) in diameter and engulfs almost the entire north pole of Titan. The new image was acquired on Dec. 29, 2006, by Cassini's visual and infrared mapping spectrometer. Scientific models predicted this cloud system, but it had never been imaged in such detail before.



"*We knew this cloud had to be there but were amazed at its size and structure*," said Dr. Christophe Sotin, a member of the visual and infrared mapping spectrometer team. "*This cloud system may be a key element in the global formation of organics and their interaction with the surface*." The same cloud system seen on Dec. 29, was still there two weeks later during a Jan. 13, 2007, flyby, even though observing conditions were slightly less favorable than in December. The Cassini radar team reported last year that the lakes at the north pole are partly filled, and some appear to have evaporated, likely contributing to this cloud formation, which is made up of ethane, methane and other organics. These findings reinforce the idea that methane rains down onto the surface to form lakes and then evaporates to form clouds. Scientists compare this methane cycle to the hydrological cycle on Earth, dubbing it "methane-ologic cycle."

Ground-based observations show this Titan cloud system comes and goes with the seasons. A season on Titan lasts approximately seven Earth years. Based on the global circulation models, it seems that such cloud activity can last about 25 Earth years before almost vanishing for four to five years, and then appearing again for 25 years. Scientists expect this cloud to be around for several years. As the seasons change, scientists expect a shift of these clouds and lakes from the north pole to the south pole. On Titan's south pole, scientists have seen only one kidney-shaped lake with Cassini's imaging cameras. "*With 16 more flybys to come this year, we should have the opportunity to monitor the evolution of this cloud system over time*," said Dr. Stephane Le Mouelic, working with the Cassini visual and infrared mapping spectrometer team. The cloud image is available at: http://saturn.jpl.nasa.gov/news/press-release-details.cfm?newsID=720

EXPLAINING BRIGHTNESS DIFFERENCES IN 1a SUPERNOVAE

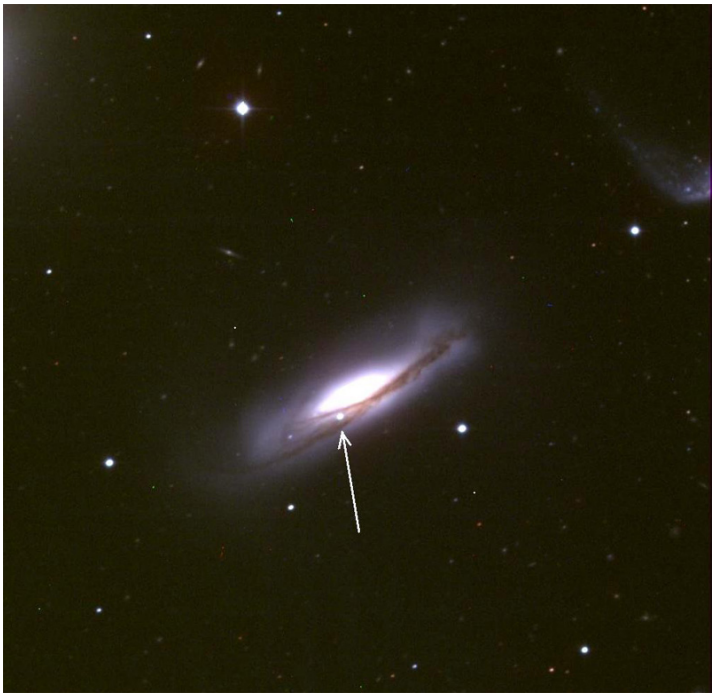
Supernovae stand out in the sky like cosmic lighthouses. Scientists have now found a way to use these cosmic beacons to measure distances in space more accurately. The researchers have been able to show that all supernovae of a certain type explode with the same mass and the same energy -- the

brightness depends only on how much nickel the supernova contains. This knowledge has allowed the researchers to calibrate the brightness of supernovae with greater precision. This means that in the future, they will use the brightness of a supernova that they are observing through their telescopes to determine more accurately how far away from the Earth the cosmic lighthouse is emitting its rays.

The end of a star's life, when the star has become heavy enough, is marked by a huge explosion -- a supernova. For a few weeks, a supernova looks almost as bright as a whole galaxy containing billions of stars. Physicists designate the brightest of these supernovae as Type Ia. Their brightness, measured from the Earth, is a measure of their distance from us -- but there are several uncertainties. "*The question still remains: how suitable are supernovae really for measuring distance? For example, the knowledge that the Universe is expanding rapidly is largely based on observations of supernovae*," explains Prof. Wolfgang Hillebrandt. All Type Ia supernovae exhibit similar levels of brightness, but they are not exactly consistent.

Scientists have now made a breakthrough. They have come to the conclusion that the explosion energy of the Type Ia supernovae is almost consistent -- it is equivalent to the fusion energy which a white dwarf with around one and half times the mass of the Sun can develop. However, the amount of radioactive nickel and medium-weight chemical elements such as silicon vary from supernova to supernova and explain the difference in their brightness. The more nickel a supernova contains, the brighter it shines. In the explosion, nuclear fusion of carbon and oxygen creates large quantities of radioactive atomic nuclei; in some supernovae, this is mainly the radioactive isotope 56 of the element nickel. The energy from its radioactive decay is converted to light in the supernova. The fusion therefore supplies both the energy and the light for the explosion. The nuclear fusion, however, can end with lighter atomic nuclei like silicon, for example. This creates the same amount of energy, but the supernova is not so bright. The researchers identify this situation when they also see the silicon in the light spectrum of the supernova.

Over the last four years, scientists have looked at 20 Type Ia supernova explosions, following each one for several weeks. Using spectroscopic and photometric data and complicated numerical simulations, they arrived at results that now make it possible to refine existing calibration methods. Astronomers calibrate the differences in brightness of the supernovae with their light curves; that is, the way the brightness develops over time in newly discovered supernovae. The light curves of brighter supernovae diminish more slowly than those of less bright supernovae. Up to now, the weakest link in this calibration method has been limited knowledge about the supernova explosions themselves: what causes the differences in brightness and are the corrections made to them justified? The supernovae that play a part in cosmology in measuring distances exploded just as our solar system was coming into existence, or even earlier. Consequently, there is no guarantee that these are the same explosions as those for which the light curves have been calibrated.



In order to exclude possible systematic differences, scientists need to have a very good understanding of the explosions, and the scientists have now made a large contribution to this. "*Our surprising results have for the first time delivered a solid basis on which we can use supernovae to measure distances in space*," says Wolfgang Hillebrandt. "We now understand the differences in the brightness of supernovae better and can calibrate this cosmic yardstick accurately in the future." These findings will also benefit cosmologists who use the brightness of supernovae to deduce dark energy. Scientists believe that it is this dark matter that is responsible for the rapid expansion of the Universe. http://www.mpg.de/bilderBerichteDokumente/multimedial/bilderWissenschaft/2007/02/Hillebrandt0701/Web_Zoom.jpeg The arrow points to the supernova 2002bo, the explosion of a white dwarf in the galaxy NGC 3190 in the Leo constellation -- 60 million light years away from earth.

FROM THE EDITOR'S TERMINAL

The Stargazer is your newsletter and therefore it should be a cooperative project. Ads, announcements, suggestions, and literary works should be received by the editor at least two weeks prior to the next upcoming scheduled EAS meeting. If you wish to contribute an article or suggestions to ***The Stargazer*** please contact Mark Folkerts by email or by telephone (425) 486-9733 or co-editor Bill O'Neil, at (774) 253-0747.

The Star Gazer
P.O. Box 12746
Everett, WA 98206

In February's StarGazer:

The next EAS Meeting is 3:00 P.M. Saturday February 17th at the Everett Public Library Auditorium.