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When a Tight Budget Brings Space Dreams Back to Earth

By Evan Schneider

When Hayden Planetarium director Dr. Neil de-Grasse Tyson and others were planning the 10th annual Isaac Asimov Memorial Debate some months ago, they may not have had any idea of how topical the subject, “Moon, Mars and Beyond: Where Next for the Manned Space Program?” would be.

Then came the February 1 submission of the Obama Administration’s fiscal 2011 budget, which cancelled NASA’s plan to build a new generation of space vehicles to send astronauts back to the Moon. This signaled the end of the Constellation initiative, and called for greater privatization of the space program. The new budget direction will also lead to greater prioritization of low-Earth orbit missions.

If there was a thread running through the Asimov debate, it was not simply that it was regrettable that the Constellation program to return to the Moon was cancelled, but that the cancellation ruptured needed continuity in NASA space programs. As Robert Zubrin, president of Pioneer Astronautics and principal of the Mars Society, put it, “The shuttle program is ending, Obama has cancelled the Moon program, so are we going anywhere? We need gutsy leadership to get the space program done.”

A pro-Moon viewpoint was expressed by Paul Sudis, senior staff scientist at the Lunar and Planetary Institute. Calling Constellation’s cancellation disappointing, he talked about the Moon as the obvious target for the next steps into space. “There’s [recently discovered] ice in polar shadows, energy resources and materials to convert for use in space exploration.”

Similarly, Ken Ford, CEO of the Institute for Human & Machine Cognition and chair of the NASA Advi-

sory Council, posited that Constellation’s design would have been the same for a future manned mission to Mars, bringing what would most likely be 70% of new technology to bear on that program. “This efficiency supports a Moon-mission expenditure to provide the proving ground for future missions,” he said.

Spudis felt it would be a mistake to give NASA \$20 billion without a destination. Tyson, who moderated the discussion, pointed out that only half a penny of each tax dollar goes to NASA. Doubling that, as many would like, would have no major effect on the budget but would have a big impact to NASA’s ability to fund missions, he noted.

But Zubrin asserted that the problem isn’t strictly funding for NASA. “While there were many technological developments by NASA from 1961 through 1973, NASA currently is not developing new technology.” And Zubrin is leery about greater privatization: “You can’t put parts from various companies together easily. I’m concerned about fitting things together with greater privatization. JPL wouldn’t have worked if it had developed parts suggested by various corporations.”

Steven Squyres, Cornell professor and principal investigator of the Mars Exploration Rover Project, noted that “The Soviets figured out what worked and have stuck with it for the last 35 years. The U. S. tinkers and moves on. That’s NASA’s culture, which is both good and bad. Each of our planetary missions is different. Our shuttle was retired after four flights and we buy rides in the Soyuz capsule.”

Not all panelists chastised the administration. Gen. Lester Lyles (USAF, ret.) stated firmly that “NASA will

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What's Up

By Tony Hoffman

The Sky for April 2010

Evening Planet Bonanza. The evening sky features no fewer than four planets, at least for much of the month. Little Mercury makes its best evening appearance of the year. In the first week of April, Mercury and Venus appear just a few degrees apart above the sunset glow in Aries.

Mercury starts the month at magnitude -1, fading to magnitude 1.2 by midmonth as it sinks back into the solar glare and is lost to view. Venus, however, climbs steadily higher, blazing at a constant magnitude -3.9 during the month. Mars fades from magnitude 0.2 to a still-brilliant 0.7 during April. At midmonth, it skims just north of the Beehive Cluster in Cancer. Saturn, just past opposition, shines at magnitude 0.7 in Virgo. We're still seeing the rings nearly edge-on; they're inclined only 2 degrees to our line of sight.

A Neptunian "Year" is Ending. At magnitude 7.9, Neptune is a tough binocular target from light-polluted areas. It shows a tiny blue-green disk in a telescope. By late April the planet, near the Capricornus/Aquarius border, will be visible in the predawn sky. Normally, this wouldn't be worth mentioning, but this year is different: Neptune is completing its first orbit of the Sun since it was discovered 164 years ago. The Neptunian "year" won't be over until next year, but the outer world is already back in the same part of the sky in which Johann Galle first spotted it on September 23, 1846. The eighth planet had been predicted mathematically by Urbain Le Verrier, based on observed perturbations in the orbit of Uranus; Galle found it within a degree of the predicted position. Neptune was actually first recorded by Galileo in two observations a month apart starting in late 1612, but its motion is slow enough that he never reported it. Recent evidence has come to light that he was aware of its motion, based on an ink sketch of the sky he'd made.

April 6 Last-quarter Moon at 5:37 a.m.

April 8 Mercury at greatest elongation in evening sky (*see above*).

April 11 Moon lies near Jupiter.

April 14 New Moon at 8:29 a.m.

April 15 Moon lies less than 2 degrees from Mercury as the sky darkens.

April 16-17 Mars lies 1 degree north of the Beehive star cluster (*see above*).

April 21 First-quarter Moon at 2:20 p.m.

April 22 Moon lies near Mars; Lyrid meteor shower peaks.

April 24 Moon at perigee, 228,131 miles away, 5 p.m.

April 25 Moon lies near Saturn.

April 28 Full Moon at 8:18 a.m.

Sunspots Wax and Wane

By Joseph A. Fedrick

Sunspots reappeared in projected images of the Sun with my 60mm refractor during January and February. From January 10 to February 28, I observed the Sun on 13 days and saw spots all days. From February 7 to February 12, I watched a long, narrow, snaking complex group of at least seven sunspots that spanned approximately one-eighth of the solar disk rotate across the disk. By February 12, the group appeared foreshortened and near the solar limb. By February 28, sunspot activity had waned so I saw only one small spot that day. On March 7 and 8, I observed the Sun but saw no spots. Sunspot activity still seems less than 11 years ago. This present cycle appears delayed or weaker than the previous cycle.

I used the same f/15 achromatic refractor at 50x to observe the asteroid Vesta as it just passed in front of the gap between the stars Gamma Leonis and 40 Leonis on the evenings of February 16, 17 and 18. The apparent movement of Vesta was quite dramatic at 50x from night to night. Vesta appeared somewhat yellowish in my scope while Gamma Leonis was ruddy and 40 Leonis bluish. Vesta was quite bright and was also an easy target in my 10x50 binoculars. The apparent retrograde motion of Vesta at this time was really a type of parallax effect caused by Earth's overtaking Vesta in its orbit.

Mars began to fade noticeably as Earth left it behind and as Mars retrograded past the Beehive Cluster in Cancer and toward Castor and Pollux in Gemini. Saturn rose earlier each night while Venus remained below the horizon clutter from my vantage point; Rich Rosenberg had already seen Venus from the Brooklyn Promenade. Jupiter, Neptune, Uranus and Mercury remained hidden in the solar glare during late February and early March. ■

A Message from AAA President Richard Rosenberg

Hello, members:

It looks as if winter has finally ended and spring is here. That means a lot of activity.

Our spring class will be given at headquarters at 120 Warren St. from 6:30 to 8:30 p. m. on six consecutive Wednesdays starting April 7. There will actually be three mini-classes, each two weekly sessions.

In the first two classes, I'll discuss the solar system from an historical point of view. We'll see how observation and theory work together. Then Jason Kendall will speak on cosmology one week, followed by telescopes and the sky. Finally, Shana Tribiano will discuss the blue (ultraviolet, x-ray, gamma ray) and red (infrared, microwave, radio) ends of the electromagnetic spectrum, how they're detected and their significance in understanding the universe.

Early April means we'll have an opportunity to see Mercury in the evening twilight. Brilliant Venus will be nearby and will lead you to the innermost planet. Mars and Saturn will also be visible.

To check out these planets and other wonders of the night sky, we resume observing at the High Line (every Tuesday starting April 13), and monthly sessions at Prospect Park, Cadman Plaza and Carl Schurz Park. They join Floyd Bennett Field, Great Kills and Inwood Hill Park, and solar observing in Central Park. See Events on the Horizon on page 11 for more info.

At 7 p. m. on Thursday, April 1 (no April fool) at the Avenue U Salt Marsh Nature Center in south Brooklyn, I'll give a talk on the spring sky, with observing afterwards. We can use more people with telescopes. There's parking right in front. jI'll give a talk on the spring sky, with observing afterwards. There's parking right in front of the center.

Public TV's NOVA celebrates the 20th anniversary of the Hubble Space Telescope with two shows on "Hunting the Edge of Space." On Tuesday April 6, "The Mystery of the Milky Way" will be shown, and a week later "The Ever Expanding Universe."

Next month is the club's annual meeting, on Wednesday, May 19 at headquarters. Join your fellow members for a buffet dinner, followed by the business meeting, at which committee chairs will report on events of the past year and I'll report on the overall state of the organization.

Rich Rosenberg, AAA President, president @aaa.org, (718) 522-5014

AAA Lecture April 9: Neutrino Telescope in the City

Dr. Glennys Farrar, professor of physics at New York University, will discuss "High-Energy Astrophysics with a Neutrino Telescope in New York City" when she delivers an AAA lecture Friday, April 9 at the Kaufmann Theater of the American Museum of Natural History. The free public lecture begins at 6:15 p. m.

"The ubiquitous water tanks on top of almost all NYC buildings, about six floors tall, can be used to form the world's finest telescope for detecting high-energy astrophysical neutrinos," Farrar says. "I will describe

how the system would work and what steps are underway to make it a reality. People in the AAA might want to become involved; it will be novel and interesting."

Farrar received her Ph.D. in theoretical physics from Princeton University in 1971, breaking the gender barrier in physics there. She was a member of the Institute for Advanced Study and on the faculties of Cal Tech

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Traveling in the Footsteps of Galileo Galilei

By Jason Kendall

When **John Gianforte**, owner/director of the Blue Sky Observatory in Durham, N. H., wanted to know more about Galileo Galilei, he didn't rely on books, films or other documents: He and his wife took a trip to Italy to learn about the great man by walking on the very paths that he took 400 years ago.

Before Gianforte spoke to the AAA March 5, attendees were treated to a thematically related song by Donna Stearns and the Big Bangers, "Up Up Up in the Sky," which is about Galileo, star-crossed lovers and spirituality. It was a perfect beginning to the evening.

Gianforte walked the audience through a history of Galileo, giving the classic tale of his triumphs and woes, his luck and his missteps. He described the so-called father of science as a deeply spiritual man, possessing a difficult family situation, as well as a dependent extended family, and daughters who never married.

But Gianforte's greatest tale was his own travelogue. He admonished all in the lecture hall that while the glories of the night sky may be wondrous, they should take their spouses or best friends to Italy. He turned to the pictures from his travels to Venice, to show us the view from the tower that Galileo used to sell his first telescope to the Venetian Senate.

The speaker showed photos of the pulpit at the University of Padua that Galileo stood on to give lectures, challenging his colleagues with aggressive and innovative thinking. Gianforte pointed out that moving back to Venice from Padua was not only for an increase in salary --Galileo had a bloodhound's nose for opportunity--but that the Venetian nightlife, culture and food were spectacular, with Galileo's well-known appetite for it all.

Using the beauty of the city that Galileo called home, Gianforte seemed to be showing yet another story, that of the love between himself and his wife Doris. With photos of her beaming back at John, holding a wine glass, the trip to retrace Galileo's steps clearly became all the more wondrous.

Gianforte pointed out the front door of Galileo's home

in Padua, where he taught at the university, and noted that across the street was an archway through to a courtyard. He said the place had not changed for more than 400 years. He almost expected to see Galileo dart from one building to the next under that archway, his head down, muttering in thought.

The real treat came when Gianforte described his departure from Italy. He saw an old woman who beckoned to them from across a street. They had to catch a plane, they moved on. But he wondered if the woman had a room to rent, as is customary there, or whether she had a restaurant nearby with home-grown foods. He snapped a photo of the woman in red, leaning like a much younger woman on a stone wall, never to know the mysterious and friendly intent of her beckoning.

Galileo loved Italy for so many reasons, that even through his house arrest he could still see his daughters' convent, make wine in his yard and publish groundbreaking physics books. He taught the world not just about science, but about how to live a good, full life. ■

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and Rutgers before moving to NYU in 1998.

Among her accomplishments in particle physics, Farrar is perhaps best known for pioneering the phenomenological study of supersymmetry (SUSY). With colleagues, she developed most present search techniques for superparticles, and gave the first limits on SUSY breaking and superpartner masses from accelerator experiments and precision observables. Farrar's current work focuses mainly on problems at [the intersection of astrophysics, cosmology and particle physics](#), including ultra-high energy cosmic rays, the nature of dark matter and dark energy, and the origin of the asymmetry between matter and antimatter.

The final presentation in the AAA's 2009-10 lecture series is on Friday, May 7. Ruben Kier of Advanced Radiology Consultants speaks on "[Best Targets for Amateur Astrophotography](#) and What They Reveal about Our Universe." ■

Discussion Is Lively and Diverse at AAA Seminar

By Jason Kendall

Chair, Recent Advances Seminar

On March, 11, I led a group of about 30 people, both AAA members and students of board member Gerceida Jones' NYU astronomy class, on a roundabout exploration of many topics in current astronomy. But I didn't do all the leading. As chair of the Recent Advances in Astronomy Seminar, I had a different goal. I'd prepared much material, but wanted to see where the night went.

We started off talking about a recent paper by a colleague of mine from graduate school, Dr. George Rhee, now at the University of Nevada Las Vegas, about the origin of bulgeless dwarf galaxies (http://arxiv.org/PS_cache/arxiv/pdf/0911/0911.2237v1.pdf). I played the accompanying video, showing the merger of the dwarf galaxies and how supernovae halted the development of these small galaxies.

After some discussion about the nature of this research and how it was carried out, the superb video prompted a discussion of other bursting and explosive phenomena, and we veered into a discussion on the nature of solar flares. This is exactly what I'd wanted to occur. The goal of the seminar is not to be a lecture or class, but a free-form discussion on current topics. We talked about the size scales of solar flares, the history of observations, what solar flares can do, the great solar flare of 1859 (<http://www.solarstorms.org/SS1859.html>) and solar flares' effect on the world around us.

One student started a lively discussion about how birds and animals can detect solar flares. It's important to bring such ideas up, because they highlight the club's

important duty to educate and inform the public about astronomy. The ensuing discussion became quite lively. Indeed, we ranged far in our discussion. I steered the topic to a new area, Mercury, to look at pictures from the MESSENGER mission, and we quickly shifted focus to exoplanets and the Kepler Space Telescope.

We talked about the exoplanets that were just reported at the American Astronomical Society meeting in January, as well as how fast they're being discovered: well more than 400 so far. I'd been on a conference call earlier in the day with NASA/JPL, where the speaker was recapping recent advances, and I shared the entire PowerPoint from that conference call with seminar attendees. This led to my requesting a student to bring in, at the next seminar, a discussion on interstellar planetary objects. This also led to a talk about dark matter, and whether such planets would contain dark matter.

Maya Kushner will bring us a report this month about MACHOs and the search for large objects in the halo of our galaxy. I then pulled up "The Digital Universe" from the Hayden, we looked at our local solar neighborhood and I highlighted known exoplanets. We looked for nearby exoplanets, and as we cruised around the 3-D data set, I issued a challenge to all in attendance and to all AAA members. Bring a 10-minute presentation with 10 PowerPoint slides and be ready for 5-10 minutes of questions. Send me an e-mail, so I know what you want to bring and I can guide you into the process. We want everyone to come and spark a lively round of discussion like we had last month. ■

Report on the February Seminar by Mary Carlson, Former Seminar Chair

Participants at the February Recent Advances in Astronomy seminar were treated to some astounding new discoveries by the Hubble Space Telescope following its latest (and last) additions and repairs. The vistas were spectacular.

Another member presented an in-depth analysis of the Saturnian moon Titan and the presence there of two main elements, methane and ethane. This sparked a

discussion on the possibility of probiotic life. The question was posed, "Could we go there?"

A third participant took us on an imaginary and quite visual trip to some of the 425-plus known extrasolar planets. Through the creative imaginations of astronomy artists, we were able to vicariously touch other worlds. There was an ample supply of oxygen and it was

That Expelled Planet...That Dog...That Pluto

By Thomas Haeberle

The red curtain opens and what we used to know as the nine planets are displayed. Hayden Planetarium director Dr. Neil deGrasse Tyson, voice booming, explains the uniqueness of our solar system, which for 75 years hadn't changed until a controversial vote in 2005 by the International Astronomical Union (IAU) demoted Pluto from planetdom and changed Tyson's life as well.

A NOVA show March 2, "The Pluto Files," had the same title as Tyson's recent book. He tried to explain how he wound up at the center of a firestorm which he started by demoting Pluto. As in the book, Tyson tried to find why this cold, distant rock captures so many hearts.

Tyson's problems started a year after the renovated planetarium reopened and someone overheard a boy saying, "I can't find Pluto." The adult contacted Kenneth Chang of *The New York Times*, who wrote an article, "Pluto Not a Planet."

Tyson was accused of being a Pluto hater by school kids and felt he had to hit the road to get answers. Stopping first at Harvard, he was greeted by colleagues with different views. Planetary scientist Mark Sykes, who fervently opposed demotion, contended roundness and physical characteristics should be the main criteria. Asteroid specialist Brian Marsden said he'd use the word "world" for Pluto. Harvard astronomer Owen Gingerich said, "The solar system is this complicated place. People need to know there's a richness out there."

Tyson journeyed to the heartland to learn more about Pluto discoverer [Clyde Tombaugh](#). His story is a true American tale: A self-educated farm boy seeks his dream of becoming an astronomer. He did so by discovering a planet at the Lowell Observatory, the first in 84 years, without having ever gone to college.

Tyson pinpointed the American love affair with Walt Disney's lovable dog. He spoke with Roy Disney, who stated there's no evidence Walt deliberately named the pooch for the planet, but he pointed out his fascination with space and "he made science fun to learn."

In an Illinois café, a woman asked Tyson, in reference

to the IAU demotion, "Since when is science decided by a vote?" With no clear answer, Tyson hopes that everyone will "recognize the diversity of stuff that orbits the Sun and invent a new lexicon that represents our new understanding of the solar system..."

In Streator, Ill., Tombaugh's birthplace, it was obvious folks adore Tombaugh, with murals and a street named after him. In a barbershop chair, after lengthy discussions on Pluto with patrons, Tyson was asked his opinion on Pluto, with the barber's razor blade to his neck.

He escaped unharmed and headed to New Mexico to meet Tombaugh's children. They described him as being sort of different. It wasn't unusual for them to see dad grinding a telescope mirror in the kitchen.

In California, Tyson shared a burger "with two colleagues who were convinced there was something else out there." The astronomers are David Jewett, who co-discovered many far-off icy dwarfs, and Michael Brown, who discovered Eris, which is larger than Pluto.

Brown called the IAU definition a rock-solid concept. He felt it just didn't seem right to call his discovery the 10th planet. He termed William Herschel's discovery of Uranus a big deal. Eris, apparently, wasn't.

The journey ended at Johns Hopkins University in Maryland and a visit with Alan Stern, principal investigator for the New Horizon mission to Pluto. He explained the mission and why he considers Pluto a planet. He used a dog analogy: "If you see a Chihuahua, you know it's a dog. It has the same characteristics of any other dog. Same goes for Pluto."

Tyson's opinions differed sharply, yet he seemed less passionate than he was in his book. The documentary was humorous, even giddy. Most scientists don't seem to take the debate too seriously.

The two camps have seemed to come to some sort of closure, ending with a visit by Tombaugh's daughter to the Hayden. Relieved to see dad's "planet" on a wall, she conceded it might be for the best. ■

Music Merges with Astronomy for a Double Treat

By John Delaney

Classical music fans with an interest in astronomy enjoyed a double treat January 28 at Carnegie Hall: “The Planets—An HD Odyssey.” The Houston Symphony offered a rousing performance of Gustav Holst’s signature composition with a video presentation directed by astronomer/director Duncan Copp, a kind of vivaldi, planetary grand tour set to orchestral music.

Listeners unfamiliar with Holst’s most famous work, “The Planets,” would probably find the work derivative somehow, largely due to the huge influence the music has had on later composers such as John Williams of “Star Wars” fame. Many directors have used movements from “The Planets” for movies and documentaries.

The combination of music, space-probe images and computer-generated images (CGI) of the solar system’s planetary bodies was exhilarating. Conductor Hans Graf flawlessly executed the difficult task of keeping his ensemble in synch with the visual presentation, the most important element of the performance.

With the accompaniment of a world-class symphony, attendees were treated to a multimedia voyage through the solar system, featuring the best of some 40 years of images transmitted from robotic space missions. The presentation started with the most bellicose movement of the composition, “Mars, the Bringer of War.” The visual journey began with a slow, CGI-generated approach to Mars, the planet filling the screen as the enormous Valles Marineris came into view. The warlike staccato of “Mars” built to the first of several crescendos as the audience swooped into the solar system’s largest canyon. The video then shifted to scrolling images of craters, ancient river patterns and other Martian features.

The next movement, “Venus, the Bringer of Love,” was by contrast tranquil and elegant, with accompanying imagery visually complementary. The sequence of gliding through Venus’ thick cloud deck and viewing the Magellan space probe’s color-corrected topography worked well with the score. The melodious piece, of course, doesn’t reflect the nature of its planetary namesake. In a video introduction before the sequences began, planetary scientist Andrew Ingersoll quipped he thought Holst’s music for Venus was dead wrong since the planet

is an inferno.

Overall, the musical-visual synergy remained effective, but a few movements were less stellar for various reasons. For instance, the stark, cratered surface of Mercury—as depicted in images from the Messenger Space Mission—seemed ill-suited to the frantic, scherzo music of “Mercury, the Messenger.” No amount of split-screen editing could disguise the reality of Mercury’s cratered and barren surface, with no rings or moons. Likewise, the marching, shifting tempo of “Uranus, the Magician” seemed too busy for the billiard ball blandness of the gas giant. In fact, the Jet Propulsion Laboratory’s imaging team was somewhat disappointed with images from Uranus during the 1986 Voyager 2 encounter. By comparison, the somber, majestic clock-like processional of “Saturn, the Bringer of Old Age” was enhanced by recent images from Cassini and CGI sequences that swooped under the rings, simulating entry into a celestial cathedral.

The most successful movements were “Jupiter, the Bringer of Jollity” and “Neptune, the Mystic.” In the first, perhaps the best-known of the seven, the triumphant waltz of Holst’s music meshes perfectly with what is arguably the most visually dynamic of the solar system’s planets. Swirling psychedelic clouds and storms, volcanically active and ice-covered Moons, as depicted with images from Voyager and Galileo probes, were well-sequenced in single shots and split-screen formats. The animated sequence of the first Voyager approach to Jupiter—synchronized with the main theme of the movement—conveyed the sense of wonder that astronomers must have experienced when receiving their first close up-views of the giant planet.

As for “Neptune,” this haunting, ethereal piece truly captured the essence of the most distant planet, still very much a mystery. The movement materializes like a weather system, echoing the dynamic cloud-pattern images captured by Voyager 2 as it left the solar system after the 1989 encounter. In a sense, the planet’s eeriness is due in part to its strangely Earth-like appearance. The sonorous fade-out of a woman’s choir, with all its connotations of the unknown, seemed the perfect conclusion for an inspirational journey for the senses. ■

Review: This Book Can Truly be Said to be Very ‘Far Out’

By Lynn Darsh

I loved looking at the images in “[Far Out: A Space-Time Chronicle](#)” (Abrams, \$55). Borrow or buy this book, find a sunny window seat, and let sunlight illuminate some of the hundreds of gorgeous full-page or fold-out color photographs of deep space. The images come to life in our star’s light.

Wonder at the mysterious richness of our galaxy, its planetary nebulae, Orion’s proplyds (protoplanetary disks), the Hubble image of the [Pillars of Creation](#) in the Eagle Nebula “recreated using more accurate color data,” [Bok globules](#) and the Homunculus Nebula, the result of what author Michael Benson calls the “supernova impostor event” of Eta Carinae. Look farther out at other galaxies with hydrogen clouds and hot O and B-type stars ionizing their gases and pushing them away. Examine what Benson calls “the [Antennae Galaxies](#)’ cosmic pileup,” where tidal gravitational forces have compressed gases and dust of two colliding spirals into one glowing embryonic shape and formed new stars in the nebulae while two gas trails jetted away. Then think about the Milky Way’s predicted collision with Andromeda: It might look like this in about 2.5 billion years.

Enjoy the spectacular beauty of the universe revealed by the book’s extraordinary craftsmanship. From writing explanations of the images to choosing the most illustrative photographs by amateurs and professionals, taken in driveways, on Mauna Kea and from space, Benson has created a magnificent book. It’s a core visual reference book, a clearly written introduction to what astronomers have recently learned about galaxies.

For example, in Chapter 2--“Nested Supernova Remnants”--Benson writes, “The biggest and nearest supernova remnant to Earth is the Gum Nebula.” The explanation of its two-page image is, “Like most nebulae, Gum 17 is simply a vast semitransparent cloud of interstellar hydrogen, the most common element in the universe. Its red color is the result of ionization by nearby stars, a process comparable to the excitation of molecules by electricity within a neon sign. Although they only acquire colors like this at sunset, the clouds in Earth’s atmosphere are also predominantly comprised of hydrogen.” What a vivid, clear introduction to nebulae!

“Far Out” is a visual galactic primer for amateurs who enjoy beautiful illustrations and good writing that at times aspires to poetry. Benson observes that telescopic images have been “translated” to “their true colors” so ionized hydrogen appears red and Hubble’s [Carina](#) appears purple in places where the “intense ultraviolet light of the giant blue stars powering the nebula can be seen mixing with the ionized red of Carina’s hydrogen.”

Some of the most beautiful pictures are long-exposure, deep-sky images of dozens or hundreds or thousands of galaxies floating in the immensity of inky black space. One image illustrates, in delicate pastels, the merging spirals in the center of the Hercules cluster. Recent evidence indicates elliptical galaxies are formed by such mergers, Benson notes.

The front jacket has a photograph of a spiral galaxy, edge-on. The Milky Way might look like this to an observer 30 million light-years away. Benson imagines others looking at us as we look towards them. What was happening on Earth when photons left on their journey towards our telescope? Benson writes briefly about Earth’s natural and human history in many chapters of this chronologically-organized book. We travel from Earth into space and further back in time by reading front to back. But he’s also written the book to be read from back to front, to show how the universe evolved.

Chapters open with poetic settings of a scene in time and space, then a page introducing, explaining and meditating upon the subject and our reactions. For example, “If explosions like the [Crab](#)’s initiatory blast are fully capable of obliterating such natural formations as the Pillars of Creation, we should remember that they also disperse life’s building blocks far and wide. Although the expression and product of the awesome death throes of giant stars, these blasts shouldn’t be misunderstood as simply representing cataclysmic destruction. Rather, they’re dialectical--creation within destruction, as much as the reverse. Although the famous pillars may no longer exist, although the Eagle Nebula may have been swept away entirely, it’s worth considering that the many stars it produced now float free, adding their light to the massed glow of the Milky Way.” ■

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get it right under President Obama,” although he did express concern about funding without a specific direction and set of goals. Lyles also noted that the international cooperation demonstrated in the International Space Station should be continued on future space projects.

From a military standpoint, Lyles said, the objective is to defend CIS, the area between Earth and the Moon. Calling the Moon the ultimate high ground, Lyles noted that during Desert Storm, the military appreciated space assets and their aid in fighting the war. Although he didn't say so, the implication was that these assets are currently being brought to bear in Iraq and Afghanistan.

“The military had bet on the shuttle, but after the Challenger disaster felt it needed a current generation of expendable launch rockets developed with NASA.”

Spudis felt that private ventures will drive future exploration, noting that Columbus was funded by investors. Tyson pointed out that war is frequently the driver of funding. The Cold War was the backdrop for much technological development for decades. Now that the Cold War is over, and new economic realities exist, NASA presumably has to fight for funding in ways not seen in decades past.

The panel touched several times on asteroids and planetary moons. Squyres was the most vocal pro-asteroid proponent, citing low gravity, no gravity well and some asteroids being rich in carbon and/or metallic elements. He felt we should only mine materials from these objects. Like the Moon and Mars, “they're not good places to live. Our South Pole is balmyer than Mars.” Ford thought that NASA should go to the Moon, continue to Mars' inner moon Phobos and then to Mars. But Spudis wasn't in favor of these ventures since transit times for near-Earth asteroids are longer than to the Moon; a round trip could be seven months for an asteroid vs. about a week for the Moon.

Spudis also noted that asteroids rotate fast; in fact, they co-orbit with clouds of debris. And he believes there's still a question what they're made of. He noted that the Moon has the gravity processing granular material but dust is still a problem. Squyres, though, said getting material from asteroids could be a tractable problem

and that “there's good stuff on asteroids.” Ford observed the lack of need for a lander as for the Moon, where a ship had to be kept in orbit. This means asteroid exploration could happen quicker than planets or moons, even though an incremental plan is needed.

While promoting asteroids, Squyres had broader vistas. “I would like to have the next decade be one of planetary exploration, a survey of the planets via space probes followed by humans exploring the solar system.” Nonetheless, Squyres believes the Moon shouldn't be factored out of the space equation: “The Moon should be tested before a more interesting place, even though the dominant long-term goal should be Mars.”

The audience was greeted by a surprise guest via telephone: Col. Edwin (Buzz) Aldrin (USAF, ret.) the second man on the Moon. An avid supporter of NASA's manned space programs, Aldrin had been monitoring the debate, and presented his historical perspective of the space program. This included supporting many panelist comments on commercialization as a driver for space missions and for the creation of new technologies, the U. S. striving for global leadership by supporting space exploration through international competition with the Soviet Union in the early '60s and the need to keep the public excited about space travel.

Aldrin also said the U. S. needs a unified space vision from five fields: exploration, development, commercial, scientific and security. Integrating the goals of each area will produce a comprehensive approach to space exploration, he contended. The Apollo 11 astronaut is concerned that we have a five-year gap between completed shuttle missions and the next new horizon yet to be determined, similar to 1975-81, between the phaseout of Apollo and the inauguration of the shuttle, while the Russians made Soyuz. “We need continuity with no gaps.”

Aldrin is convinced continuity can be achieved by stretching out remaining shuttle missions to one per year through 2015 and subsidizing commercial orbital transportation services. These include the SpaceX Falcon 9 and Dragon capsule, and shuttling astronauts to the ISS, therefore giving the space agency time to develop new strategies, launch vehicles and spacecraft for years beyond 2015 on the way to an eventual manned space flight to Mars. ■

Briefs: Panel Backs Link between Asteroid, Mass Extinction

A **blue-ribbon international panel** of scientists last month supported the link between the [Chicxulub asteroid](#) impact crater in Mexico's Yucatán Peninsula with the mass extinction of dinosaurs and the majority of life on Earth 65 million years ago, known as the K-T boundary mass extinction. The K-T boundary refers to a layer of iridium-rich clay that marks the end of the Cretaceous period 65 million years ago. Iridium is a chemical element commonly found in asteroids and comets. Scientists cautioned that as with the concept of plate tectonics, now accepted, the concept of an impact mass extinction hypothesis is revolutionary, and there will be people who won't accept it. But they noted specialists in the historical importance of scientific ideas conclude that the impact mass-extinction hypothesis is fundamentally a bigger change than the theory of plate tectonics.

NASA's most powerful Mars orbiter has bounced back from hard luck, and scientists are eager to resume observations. After glitches that began in February 2009, managers put the [Mars Reconnaissance Orbiter](#) (MRO) into protective safe mode in August. The spacecraft was resurrected last month and resumed operations. MRO has taken the most detailed images yet of the Martian surface and has made findings that add to understanding of the geology and history of water. The timing for MRO's return is fortuitous. It's spring in the northern hemisphere, and scientists are eager to take advantage of good visibility provided by the relatively dust-free atmosphere. Instruments will observe changing polar caps, examining the extent and composition of retreating north polar frosts and growth of the south polar cap.

A **3-D view from Mars-orbiter data** reveals highs and lows of the Mojave Crater. In a new image of a portion of the crater's walls, based on terrain modeling, vertical dimensions are exaggerated by three times vs. horizontal dimensions. Resulting images look like the view from a low-altitude aircraft. This shows material that's ponded and backed up behind massive blocks of bedrock in the crater's terrace walls. Hundreds of Martian impact craters have similar ponding. Scientists believe pitted ponds are created when material melted by crater-causing impacts is captured behind wall terraces. Mojave Crater, 37 miles in diameter, may be as young as 10 million years, very young for a crater of this size. This helps scientists better understand features of other craters. Cra-

ters this size generally have already been affected by erosion, sediment and other geologic processes.

Mars Express last month skimmed past Phobos at just 67 km, the closest any manmade object has ever approached the enigmatic moon. Data could help unlock the origin of not just Phobos but other second-generation moons in the solar system, those that coalesced in orbit after their planets formed, rather than forming out of the same birth cloud. Phobos looks like a solid object but previous flybys have shown it's not dense enough to be solid all the way through. Instead, it must be 25%-35% porous. This has led scientists to believe it's little more than a "rubble pile," composed of blocks large and small resting together, with possibly large spaces between them where they don't fit together.

To **weigh the universe**, scientists use two kinds of cosmic scales: one to measure regular matter, another to deduce how much dark matter remains hidden underneath. These calculations have been taken further than ever by a new study that tallied both types of mass in smaller and more distant groups of galaxies than previous projects. The study found faraway small clusters have roughly the same proportion of dark matter to regular matter as closer galaxy groups.

The Fermi Gamma-Ray Space Telescope, which hunts for the most powerful explosions in the universe, is turning its eye on Earth to hunt for tiny flashes of radiation to determine if they pose a rare but deadly threat to high-flying commercial airliners. It's joined the search for [gamma-ray flashes](#) above thunderstorms which are ultra-brief but could be a concern for flyers. Just one millisecond blast of terrestrial gamma-ray flashes (TGFs) could expose passengers and crew to the radiation of 400 chest X-rays. It's unknown if lightning triggers TGFs or whether they provide the quick burst of electrons that may spark a lightning strike.

NASA's Cassini Saturn probe has been granted new life thanks to an [extension of its mission](#) through 2017. The spacecraft, which launched in 1997 and arrived at Saturn in 2004, was slated to be decommissioned in September this year. But it received a reprieve in the

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Briefs: Part of a Comet Formed in Inner Solar System

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2011 NASA budget proposal, which allocates \$60 million per year for seven years.

Superfast protons originate in distant remnants of dead stars, new evidence indicates. Such supernova remnants contain shells of gas ejected from a star before it collapsed in a supernova explosion. They harbor strong magnetic fields thought to behave like giant particle accelerators, speeding up particles that become cosmic rays. New Fermi observations reveal supernova remnants emitting radiation 1 billion times more energetic than visible light. This radiation, short-wavelength gamma-ray light, could be a signature of cosmic rays, thought to produce gamma rays when they collide with gas. Scientists think younger supernova remnants have stronger magnetic fields, able to hold on to particles long enough to accelerate them to the highest speeds, creating the highest-energy cosmic rays.

New analysis of a tiny piece of a comet shows some of its material formed in the inner solar system before it was kicked outward and incorporated into the comet. This provides the first info on when comet material formed, in this case almost 2 million years after the first material in the solar system, about 4.6 billion years ago with the birth of the Sun. Scientists probed whether the particle contained a radioactive isotope of aluminum, which would have been long gone after the first few million years of the solar system. This isotope is signature of the oldest solids thought to have formed in the early solar system. But the particle seemed to contain little, if any, of the magnesium isotope that the radioactive aluminum decays into. This suggests the material didn't form until at least 1.7 million years after the first material in the solar system. The material also seems to have undergone periods of melting, suggesting it formed in the inner solar system. Some meteorite particles also show signs of heating and melting, suggesting both materials formed in similar environments.

Vast pockets of water ice numbering in the millions of tons have been discovered at the Moon's north pole, opening up another region for potential exploration by astronauts and unmanned probes. There's evidence of at least 600 million metric tons of water ice on the bottom

of craters. The resource could be mined to produce oxygen or rocket fuel to support a Moon base. More than 40 craters from 1 to 9 miles wide were found with the water ice, which was discovered in permanently shadowed craters. In another development, Moon water has been found for the first time in rocks brought back during Apollo missions. The water is similar to that detected in comets, suggesting the Moon's supply got there through comet impacts. Traces of water earlier turned up in Apollo rocks, but from terrestrial-water contamination.

The ever-present fog of energetic gamma rays permeating the universe isn't created by what astronomers expected, new [Fermi](#) data reveal. The sky glows in gamma rays even far away from well-known bright sources, such as pulsars and gas clouds within the Milky Way or the most luminous active galaxies. Astronomers had thought the accumulated glow of active galactic nuclei accounted for most of this gamma-ray background, but this isn't the case. Scientists compared emissions from active galaxies Fermi detected against the number needed to produce the observed extragalactic background, and found active galactic nuclei are only minor contributors to the background gamma-ray glow, accounting for less than 30% of the extragalactic gamma-ray background Fermi sees. Particles accelerated in star-forming galaxies and galaxy-cluster mergers could fuel the gamma-ray background.

The protective magnetic field shrouding the early Earth was likely only half as strong as today, a new study suggests. And the Earth's magnetic field is 200 million years older than previously thought, which has implications for the amount of water originally present on Earth, and perhaps on development of life. Scientists examined crystals in ancient rocks that preserve magnetic signatures, focusing on the best preserved grains from 3.5 billion-year-old dacite outcroppings. Rock crystals recorded a field 30%-50% weaker than what exists today. This weaker magnetic field also has implications for conditions on the early Earth. In the past, not only was the field weaker, the Sun was likely rotating more rapidly and therefore spinning off a stronger solar wind and a magnetopause likely much closer to Earth. Today it's at a distance of about 10.7 Earth radii, but then it would likely have been around 5 Earth radii. (Earth's average

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radius is about 4,960 miles.). So particles streaming from the Sun were much more likely to reach Earth. The implication: It's very likely the solar wind was removing volatile molecules, like hydrogen, from the atmosphere at a much greater rate than today. The loss of hydrogen implies a loss of water as well. If much water was stripped away early in Earth's history, to get the amount of water we have now, the planet must have started with a fairly robust inventory of water. The magnetic field may predate establishment of life on Earth.

A huge lunar crater could offer a view of the Moon's innards. Shortly after the Moon formed, an impact created the South Pole-Aitken (SPA) basin, almost 1,500 miles across and more than five miles deep. The impact punched into layers of the lunar crust, scattering material across the Moon and into space. The tremendous heat of the impact also melted part of the floor of the crater, creating a sea of molten rock. Scientists say a crater on the edge of the SPA basin may provide a rare view of the early surface. The Apollo Basin was formed by later impact of a smaller asteroid and is about 300 miles across. Portions of the interior of Apollo have a similar composition to the impact melt in the SPA basin. As one goes deeper into the Moon, the crust contains minerals with greater amounts of iron.

Astronomers have shown a pair of white dwarfs spin around each other in just 5.4 minutes, making them the fastest-orbiting and tightest binary star system ever found. The stars of HM Cancri are so near each other--about a quarter of the distance between Earth and the Moon--that they couldn't get much closer without merging. Smaller white dwarfs are more massive than bigger, puffier ones, given these stars' extreme densities. In the case of HM Cancri, this has led to the smaller, though heavier, star gravitationally stealing matter from its nearby companion. The more massive star is distorting the shape of the lighter one into that of a pear or a raindrop. Matter striking the heavier star unleashes bursts of light and energy. This periodic brightening implied the 5.4-minute orbital period. The stars that smoldered into the white dwarfs must have initially been much farther apart given how little space remains between them. The previous record-setter was more than nine minutes, somewhat less than twice the time of the spectacular 5.4 minutes. ■

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Go See This Exhibit!

By Mary Carlson

Currently at the Rubin Museum of Art is a most evocative exhibit, "Visions of the Cosmos: From the Milky Ocean to an Evolving Universe." It incorporates history, geography and religion as they define diverse cultures and their conceptions of the universe. The milky ocean represents the swirling sea so paramount in the Hindu belief of creation. An evolving universe refers to the Western sense of the cosmos and ultimately to our exploration of space.

Eastern collections of deities from Buddhism, Hinduism and Jainism provide a complementary platform for more human-centered Western cosmology. From the realm of the Himalayan gods, we travel west to the more familiar world of Ptolemy, Copernicus and Galileo. We're first introduced to the geocentric version of our universe through 16th century creation writings and then to the radical heliocentric world as envisioned in Copernicus' *De Revolutionibus Orbium Coelestium*, Galileo's *Dialogus De Systemate Mundi* and *An Original or New Hypothesis of the Universe* by Thomas Wright. All writings are the original versions.

The transition is seamless, from Buddhist artifacts of a three-dimensional universe to current astrophysical discoveries of an expanding cosmos. Through film, we're whisked off a Himalayan mountaintop on a journey through satellite orbits, star formations and galaxy boundaries to the afterglow of the Big Bang and back. This is a trip made possible by the AMNH's "Voyage through an Evolving Universe."

Catch this excellent exhibit before it closes May 10. The museum is at 150 West 17 Street. It's open seven days a week at 11 a. m.; closing hours vary. ■

AOS Wins Outreach Award

The Long Island-based Amateur Observers' Society of New York has won *Astronomy* magazine's annual Out-of-This-World contest for astronomy-outreach programs. The magazine cited the breadth of AOS' Reach for the Universe programs, children's workshops, weekly presentations and observing sessions. "Telescope clinics help current scope owners get the most out of their equipment," it said. ■



Events on the Horizon

April 2010

M: members; **P:** open to the public; **T:** bring your telescopes, binoculars, etc.;
C: cancelled if cloudy;

HQ: at AAA headquarters, Downtown Community Center, 120 Warren St.
AMNH: For ticket information, call (212) 769-5200

For directions to AAA observing events, check the club's website, www.aaa.org.

Thursday, April 1, 7 to 9 PM

Observing, Avenue U Salt Marsh Nature Center

FREE, P, T A talk followed by observing at a dark location in south Brooklyn.

Saturdays April 3, 10, 17, 24, 8 p. m.

Observing at Inwood Hill Park, Manhattan, P, T, C

Next dates: Saturdays in May.

Tuesday, April 6, 6:30 p. m.

Hayden Planetarium presentation by the AAA's Jason Kendall, P, AMNH

The AAA board member will speak on "Planetary Real Estate." He'll fly through the solar system to show how planets orbit the Sun and will discuss NASA missions.

Thursday, April 8, 6:30-8:30 p. m.

Recent Advances in Astronomy Seminar, M

At NYU conference room, 726 Broadway, two blocks below 8th Street, 6th floor. Next date: May 13.

Friday, April 9, 6:15 p. m.

AAA lecture, FREE, P

Glennys Farrar, professor of physics at NYU, will discuss "High-Energy Astrophysics with a Neutrino Telescope in New York City." Next lecture: May 7.

Monday, April 12, 7:30 p. m.

Hayden Planetarium lecture, P, AMNH

In "Dark Matter, Revealed," MIT physicist Peter Fisher will speak on the major role dark matter, although invisible, plays in our galaxy and the universe. He'll discuss the history of dark matter and the search to find it, and will also highlight new research from MIT that aims to discover how dark matter is created.

Tuesday, April 13, dusk to 10 p. m.

Observing at Cadman Plaza, Brooklyn, P, T, C

Next date: May 11.

Wednesday, April 14, 8:30-10 p. m.

Observing at Fort Tryon Park near The Cloisters, Manhattan, P, T, C Next date: May 12.

Saturday, April 17, dusk

Observing at Great Kills Gateway National Park, Staten Island, P, T, C Next date: May 15.

Wednesday, April 21, 8-11 p. m.

Observing at Prospect Park, Brooklyn, P, T, C

Next date: May 19.

Friday, April 23, dusk-10 p. m.

Observing at Carl Schurz Park, Manhattan, P, T, C

Next date: May 28.

Friday, April 23, 8-10 p. m.

Observing at Floyd Bennett Field, Brooklyn, P, T, C

On the model airplane flying field. Next date: May 21.

Saturday, April 24, 10-noon

Solar Observing at Central Park, P, T, C

At the Conservatory Waters. Next date: May 29.

Monday, April 26, 5:30 p. m.

Lecture by Sir Martin Rees, FREE, P

The renowned cosmologist and astrophysicist will speak on "From Big Bang to Biosphere" at Rockefeller University, 1230 York Avenue at 66th Street.

Tuesday, April 27, 6:30-8:30 p. m.

Observers' Group, M, HQ

Pre-meeting dinner at 5:15 at the Gee Whiz Diner, Warren and Greenwich streets. Next date: May 25 ■

AAA Annual Meeting May 19

In accordance with the AAA bylaws, the annual meeting will be held Wednesday, May 19 at headquarters, Downtown Community Center, 120 Warren St. 6:30 p. m.: social gathering. 7:30 p. m.: annual meeting, for all members.

The 7:30 p. m. meeting will include elections to fill vacancies on the AAA board of directors. Nominations, besides those made by the nominating committee, may be presented to the AAA president or to the recording secretary no later than seven days before the annual meeting. Each such additional nomination requires the signatures of at least 18 AAA members.

Nominating Committee Backs 7 for AAA Board

The AAA nominating committee last month backed six board members for election to three-year terms at the May 19 annual meeting. They are financial secretary Alice Barner, Luis Marcelo Cabrera, Mary Carlson, former president Lynn Darsh, recording secretary Edward J. Fox and Jason Kendall. The committee also endorsed Gerceida Jones for election to a one-year term. Appointed to the board in February to briefly replace Shoba Bandi Rao, Jones would complete her predecessor's term.

The committee consisted of *Eyepiece* editor Dan Harrison, treasurer Thomas Haeberle and former president Michael O'Gara.

Brooklyn Observing

On Sunday, April 25 from 1 to 5, there will be solar observing aided by the Enviromedia Mobile at IKEA/ Erie Basin Park at Red Hook, Brooklyn to celebrate Earth Day. The Mobile, a traveling nature and marine museum, is sponsored by The Urban Divers Estuary Conservancy. On Saturday, June 5, there will be solar observing (1 to 7) and stargazing (9 to 11). Other dates are July 17, August 15 and September 12. The organization has one solar scope and two low-grade lunar scopes, so is looking for AAA help, notes AAA member Ludger Balan. The events are part of a spring- and summer-long waterfront festival. Twenty-one dates and a 15-site tour are planned. Info: harlemriver.udec@gmail.com. ■

**Amateur Astronomers Association
Gracie Station
P. O. Box 383
New York, NY 10028**

**Forwarding and Address
Correction Requested**

First Class