

# The Stargazer

April 2004

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## EAS BUSINESS...

### RECAP OF LAST MEETING

At the March meeting, Connie Rockosi from the University of Washington astronomy department gave a presentation on the Sloan Digital Sky Survey telescope and 5 color CCD camera array that is used to take dusk-to-dawn strip 'drift-scan' images of the sky. These images are being used to survey the sky to provide photometric and positional info on objects, including the over 1 million galaxies that have their red-shifts captured with the fiber-optic fed spectrographs on the same telescope, and used to plot a 3-dimensional galaxy map of the surrounding universe.

**NEXT EAS MEETING - SATURDAY MARCH 27<sup>TH</sup> 7:00 PM - PROVIDENCE PACIFIC CLINIC (916 PACIFIC AVENUE) IN THE MONTE CRISTO ROOMS ON THE MAIN FLOOR.**

Map/directions to the EAS meeting are available at: [http://members.tripod.com/everett\\_astronomy/directions\\_to\\_club\\_meeting\\_s.htm](http://members.tripod.com/everett_astronomy/directions_to_club_meeting_s.htm)

### Scheduled Meeting Dates:

Apr 17<sup>th</sup> - EAS Mtg - (Vincent Woolf, Helium Stars) 7 PM  
 Apr 24<sup>th</sup> - Astronomy Day at Library  
 May 22<sup>nd</sup> - EAS Mtg - (Bill Cook, Captain's on Optics) - 7 PM  
 Jun 26<sup>th</sup> - EAS Mtg - (Eric Algol, UW, T Tauri Star) 7 PM  
 Jul 14-17<sup>th</sup> - Table Mt. Star Party  
 Jul 31<sup>st</sup> - EAS Mtg - 7:00 PM  
 Aug 11-14<sup>th</sup> - Oregon Star Party  
 Aug 28<sup>th</sup> - EAS Mtg - (Dr. Julie Lutz, UW Astronomy) 7 PM  
 Sep 17-18<sup>th</sup> - Sun Lakes Star Party  
 Sep 25<sup>th</sup> - EAS Meeting - 7:00 PM  
 Oct 30<sup>th</sup> - EAS Meeting - 7:00 PM  
 Nov 20<sup>th</sup> - EAS Meeting - 7:00 PM  
 Dec 11<sup>th</sup> - EAS Holiday Dinner

### MEMBER NEWS

**Astronomy Day at the Everett Library - April 24<sup>th</sup> ! Come join the activity, meet new people interested in astronomy, and share a great day of fun and observing!**

## CLUB STAR PARTY INFO

### Upcoming star party schedule:

**April 23, 24 - Astronomy Day (Harborview Park,)**

We try to hold informal close-in star parties each month during the spring and summer months on a weekend near the New moon at a member's property or a local park. (call Bob Lyon at (425) 337-1510 for info or check the EAS website.) Members contact Bob Lyons for scope borrowing.

## FINANCIAL HEALTH

The club maintains a \$700+ balance. We try to keep approximately a \$500 balance to allow for contingencies. Emailing a digital copy of the newsletter has been suggested to reduce printing and postage costs, and speed up delivery, please email Mark if electronic copy would be OK for you.

## CLUB SCOPES' STATUS

SCOPE	LOAN STATUS	WAITING
10-INCH DOBSONIAN	ON LOAN	NO WAIT LIST

EAS members: contact Bob Lyons (425) 337-1510 or 'bdlyons at verizon.net' to borrow a scope.

## ASTRO CALENDAR

### April 2004

Apr 19-25 - Astronomy Week  
 Apr 22 - Lyrids Meteor Shower Peak  
 Apr 23 - Comet C/2002 T7 (LINEAR) Perihelion (0.61 AU)

### Apr 24 - Astronomy Day

**April 23, 24 - Astronomy Day Observing (Harborview Park)**

Apr 26 - Opportunity Mars Rover, End of Primary Mission  
 Apr 28 - Asteroid 5 Astraea At Opposition (9.8 Magnitude)

### May 2004

May 05 - Eta Aquarids Meteor Shower Peak  
 May 07 - Comet C/2001 Q4 (NEAT) Closest Approach To Earth (.32 AU)  
 May 14 - Mercury at Greatest Western Elongation (25 Degrees)  
 May 15 - Comet C/2001 Q4 (NEAT) Perihelion (0.962 AU)  
 May 21 - Moon Occults Venus  
 May 25 - Mars Passes 1.6 Degrees From Saturn

**June 2004**

Jun 08 - Venus Transits The Sun  
 Jun 09 - Moon Occults Vesta  
 Jun 11 - Pluto At Opposition  
 Jun 12 - Mercury Passes 1.3 Degrees From Venus  
 Jun 21 - Summer Solstice (00:57 UT)  
 Jun 26 - Mercury Passes 2.1 Degrees From Saturn

**July 2004**

Jul 01 - Cassini, Saturn Orbit Insertion  
 Jul 05 - Earth At Aphelion (1.017 AU From Sun)  
 Jul 07 - Asteroid 3 Juno At Opposition (9.6 Magnitude)  
 Jul 11 - Mercury Passes 0.1 Degrees From Mars  
 Jul 26 - Mercury Greatest Eastern Elongation (27 Degrees)  
 Jul 29 - South Delta-Aquarids Meteor Shower Peak

**August 2004**

Aug 01 - Alpha Capricornids Meteor Shower Peak  
 Aug 06 - Southern Iota Aquarids Meteor Shower Peak  
 Aug 06 - Neptune At Opposition  
 Aug 12 - Perseids Meteor Shower Peak  
 Aug 25 - Northern Iota Aquarids Meteor Shower Peak  
 Aug 27 - Uranus At Opposition  
 Aug 31 - Venus Passes 1.9 Degrees From Saturn  
 Aug 31 - Start of Mars Solar Conjunction

**September 2004**

Sep 22 - Autumnal Equinox, 16:30 UT  
 Sep 27 - Mars Passes 0.2 Degrees From Jupiter  
 Sep 29 - Mercury Passes 0.6 Degrees From Jupiter  
 Sep 29 - Mercury Passes 0.8 Degrees From Mars

**October 2004**

Oct 09 - Draconids Meteor Shower Peak  
 Oct 13 - Moon Occults Mars  
 Oct 14 - Moon Occults Mercury  
 Oct 21 - Orionid Meteor Shower Peak  
 Oct 28 - Lunar Eclipse  
 Oct 31 - Daylight Saving - Set Clock Back 1 Hour

**OVER THE AIRWAVES**

"Our group of radio script writers now consists of EAS and SAS members Jim Ehrmin, Pat Lewis writer emeritus, 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 have a good idea for an astronomy broadcast or would like to try your hand at writing a script, call Pat Lewis at (206) 524-2006 or email to joagreen@aol.com. 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 8:58 A.M. and 5:58 P.M. Saturday and Sunday). 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 LIBRARY – BOOK & VIDEO LIST**

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.

**MEMBERSHIP BENEFITS & INFORMATION**

Membership in the **Everett Astronomical Society (EAS)** will give you access to all the material in the lending library. The library, which is maintained by Scott Gibson, consists of several VCR tapes, many books, magazines, and software

titles. Membership includes invitations to all of the club meetings and star parties, plus the monthly newsletter, *The Stargazer*. In addition you will be able to subscribe to *Sky and Telescope* for \$7 off the normal subscription rate, contact the treasurer for more information. **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 will renew your *Sky and Telescope* subscription for you. **Astronomy** magazine offers a similar opportunity to club members.

EAS is a member of the **Astronomical League** and you will receive the Astronomical League's newsletter, *The Reflector*. Being a member also allows you the use of the club's telescopes, an award winning 10 inch Dobsonian mount reflector, built as a club project or the 60mm refractor. Contact Bob Lyons (425) 337-1510 to borrow a telescope. EAS dues are \$25. Send your annual dues to the **Everett Astronomical Society**, P.O. Box 12746, Everett, WA 98206. Funds obtained from membership dues allows the Society to publish the newsletter, pay Astronomical League dues and maintain our library.

**OBSERVER'S INFORMATION...****LUNAR FACTS**

Apr 05	Full Moon
Apr 12	Last Quarter Moon
Apr 19	New Moon
Apr 27	First Quarter Moon
May 04	Full Moon
May 11	Last Quarter Moon
May 19	New Moon
May 27	First Quarter 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](http://www.lpi.usra.edu/research/lunar_orbiter)

**UP IN THE SKY -- THE PLANETS**

Object	Rises	Transits	Sets	Constellation
Sun	6:23 am	12:25	19:56	Pisces
Mercury	Daylight	Daylight	20:29	Pisces
Venus	Daylight	Daylight	00:19	Taurus
Mars	Daylight	Daylight	00:34	Taurus
Jupiter	Daylight	22:25	5:12 am	Leo
Saturn	Daylight	18:11	2:08 am	Gemini
Uranus	4:53 am	Daylight	Daylight	Aquarius
Neptune	4:02 am	Daylight	Daylight	Capricornus
Pluto	0:11 am	5:09 am	Daylight	Serpens

(times local time for Everett PDT)

**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>

**Pacific Science Center Space Lecture Series**

**Lynn Moroney, Chickasaw Storyteller - "Science Story"**  
**Saturday, May 1, 2004 - 2 p.m.** (Adobe Laser Dome)

Through "Science Story" Lynn Moroney explains how and why stories have been used to teach people about the world, and the place of story in astronomy and other space sciences. Long before we went into space, it was the stories, that helped us wonder about the universe and even today they invite us to

wonder and spark our curiosity. Space isn't just for scientists, rather the arts help us "know" the world, and when we blend the two, we can have a richer understanding of the universes and ourselves.

**SPACE: A Journey To Our Future**, is open now through May 9, 2004. In an immersive exhibit experience, SPACE celebrates the past, present and the future of space exploration and discovery. For more information visit [www.spaceexhibit.com](http://www.spaceexhibit.com).

#### 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>

#### CONSTELLATIONS OF THE MONTH, YOUNG ASTRONOMER'S CORNER, PLANETARY FOCUS, ASTRONOMY & TELESCOPE LINGO, ASTRONOMY FUN FACTS, AND MIRROR IMAGES

These monthly columns are being published this month in a special Astronomy Day hand out available at the Everett Library on April 24<sup>th</sup>. See you there !

#### ASTRONOMICAL NOTES -- ON & OFF THE NET...

##### STANDING BODY OF WATER LEFT ITS MARK IN MARS ROCKS

NASA's Opportunity rover has demonstrated some rocks on Mars probably formed as deposits at the bottom of a body of gently flowing saltwater.

"We think Opportunity is parked on what was once the shoreline of a salty sea on Mars," said Dr. Steve Squyres of Cornell University, Ithaca, N.Y., principal investigator for the science payload on Opportunity and its twin Mars Exploration Rover, Spirit. Clues gathered so far do not tell how long or how long ago liquid water covered the area. To gather more evidence, the rover's controllers plan to send Opportunity out across a plain toward a thicker exposure of rocks in the wall of a crater.

NASA's Associate Administrator for Space Science Dr. Ed Weiler said, "This dramatic confirmation of standing water in Mars' history builds on a progression of discoveries about that most Earthlike of alien planets. This result gives us impetus to expand our ambitious program of exploring Mars to learn whether microbes have ever lived there and, ultimately, whether we can."

"Bedding patterns in some finely layered rocks indicate the sand-sized grains of sediment that eventually bonded together were shaped into ripples by water at least five centimeters (two inches) deep, possibly much deeper, and flowing at a speed of 10 to 50 centimeters (four to 20 inches) per second," said Dr. John Grotzinger, rover science-team member from the Massachusetts Institute of Technology, Cambridge, Mass. In telltale patterns, called crossbedding and festooning, some layers within a rock lie at angles to the main layers. Festooned layers have smile-shaped curves produced by shifting of the loose sediments' rippled shapes under a current of water.

"Ripples that formed in wind look different than ripples formed in water," Grotzinger said. "Some patterns seen in the outcrop that Opportunity has been examining might have resulted from wind, but others are reliable evidence of water flow," he said.

According to Grotzinger, the environment at the time the rocks were forming could have been a salt flat, or playa, sometimes covered by shallow water and sometimes dry. Such

environments on Earth, either at the edge of oceans or in desert basins, can have currents of water that produce the type of ripples seen in the Mars rocks. A second line of evidence, findings of chlorine and bromine in the rocks, also suggests this type of environment. Rover scientists presented some of that news three weeks ago as evidence the rocks had at least soaked in mineral-rich water, possibly underground water, after they formed. Increased assurance of the bromine findings strengthens the case rock-forming particles precipitated from surface water as salt concentrations climbed past saturation while water was evaporating.

Dr. James Garvin, lead scientist for Mars and lunar exploration at NASA Headquarters, Washington, said, "*Many features on the surface of Mars that orbiting spacecraft have revealed to us in the past three decades look like signs of liquid water, but we have never before had this definitive class of evidence from the Martian rocks themselves. We planned the Mars Exploration Rover Project to look for evidence like this, and it is succeeding better than we had any right to hope. Someday we must collect these rocks and bring them back to terrestrial laboratories to read their records for clues to the biological potential of Mars.*" Squyres said, "*The particular type of rock Opportunity is finding, with evaporite sediments from standing water, offers excellent capability for preserving evidence of any biochemical or biological material that may have been in the water.*"

Engineers at NASA's Jet Propulsion Laboratory expect Opportunity and Spirit to operate several months longer than the initial rover's three-month prime missions on Mars. To analyze hints of crossbedding, mission controllers programmed Opportunity to move its robotic arm more than 200 times in one day, taking 152 microscope pictures of layering in a rock called "Last Chance."

##### MARTIAN MYSTERY EXPLAINED

<http://geomorphology.geo.arizona.edu/personal.html>

The spiral troughs of Mars' polar ice caps have been called the most enigmatic landforms in the solar system. The deep canyons spiraling out from Red Planet's North and South poles cover hundreds of miles. No other planet has such structures.

A new model of trough formation suggests that heating and cooling alone are sufficient to form the unusual patterns.

Previous explanations had focused on alternate melting and refreezing cycles but also required wind or shifting ice caps. "*I applied specific parameters that were appropriate to Mars and out of that came spirals that were not just spirals, but spirals that had exactly the shape we see on Mars.*" said Jon Pelletier, an assistant professor of geosciences at the University of Arizona in Tucson. "*They had the right spacing, they had the right curvature, they had the right relationship to one another.*"

His report, "*How do spiral troughs form on Mars?*," is published in the April issue of the journal *Geology*. One of his computer simulations of the troughs graces the cover. How the icy canyons formed in a spiral has puzzled scientists since the pattern was first spotted by the Viking spacecraft in 1976. Pelletier, a geomorphologist who studies landforms on Earth such as sand dunes and river channels, has a fondness for natural patterns that are regularly spaced. Spirals fit the bill, and while perusing a book on mathematical patterns in biology, he was struck by the spiral shape formed by slime molds. He wondered whether the mathematical equation that described how the slime mold grew could also be applied to geological processes. "*There's a recipe for getting spirals to form,*" he said. So he tried it out, using information that described the situation on Mars.

Temperatures on Mars are below freezing most of the year. During very brief periods during the summer, temperatures on the polar ice caps get just high enough to let the ice melt a bit, Pelletier said.

He proposes that during that time, cracks or nicks in the ice's surface that present a steep side toward the sun might melt a bit, deepening and widening the crack. Heat from the sun also diffuses through the ice. Much as ice cubes evaporate inside a freezer, on Mars, the melting ice vaporizes rather than becoming liquid water. The water vapor, when it hits the cold, shady side of the little canyon, condenses and refreezes. So the canyon expands and deepens because one side is heated occasionally while the other side always remains cold. *"The ambient temperatures on Mars are just right to create this form. And that's not true anywhere else in the solar system,"* he said. *"The spirals are created because melting is focused in a particular place."* Pelletier said the differential melting and refreezing is the key to the formation of Mars' spiral troughs. So he put mathematical descriptions of the heating and cooling cycles into the spiral-generating equation and ran computer simulations to predict what would occur over thousands of such cycles. He did not include wind or movement of polar ice caps in his model. The computer made patterns that match what's seen on Mars, even down to the imperfections in the spirals. *"The model I have predicts the spacing between these things, how they're curved, and how they evolve over time to create spiral feature,"* he said.

*"A lot of planetary sciences is about making educated guesses about the imagery that we see. We can't go there, we can't do field experiments,"* he said. *"The development of numerical models provides strong suggestions as to what's essential to create the form that we see,"* and allows scientists to test their assumptions, he said.

### **PLANETARY SYSTEMS WITH HABITABLE EARTHS?**

More than 100 planetary systems have already been discovered around distant stars. Unfortunately, the limitations of current technology mean that only giant planets (like Jupiter) have so far been detected, and smaller, rocky planets similar to Earth remain out of sight.

How many of the known exoplanetary systems might contain habitable Earth-type planets? Perhaps half of them, according to a team from the Open University, led by Professor Barrie Jones.

By using computer modeling of the known exoplanetary systems, the group has been able to calculate the likelihood of any 'Earths' existing in the so-called habitable zone - the range of distances from each central star where life as we know it could survive. Popularly known as the "Goldilocks" zone, this region would be neither too hot for liquid water, nor too cold.

By launching 'Earths' (with masses between 0.1 and 10 times that of our Earth) into a variety of orbits in the habitable zone and following their progress with the computer model, the small planets have been found to suffer a variety of fates. In some systems the proximity of one or more Jupiter-like planets results in gravitational ejection of the 'Earth' from anywhere in the habitable zone. However, in other cases there are safe havens in parts of the habitable zone, and in the remainder the entire zone is a safe haven. Nine of the known exoplanetary systems have been investigated in detail using this technique, enabling the team to derive the basic rules that determine the habitability of the remaining ninety or so systems. The analysis shows that about half of the known exoplanetary systems could have an 'Earth' which is currently orbiting in at least part of the habitable zone, and which has been in this zone for at least one billion years. This

period of time has been selected since it is thought to be the minimum required for life to arise and establish itself.

Furthermore, the models show that life could develop at some time in about two thirds of the systems, since the habitable zone moves outwards as the central star ages and becomes more active.

### **HABITABLE MOONS**

A different aspect of this problem is being studied by PhD student David Underwood, who is investigating the possibility that Earth-sized moons orbiting giant planets could support life.

All of the planets discovered so far are of similar mass to Jupiter, the largest planet in our Solar System. Just as Jupiter has four planet-sized moons, so giant planets around other stars may also have extensive satellite systems, possibly with moons similar in size and mass to Earth. Life as we know it cannot evolve on a gaseous, giant planet. However, it could survive on Earth-sized satellites orbiting such a planet if the giant is located in the habitable zone. In order to determine which of the gas giants located within habitable zones could possess a life-friendly moon, the computer models search for systems where the orbits of Earth-sized satellites would be stable and confined within the habitable zone for at least the one billion years needed for life to emerge.

The team's method of determining whether any putative 'Earths' or Earth-sized satellites in habitable zones can offer suitable conditions for life to evolve can be applied rapidly to any planetary systems that are newly announced. Future searches for 'Earths' and extraterrestrial life should also be assisted by identifying in advance the systems most likely to house habitable worlds. The predictions made by the simulations will have a practical value in years to come when next-generation instruments will be able to search for the atmospheric signatures of life, such as large amounts of oxygen, on 'Earths' and Earth-sized satellites.

There are currently 105 known planetary systems other than our own, with 120 Jupiter-like planets orbiting them. Two of these systems contain three known planets, 11 contain two and the remaining 92 each have one. All but one of these planets has been discovered by their effect on their parent stars' motion in the sky, causing them to wobble regularly. The extent of these wobbles can be determined from information within the light received from the stars. The remaining planet was discovered as the result of a slight dimming of starlight caused by its regular passage across the disk of its parent star. Future discoveries are likely to contain a higher proportion of systems that resemble our Solar System, where the giant planets orbit at a safe distance beyond the habitable zone. The proportion of systems that could have habitable 'Earths' is, therefore, likely to rise. By the middle of the next decade, space telescopes should be capable of seeing any 'Earths' and investigating them to see if they are habitable, and, indeed, whether they actually support life.

### **ASTRONOMERS TAKE SEARCH FOR EARTH-THREATENING SPACE ROCKS TO SOUTHERN SKIES**

The hunt for space rocks on a collision course with Earth has so far been pretty much limited to the Northern Hemisphere.

But last week astronomers took the search for Earth-threatening asteroids to southern skies.

Astronomers using a refurbished telescope at the Australian National University's Siding Spring Observatory discovered their first two near-Earth asteroids (NEAs) on March 29. NEAs are

asteroids that pass near the Earth and may pose a threat of collision.

Siding Spring Survey (SSS) astronomer Gordon Garradd detected a roughly 100-meter (about 300-foot) diameter asteroid and 300-meter (about 1,000-foot) diameter asteroid in images he obtained with the 0.5-meter (20-inch) Uppsala Schmidt telescope.

SSS partner Robert H. McNaught confirmed both discoveries in images he took with the Siding Spring 1-meter (40-inch) that same night. The 100-meter asteroid, designated 2004 FH29, makes a complete orbit around the sun every 2.13 years. It missed Earth by 3 million kilometers (1.9 million miles), or 8 times the Earth-to-moon distance, yesterday, traveling at 10 km per second (22,000 mph) relative to Earth.

The 300-meter asteroid, designated 2004 FJ29, orbits the sun about every 46 weeks. It came within 20 million kilometers (12 million miles), or within 52 lunar distances of Earth, last Tuesday, March 30, traveling at 18 km per second (40,000 mph) relative to Earth.

Neither object poses a direct threat of colliding with Earth.

Had the asteroids not missed, damage from their impacts would have depended on what kind of rock they're made of. The 100-meter object likely would mostly burn up in Earth's atmosphere in an airblast equivalent to 10 megatons of TNT, comparable to the 1908 explosion above the Tunguska River valley in Siberia, McNaught said. The 300-meter rocky asteroid likely would reach Earth's surface, dumping the equivalent of 1,400 megatons of TNT energy into Earth's atmosphere, he added. That's comparable to 200 Tunguskas, or 24 times the largest thermonuclear bomb explosion, a 58 megaton Soviet bomb exploded in 1961.

The new survey is a joint collaboration between the University of Arizona Lunar and Planetary Laboratory and ANU's Research School of Astronomy and Astrophysics. It is funded by NASA's Near-Earth Object Observation Program, a 10-year effort to discover and track at least 90 percent of the one kilometer (six-tenths of a mile) or larger NEOs with the potential to become impact hazards.

When astronomers detect what they suspect is an NEA, they immediately must take additional images to confirm their discovery, McNaught said. Surveys often have to suspend their NEA searches and spend observing time confirming NEAs, or they risk losing them altogether because follow-up observations were made too late, he added.

The SSS plan is to use the 1-meter (40-inch) telescope for part of the month to quickly confirm suspect asteroids detected with the Uppsala, freeing the smaller telescope to continue its searches.

"Our confirmation strategy worked beautifully on our first try," McNaught said.

The Uppsala Schmidt telescope was built in the 1950s for Uppsala Observatory in Sweden. It was sited at Stromlo as the Uppsala Southern Station to make wide field photographs of the southern sky. Increasing light pollution from Canberra led to its relocation to Siding Spring, near Coonabarabran in New South Wales, in the late 1982. Despite its high quality optics, the telescope drifted into disuse because it used photographic film rather than modern electronic detectors and had to be operated manually.

In 1999, McNaught and Stephen M. Larson of UA's Lunar and Planetary Laboratory joined in an effort to refurbish and upgrade the Uppsala telescope. Larson had similarly just overhauled a

manually operated, photographic wide-field Schmidt telescope in the Santa Catalina Mountains north of Tucson for his Catalina Sky Survey (CSS), part of the NASA-funded program to spot and track asteroids headed toward Earth.

The SSS builds on telescope control, detector technology and software developed for the CSS in Tucson. During the upgrade, the Uppsala was completely reconditioned, and fitted with computer control, a large format (16 megapixel) solid state detector array, and extensive support computers and software that detects objects moving against background stars. Larson said his reaction to the SSS milestone was "*one of relief, since it took several years to make the telescope and facility modifications. Now the real work begins.*"

Larson and Catalina Sky Survey team member Ed Beshore worked on commissioning the Uppsala telescope during the past few months. Commissioning a telescope is like commissioning a ship: You have to get all the parts working and working together, and adjust things so they perform as expected.

"We actually achieved 'first light' last summer, with good images from the start," Larson said.

McNaught and Garradd will operate SSS about 20 nights each month. They suspend operations when the week around full moon brightens the sky, making faint object detection difficult.

The Catalina telescope, which Larson and his team upgraded again in May 2000, features new optics that give it a 69 centimeter (27-inch) aperture and a new, more sensitive camera. Both CSS and SSS telescopes can detect objects as faint as 20th magnitude, close to sky background level generated by scattered city light and auroral glow that brightens Earth's upper atmosphere.

#### **WEB-BASED PROGRAM CALCULATES EFFECTS OF AN EARTH IMPACT**

Next time an asteroid or comet is on a collision course with Earth you can go to a web site to find out if you have time to finish lunch or need to jump in the car and DRIVE.

University of Arizona scientists are launching an easy-to-use, web-based program that tells you how the collision will affect your spot on the globe by calculating several environmental consequences of its impact.

Starting today, the program is online at <http://www.lpl.arizona.edu/impac effects>

You type in your distance from the predicted impact site, the size and type of projectile (e.g. ice, rock, or iron) and other information. Then the Earth Impact Effects Program calculates impact energies and crater size. It next summarizes thermal radiation, seismic shaking, ejecta deposition (where all that flying stuff will land), and air-blast effects in language that non-scientists understand.

For those who want to know how all these calculations are made, the web page will include "*a description of our algorithm, with citations to the scientific sources used,*" said Robert Marcus, a UA undergraduate in the UA/NASA Space Grant Program. He discussed the project recently at the 35th Lunar and Planetary Science Conference meeting in Houston, Texas.

Melosh is a leading expert on impact cratering and one of the first scientists reporters call when rumors of big, Earth-smashing objects begin to circulate.

Reporters and scientists both want to know the same thing: how much damage a particular collision would wrack on communities near the impact site.

The web site is valuable for scientists because they don't have to spend time digging up the equations and data needed to calculate the effects, Melosh said. Similarly, it makes the information available to reporters and other non-scientists who don't know how to make the calculations.

*"It seemed to us that this is something we could automate, if we could find some very capable person to help us construct the website,"* Melosh said.

That person turned out to be Marcus, who is majoring in computer engineering and physics. He applied to work on the project as a paid intern through the UA/NASA Space Grant Program.

Marcus built the web-based program around four environmental effects. In order of their occurrence, they are:

1) Thermal radiation. An expanding fireball of searing vapor occurs at impact. The program calculates how this fireball will expand, when maximum radiation will occur, and how much of the fireball will be seen above the horizon.

The researchers based their radiation calculations on information found in "The Effect of Nuclear Weapons." This 1977 book, by the U.S. Defense Department and U.S. Department of Energy, details *"considerable research into what different degrees of thermal radiation from blasts will do,"* Melosh noted.

*"We determine at a given distance what type of damage the radiation causes,"* Marcus said. "We have descriptions like when grass will ignite, when plywood or newspaper will ignite, when humans will suffer 2nd or 3rd degree burns."

2) Seismic shaking. The impact generates seismic waves that travel far from the impact site. The program uses California earthquake data and computes a Richter scale magnitude for the impact. Accompanying text describes shaking intensity at the specified distance from the impact site using a modified Mercalli scale. This is a set of 12 descriptions ranging from "general destruction" to "only mildly felt."

Now suppose the dinosaurs had this program 65 million years ago. They could have used it to determine the environmental consequences of the 15-kilometer-diameter asteroid that smashed into Earth, forming the Chicxulub Crater.

The program would have told them to expect seismic shaking of magnitude 10.2 on the Richter scale. They also would have found (supposing that the continents were lined up as they are now) that the ground would be shaking so violently 1,000 kilometers (600 miles) away in Houston that dinosaurs living there would have trouble walking, or even standing up.

If the Chicxulub Crater-impact occurred today, glass in Houston would break. Masonry and plaster would crack. Trees and bushes would shake, ponds would form waves and become turbid with mud, sand and gravel banks would cave in, and bells in Houston schools and churches would ring from ground shaking.

3) Ejecta deposition. The team used a complicated ballistics travel-time equation to calculate when and where debris blown out of the impact crater would rain back down on Earth. Then they used data gathered from experimental explosions and measurements of craters on the moon to calculate how deep the ejecta blanket would be at and beyond the impact-crater rim. They also determined how big the ejecta particles would be at different distances from impact, based on observations that Melosh and UA's Christian J. Schaller published earlier when they analyzed ejecta on Venus.

OK, back to the dinosaurs. Houston would have been covered by an 80.8-centimeter- (32-inch-) thick blanket of debris, with particles averaging 2.8 mm (about 1/8th inch) in size. They would have arrived 8 minutes and 15 seconds after impact (meaning they got there at more than 4,000 mph).

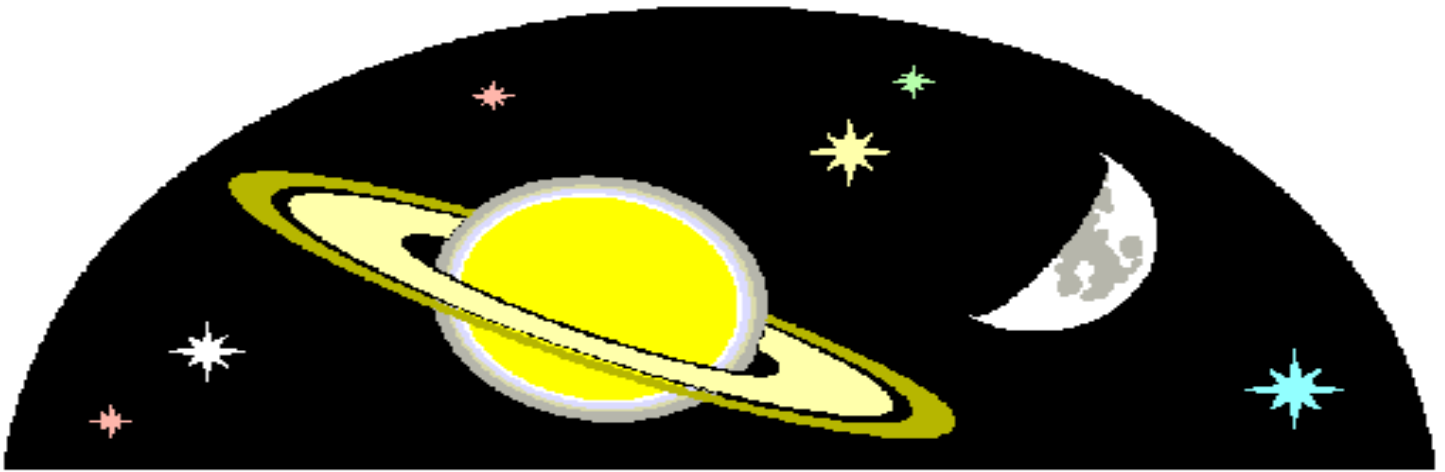
4) Air blast. Impacts also produce a shock wave in the atmosphere that, by definition, moves faster than the speed of sound. The shock wave creates intense air pressure and severe winds, but decays to the speed of sound while it's still close to the fireball, Melosh noted. *"We translate that decreasing pressure in terms of decibels from ear-and-lung-rupturing sound, to being as loud as heavy traffic, to being only as loud as a whisper."*

The program calculates maximum pressures and wind velocities based on test results from pre-1960s nuclear blasts. Researchers at those blasts erected brick structures at the Nevada Test Site to study blast wave effects on buildings. The UA team used that information to describe damage in terms of buildings and bridges collapsing, cars bowled over by wind, or forests being blown down.

Dinosaurs living in Houston would have heard the Chicxulub impact as loud as heavy traffic and basked in 30 mph winds.

#### 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 before the 1st of the month of publication, for example, material for May's newsletter should be received May 1st. 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.

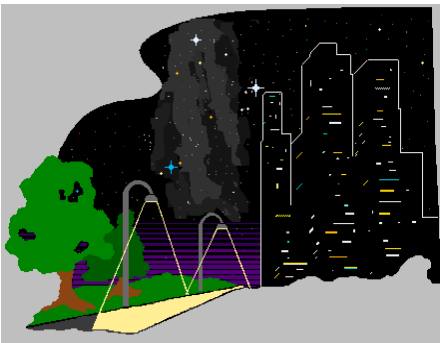


**Saturday April 24, 2004**

# Astronomy Day 2004

**Everett Public Library - Main Library - 10:00 AM - 5:30 PM**

**and Harboview Park Friday & Saturday  
8:00 PM to 11:00 PM, April 23rd & 24th,  
(weather permitting)**



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

**In April's Stargazer:**

\*\*\*\* **OBSERVER'S INFORMATION**

\*\*\*\* **ASTRO CALENDAR**

\*\*\*\* **STANDING BODY OF WATER LEFT ITS MARK IN MARS ROCKS**

\*\*\*\* **MARTIAN MYSTERY EXPLAINED**

\*\*\*\* **PLANETARY SYSTEMS WITH HABITABLE EARTHS?**

\*\*\*\* **ASTRONOMERS TAKE SEARCH FOR EARTH-THREATENING SPACE ROCKS TO SOUTHERN SKIES**

\*\*\*\* **WEB-BASED PROGRAM CALCULATES EFFECTS OF AN EARTH IMPACT**

\*\*\*\* **ASTRONOMY DAY POSTER**

**The next EAS Meeting is 7:00 P.M. Saturday, April 17<sup>th</sup> at the Providence Pacific Clinic – 916 Pacific Avenue in Everett.**