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Kepler Space Telescope Will Open Unprecedented New Vistas

By Jason Kendall

July 10. It was a dark and cloudless night. I'd been asked months ago to give a talk on some topic at Columbia University as part of its summer public-outreach program. The exoplanet bug had bitten me, and I told the head of the program, Cameron Hummels, that I'd talk about the first phase of NASA's Terrestrial Planet Finder Program.

There's been a strong shift in NASA's focus in the last decade to the hunt for planets around other stars and life on those planets. This shift has been integral to the reboot of NASA. After the successes of Pathfinder, Spirit, Opportunity, Galileo, Cassini and, of course, Hubble, the public's interest has been drawn quite understandably to the broad vistas seen and to the tantalizing possibility of life on other planets and moons in our solar system.

The most natural extension of these efforts is to conduct a survey of the sky, hunting for planets like Earth around other stars. I thought it would be great to give an update on the exciting search for other planets. Also, as part of my volunteer work with NASA/JPL as a solar-system ambassador, I was able to get a lot of posters, lithographs and bookmarks for everyone in attendance.

For millennia, people have pondered whether life exists on other planets. As far back as the ancient Greeks, this question has tantalized many. More recently, great sci-fi writers such as Asimov, Clarke, Wells, Verne, Bradbury, Heinlein and even Douglas Adams have expressed serious, playful and thoughtful speculations of what it would mean for life to exist on other planets, the conditions for life and whether it would be possible for missions to visit exoplanets.

Johannes Kepler, after spending his whole life trying to discover the hidden mechanisms of the universe, and after writing his Three Laws, wrote a wonderful book, "Somnium." Far ahead of his time, Kepler imagined life on other planets as he'd perceived it in a dream. In honor of his fundamental contribution to the understanding of the motions of the planets and his unflagging pursuit of the truth, NASA named the first telescope dedicated to the discovery of planets around other stars in his honor: the Kepler Space Telescope.

The Kepler Space Telescope is a one-meter Schmidt camera with a huge photometer at the prime focus. Launched March 7, the telescope was successfully placed in an Earth-trailing orbit. The dust cover was popped April 7, and the first image of the scope was released April 13.

The chosen star field is 105 square degrees in the region between Vega and Deneb, looking along the Orion Arm of the Milky Way. In this direction, there are approximately 3 million stars within 6,000 light-years of Earth. The telescope will stare at this star field for five years, hunting for tiny variations in the starlight indicative of Earth-sized planets. Of those 3 million stars, about 100,000 are solar-like. Of the 100,000, if planetary plane orientations are random, about 0.1% will be aligned in such a way that Kepler will see a transit. So if Earth-like planets are common around Sun-like stars, a few hundred planets will be found. If none are found, then Earths are rare, and we're alone.

As I chatted about these points, I took questions from the audience, and was glad to see a number of friendly faces, such as Rich Rosenberg and Bruce Kamiat. There were also a number of friends from Inwood

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What's Up

By Tony Hoffman
The Sky for August 2009

Jupiter Takes Center Stage. My favorite of Galileo's discoveries, and among the most far-reaching in its implications, was the finding of the four large Jovian moons--Io, Europa, Ganymede and Callisto--now collectively known as the Galilean moons. They were the first celestial objects found that clearly orbited an object other than the Earth or Sun, and they added weight to the idea that Earth might not be the center of the universe, and implicitly supported the heliocentric model of the solar system proposed by Copernicus. Now's a great chance to view the Galilean moons, as well as Jupiter's cloud belts, as the giant planet is closest to the Earth this month and visible all night. Jupiter will reach opposition on August 14, when it will be larger (49 arc-seconds across) and brighter than it's been in almost a decade, blazing at magnitude -2.9 in eastern Capricornus. It starts the month just 2 degrees from Neptune, an object Galileo recorded in his diagrams of Jupiter's moons, but he apparently never realized it was a planet despite its telltale motion.

If it's August, It Must Be the Perseids. Although it may not be the most spectacular or prolific meteor shower, the Perseids are perhaps the most well-known, thanks to their consistent strong showings year after year and their appearance in mid-summer, when it's comfortable to pull out a lawn chair and gaze at the sky for hours. A third-quarter Moon will interfere somewhat with this shower, composed of debris from Comet Swift-Tuttle, but it's predicted to be a strong showing nonetheless, particularly on the night of August 11-12, with a possible spike in the meteor count around 5 a.m. The shower is visible from 10 p.m. onward, once the radiant rises. Conditions improve after midnight, once Perseus is high in the sky.

August 1 Mercury lies near Regulus.
August 5 Full Moon at 8:55 p.m.; penumbral lunar eclipse.
August 6 Moon lies near Jupiter.
August 10 Saturn's rings edge-on to us (and invisible).
August 12 Perseid meteor shower peaks.
August 13 Last-quarter Moon at 2:55 p.m.
August 14 Jupiter at opposition.
August 15 Moon lies near Mars.
August 17 Moon lies near Venus.
August 18 Mercury lies near Saturn.
August 19 Moon at perigee, 223,469 miles from Earth, 12:58 a.m.
August 20 New Moon at 6:02 a.m.
August 21 Venus lies near Pollux.
August 22 Moon lies near Saturn and Mercury.
August 24 Mercury at greatest elongation in evening sky.

Spots Reappear on the Sun

By Joseph A. Fedrick

I projected the Sun's image onto white typing paper with my 60mm refractor 12 times from February through June and saw no sunspots. In fact, I saw no sunspots at all between August 26, 2007 and October 12, 2008 and after that date saw some small spots on only two days until July 5 of this year.

Finally, on July 5, I saw the largest group of spots on the Sun since July 12, 2007. This group of spots consisted of two clumps of spots that probably represent the poles of a magnetic field at the points where magnetic lines intersect the photosphere of the Sun. The groups of spots spanned no more than an eighth the diameter of the solar disk, about the same distance spanned by the group of spots that appeared on July 12, 2007. By July of this year, the group of spots had nearly rotated off the side of the solar disk that faces us. I saw no other spots elsewhere on the solar disk on July 8.

Solar sunspot activity is still rather weak. However, it appears that a new sunspot cycle has begun. I'm eagerly waiting to see if this will be an intense but perhaps delayed sunspot cycle, or a weaker than average cycle. This might be expected at the beginning of an extended period of diminished sunspot activity, such as the Maunder minimum of the 17th and 18th centuries that occurred during a period known as the Little Ice Age.

It's tempting to think that this year's cool summer is due to a lack of sunspots, especially since we've had hot summers near solar maximum, such in 1966, 1977, 1988 and 1999. However, we've also had cool summers near solar maximum, as in 1967 and 2002.

(Spots continued on page 12)

A Message from AAA President Richard Rosenberg

Hello, members:

As I write this, it's a few days before the July 22 total eclipse of the Sun. A few of us gathered at a bon voyage dinner for Tony Hoffman, who was heading to China for the event. Clear skies, Tony.

The Chinese restaurant we ate at was near the recently opened High Line, an unused elevated railway converted into a park. It was a beautiful evening and we enjoyed walking a few stories above street level. We couldn't help noticing how dark it was, thanks to subdued lighting, and how suitable it would be for public observing. Joe Delfausse is checking the possibility.

A virtually ringless Saturn is heading into the dusk this month, to be replaced by Jupiter. Check them out; we have 19 observing sessions this month

For the 40th anniversary of the first manned landing on the Moon, NY1 taped an interview with me, asking for my feelings on NASA's approach to manned vs. unmanned missions. I gave them my opinion and wrote an article for *Eyepiece* on the subject *(see story below)*. Do you agree with me? If not, perhaps you'll write a rebuttal.

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

AAA Announces Speakers for 2009-10 Lecture Series

The AAA last month announced the speakers for its 2009-10 lecture series. Club lectures, free and open to the public, are held Friday evenings at 6:15 at the Kaufmann Theater of the AMNH.

The opening lecture, on October 2, will be given by Michael Way of the Goddard Institute of Space Studies. He'll discuss "100 Years of Cosmology: From Spiral Nebulae to the Cosmic Microwave Background."

Other dates and speakers are:

November 6: Alan Guth, MIT, "Inflationary Cosmology: Is Our Universe Part of a Multiverse?"

December 4: Charles Baltay, Yale University, "Exploring the Dark Side of the Universe: Accelerating Universes. Dark Matter, Dark Energy and All That."
January 8: Jerry Bonnell, NASA, "Best Astronomy Pictures of the Day: 2009."
February 5: Arlin Crotts, Columbia University, "Liquid Mirror Telescopes Are Looking Up."
March 5: John Gianforte, Blue Sky Observatory, "In the Footsteps of the Master: Discovering the Contributions of Galileo." "
April 9: Glennys Farrar, NYU, title to be announced.
May 7: Ruben Kier, Advanced Radiology Consultants, "Best Targets for Amateur Astrophotography and What They Reveal About Our Universe." ■

Should There Be People Aboard Future Space Missions?

By Richard Rosenberg

I was recently interviewed by Thomas Farkas of TV station NY1 in conjunction with the 40th anniversary of the first manned Moon landing. I was asked my opinion of loss of momentum in manned spaceflight: Since the last Apollo flight in 1972, astronauts have been limited to the space shuttle and space station. Probes of the rest of the solar system has been left to unmanned missions.

I agree with NASA's strategy. When John F. Kennedy in 1961 announced the U. S. would put a man on the Moon by the end of the decade, computers and robots didn't have the capabilities they have today. Maneuvers necessary to put people on the Moon and return them

(People continued on page 10)

On Cosmological Restrictions and Certainties

Although we know an enormous amount about the universe, we observe only with photons, or light, NYU physics professor David W. Hogg told a Columbia University audience June 12.

There are further restrictions, he added. We've been observing only for a tiny snapshot in time relative to the more than 14-billion-year age of the universe. We can't do experiments in the classical sense of physics—i. e., we can't modify the universe in any way. And "everything we study is incredibly remote, so even photons are scarce."

But despite these restrictions, Hogg noted we know many things in cosmology with great scientific certainty. He focused on a small number of examples, each very well-established.

First, the universe is expanding. "We don't directly measure the expansion…but infer it from Doppler shifts. We see a pattern of Doppler shifts (redshifts) that are beautifully explained by a simple, kinematic expansion model. Furthermore, Doppler shifts are required by our ideas about relativity and energy conservation.

All alternative explanations of these data, such as 'tired light,' are bizarre, contrived and in conflict with other observations and general ideas about the character of physical law.

"The confidence we have in the conclusion that the universe is expanding comes from the simplicity and explanatory power of the model, combined with the complexity and failures of all alternatives.

"Second," Hogg stated, "there was a hot Big Bang. We can't see the Big Bang itself, but we can see that the universe was more dense and hotter in the past.

Furthermore, the observed relative abundances of hydrogen, helium, deuterium and lithium are well explained by a cosmological nucleosynthesis model based on extrapolation of the expansion and thermal history back to a time when the universe was only a few minutes old. The kinematic-expansion model, when combined with simple, laboratory-tested physics, does a great job of explaining many cosmological observables.

The alternative to the Big-Bang model, the steady-state model, has now become extremely contrived to avoid or be consistent with observations that support the very simple Big-Bang model. The confidence we have comes from the success of the simple Big-Bang model in comparison with all alternatives.

Hogg discussed two other examples. There are black holes at the centers of galaxies, including the Milky Way, and elements heavier than helium were created inside stars. With these also, we derive our confidence from the simplicity and explanatory power of the models vs. all alternatives.

Hogg concluded by saying that the same kind of arguments can and will be applied to the question of what preceded the Big Bang. This is harder to answer because the physical system is outside the observable universe. However, it isn't qualitatively different, because different explanations will have different levels of simplicity, be differently consistent with other laws of physics, and do different jobs in explaining the observable data. These data will include the initial conditions for our universe, and its contents and dynamics.

In the question period, Hogg was pressed to answer the question which formed the title of his talk--"What Happened Before the Big Bang?"--and said that although the answer is unknown, it's strongly constrained by issues of causality, the fact that regions of the universe that are currently not in causal contact nonetheless seem to have very similar properties.

Most models put the observable universe inside some kind of meta-universe that's expanding rapidly and has a much higher vacuum-energy density, with our universe some kind of lower-energy "bubble" inside this meta-universe.

However, observations supporting these kinds of models are very sparse and major changes in our thinking are likely, he asserted. ■

Getting Amazing Accuracy from the Right Mount

By George Hripcsak

My first telescope, a 60mm Tasco refractor, used a German equatorial mount (GEM). I learned to use celestial coordinates, and I built my own electric sidereal-rate clock drive out of a discarded alarm clock. I learned a lot about the sky, and I learned a lot about patience. The manual setting circles brought the telescope to an object's approximate location, and then the hunt began, thwarted by the dim view of the telescope's small objective lens and the narrow field of its eyepieces. It's been years since I've owned a GEM, but I've been yearning for an accurate, versatile mount that can carry a range of optical -tube assemblies

I recently purchased a very nice five-inch refractor. I used it on a friend's GEM and decided to get myself one. After a bit of research, I ended up with the Goldilocks story: Some mounts (GM8, CG5, GPD2, Sirius, 400GTO) were too small to carry the 15-pound telescope and its accessories, and other mounts (G11, Mach1) were too heavy or too expensive.

Four mounts seemed just right--able to carry 25 to 40 pounds, with motors to slew to objects automatically, and priced from $1,500 to $5,000--the Orion Atlas EQ-G, the Vixen Sphinx SXD, the Takahashi EM200 and a used Astro-Physics 600EGTO. I ended up settling on a used Astro-Physics 600EGTO for its workmanship and general appeal

It's a fairly involved setup. In addition to the main part of the mount, the equatorial head (30 pounds), it comes with a counterweight shaft (four pounds), a control box and a keypad to direct the telescope. You need to add a tripod (18 pounds), weights (18 pounds), a battery (eight pounds), and a mounting plate and rings to hold the telescope. You put it all together, align it with the celestial pole using one of a number of methods, and tell it where to go.

The keypad and its instructions were a little intimidating at first, but they quickly became second nature. It's designed by people who understand how astronomers think and work. I also use a computer called the Sky-Commander. I like it a lot, but I find the Astro-Physics faster and easier.

My first time under the stars was very nice. The mount found objects about as well as my computer-equipped Dobsonians (within the field of a 17mm or medium-power eyepiece) and it tracked very well. Then I discovered that there was a simple option in which the telescope guides you to very accurately polar align itself; the procedure takes less a couple of minutes. The mount alternately points at Polaris and another star and asks you to adjust the mount

The result was unbelievable. It never occurred to me that a mount could be that accurate. From one end of the sky to the other, I would identify an object on the keypad, push goto and the object would end up centered in a 5mm (high-power) eyepiece. If there were such a thing as a 1mm eyepiece (uselessly high power), objects would still be in the field of view. If I couldn't see the object, it was because it was too dim, not because I had missed it. And it tracked essentially perfectly

Assuming a mount is made very well, there are two things that affect pointing accuracy: how accurately the mount is aligned with the celestial pole and whether the telescope is truly perpendicular to the declination axis.

Whereas other manufacturers provide software that corrects for such inaccuracies, Astro-Physics doesn't. Instead, it provides the software and methods to get them right. The polar alignment method is easy enough, and I apparently got lucky on telescope mounting. One advantage of getting the alignment right instead of correcting for it is that you avoid subtle field rotation that blurs images during long exposures

During star hopping, you focus on the sky and the relationships among objects. Using a very accurate goto and tracking mount leads to a different kind of observing in which you really focus on the objects themselves. Lugging around all that weight and connecting it together is a bit of a pain, but once it's set up, it's a wonderful experience. Time will tell how often it really gets used. ■

40 Years After Apollo 11, Tyson Looks Back—and Ahead

Forty years after the first Moon landing on July 20, 1969, SPACE.com interviewed Hayden Planetarium director Neil deGrasse Tyson on exploring space, America's role in science and related matters. Excerpts:

Do you see a big difference between the public's involvement and interest in the space program back in the 1960s compared to today?

Back then, there was a keen awareness by the public as well as lawmakers in Washington of the correspondence between creative investments in science and technology, and our self image as scientific and technological leaders of the world. There was also an awareness of the role those investments would play in our economic growth. One of my worries in recent years has been the loss of that awareness. That absence of awareness is catching up and is holding us back while other nations are fully aware of this correspondence. The trend lines in research and innovation look good for places such as India and China and less good for America.

Does the public undervalue space exploration?

Too many people view it as a luxury rather than a fundamental driver to stimulate interest in science in the educational pipeline. It's vital to our prosperity and security.

Can the U.S. recover its status as a scientific leader?

While we may lose track of certain goals intermittently throughout the decades, I think we can be nimble when we need to be. All the buzz today is on the need for science literacy. That's on the agenda in ways it hasn't been in previous decades. There's a growing awareness that we're losing our technological competitive edge. I think there's an awareness we're losing our leadership, and that maybe our self image over the past several decades has been a little delusional. We tell ourselves we're leaders, and if you tell yourself enough you start to believe it.

Is part of the public apathy toward space exploration because we don't have a goal as exciting as being the first nation to land on the Moon?

There are countless space activities that would be no less exciting than the Moon missions. The search for life on Mars, for example. We have some asteroids coming our way. Why don't we deflect them? I can't think leaving Earth once is enough. I believe the manned space program can engage the public by advancing the space frontier. Every next mission takes you farther in space, either technologically or in distance. For example, take the Gemini launches. None left Earth orbit but each was more ambitious. When you don't advance a frontier, how could the public be interested?

Were you inspired to pursue science because of the Apollo missions?

No. My interest in the space program has a certain purity to it because I recognize the romance of it but I was never seduced by it. That allowed me to view it through a more purely scientific lens. My interest in space while in school came about through my scientific activities.

What do you think of NASA's plans for manned spaceflight?

It looks pretty clear that the budget isn't commensurate with expectations on NASA. Either the portfolio must be tuned down or the budget raised, or both. But something has to happen for NASA to go places. I agree we should go back to the Moon and on to Mars. We should treat all objects in the solar system, including comets and asteroids, as exploration targets. It's very possible that it can happen in my lifetime and I think it should. It's a matter of aligning the technological and political funding pistons to fire in harmony with each other. When they all fire together you can accomplish great things.

Do you think the current economic downturn presents a major roadblock to aligning those pistons?

It's not as though we didn't have problems before. It's not as though the '60s was some tranquil time of prosperity. One could argue it was one of the most troublesome decades in the history of the country, yet it was in that decade that we went to the Moon. As important as the civil rights movement was, I think what will rise to the top is that we left Earth in that time. ■

Review: A Tableau of Doomsday Scenarios—and Solutions

By Luis Marcelo Cabrera

Total destruction of Earth or at least mass extinction of life is a common and recurrent scenario in Phillip Plait's book "Death from the Skies! These Are the Ways the World Will End" (Viking/Penguin Group, $25.95).

Astronomical events delivering destruction to Earth are discussed in the book. Occurrences that happened or might have happened in the past and events that will or could happen in the future are included. The science behind those events, their odds, destructive power and possible ways to mitigate their aftermath are encompassed.

The book is surprisingly entertaining. In each of its nine main chapters you're presented with a doomsday scenario describing the influence of such astronomical occurrences on the lives of scientists and citizens.

The science-fiction style Plait uses in the doomsday scenarios is convincing and full of small details and clues that are explained subsequently in each chapter.

"Death from the Skies!" contains some black-and-white photographs and illustrations but almost no equations or formulas throughout its 300-plus pages. Nonetheless, its spellbinding story makes it hard to put down until you reach the end of each chapter.

I would have liked to see some of the calculations supporting some claims Plait makes, or at least have footnotes pointing to the original research material used to support the scientific predictions. Despite the absence of the author's research, Plait does an excellent job discussing complex math and physics, and explaining the science behind common sense-defying phenomena using plain language.

Plait's frightening and at the same time exhilarating book presents the reader with possible solutions to many of the ways Earth (or life as we know it) could end. Some solutions to prevent this from happening are achievable using existing technology and some are impossible to achieve given the current state of technology. Plait provides solutions based on proven science.

The book isn't apocalyptic, but very well-balanced in terms of what may happen and what will happen, and what the odds are of something causing fatalities.

"Death from the Skies!" also includes a table listing the nearby stars that will eventually go supernova. Detailed step-by-step recounts of the life of the Sun also delve deeply into the physics of supernovae, black holes, gamma-ray bursts, galaxy collisions and the Big Bang.

Plait has delivered an outstanding book capable of captivating your imagination without making you lose sleep about the inevitable end of the world, while explaining a lot of astronomy.

The informal language makes it easy to continue reading even if you don't understand the basis for some phenomena. The author explains everything in detail.

I went into reading the book as a skeptic. Based on the title, I didn't think it would have substantial material and would be more relevant for novices and teenagers. I was proven wrong before finishing the first chapter. ■

'Where Did Pluto Go?'

'Where Did Pluto Go?" by Paul Sutherland (Reader's Digest, $24.95) is billed as a beginner's guide to understanding the "new solar system." Anyone, beginner or not, who reads its fact-crammed 150 pages will emerge suffused with facts on the planets, their moons, "Pluto and beyond," asteroids and meteorites, and comets and meteors. The book wraps up with material on extrasolar planets and observing the planets.

A nice touch throughout the book are paragraphs on "What We Knew Then" and "What We Think We Know Now," providing interesting historical perspective. The book also features a planisphere and a pullout on the solar system. Any number of charts and excellent graphics, including upcoming celestial events, buttress the text. The book also notes the contributions of amateur astronomers. On the down side, a book billed as for beginners shouldn't leave technical terms unexplained. Example: hydrostatic equilibrium.—*Dan Harrison*

Briefs: Comet or Asteroid Creates Huge Jupiter Impact

The dark bruise that appeared suddenly near the south pole of Jupiter last month, likely the result of a comet or asteroid impact, is as big as the Pacific Ocean. The dark spot was first noticed by chance by an Australian amateur astronomer July 19. It's thought to be the result of an impact similar to that of Comet Shoemaker-Levy 9, which pummeled Jupiter 15 years ago. After he was convinced the spot was not just another storm or the shadow of one of Jupiter's moons, the amateur alerted astronomers around the world to the scar's appearance. An astronomer took advantage of previously scheduled observing time on Keck II to image the blemish. The near-infrared image showed a bright spot in the clouds of Jupiter's southern hemisphere, where the impact had propelled reflective particles high into the relatively clear stratosphere. In visible light, the bruise appears dark against the bright surface of Jupiter. Because of the complex shape of the explosion, its possible tidal effect--the gravitational tugs of Jupiter and its moon--fragmented the impactor shortly before it collided with the planet. At press time, astronomers were planning to conduct high-resolution visible and ultraviolet observations of the impact site using Hubble's new Wide Field Camera 3. Ground-based facilities will use adaptive optics to obtain sharper infrared images of the impact's aftermath.

Millions of Asians turned their eyes skyward July 22 as dawn suddenly turned to darkness across the continent in the longest total solar eclipse of this century. Starting in India just after dawn, the eclipse was visible across a wide swath of Asia before moving over southern Japan and into the Pacific Ocean. Maximum eclipse, six minutes 39 seconds, occurred in the Pacific 195 miles east of of Iwo Jima. The eclipse is the longest since July 11, 1991, when a total eclipse lasting 6 minutes, 53 seconds was visible from Hawaii to South America. There will not be a longer eclipse than this one until 2132. Tony Hoffman, who went to China for the eclipse, will report on what he saw in next month's *Eyepiece*.

After one of the longest sunspot droughts in modern times, solar activity picked up quickly in early June *(see Joe Fedrick's story on page 2)*. A new group of sunspots developed, and while not dramatic by historic standards, they were the most significant in many months. The past two years have marked the low in the 11-year cycle since 1913, and scientists wondered if activity would ever pick back up. As of early last month, the Sun in 2009 has been completely free of spots 77% of the time. Researchers last month said quiet jet streams inside the Sun were responsible and that activity would soon return to normal. The new set of spots is kicking up modest solar flares. Prior to the low-activity period, astronomers predicted the next peak in solar activity, expected in 2013, might be one of the most active in many decades. That forecast was recently revised, however, and scientists now expect the next peak to be modest.

Some of the first stars may not have formed alone but may have had partners, a new simulation suggests. Earlier simulations indicated the earliest stars would have been huge, with masses hundreds of times the Sun's, and would likely have formed in single-star systems. While binaries had been proposed, they'd never been seen in cosmological simulations. Binary and even triple-star systems are common in the more modern universe and are typically much less massive than early-generation stars. The new simulations included more precise information to better mimic conditions thought to have existed in the early universe. Just how many early stars might have been binaries isn't clear. The finding jibes with observations of very old, low-mass stars in the halo of the Milky Way. They suggest the first stars weren't quite as massive as expected.

A new atlas of cosmic dust covers the inner regions of the Milky Way, revealing where stars, gas and dust are packed together, where chaos reigns and where massive stars are born. There are thousands of previously undiscovered knots of cold cosmic dust, each a potential star. It's so dusty optical telescopes can't see anything. But cosmic material emits and reflects various forms of radiation besides the visible. The new observations were in submillimeter-wavelength light, between infrared light and radio waves on the electromagnetic spectrum. It's the largest map of cold dust so far. The area of the map covers a narrow strip of the galactic plane about two degrees wide, or four times the width of the full Moon. Submillimeter light allows astronomers to see dust clouds shining, even though they obscure our view of the universe at visible light wavelengths. The map includes the denser central regions of our galaxy, in the direction of Sagittarius--home to a supermassive

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Briefs: Evidence Points to Ocean on Enceladus

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black hole--that are otherwise hidden behind a dark shroud of dust clouds. The newly spotted dust clumps are typically a couple of light-years in size, and have masses between 10 and a few thousand times the mass of the Sun.

Astronomers have found the strongest evidence yet for an ocean beneath Enceladus. The salty water is likely feeding jets of water ice that spurt from the moon's south polar region. The water and other key life ingredients, such as organic material found in the plumes, could provide a suitable environment for life precursors. Composition of sodium compounds and overall salt levels correspond with what scientists would expect if there were an ocean beneath the moon's icy shell. Meanwhile, results from ground observations of the vapor cloud in Saturn's E ring don't show sodium. The finding, however, doesn't exclude the possibility of an Enceladan ocean.

The European Space Agency's Herschel telescope's first observations revealed water and carbon, and dozens of distant galaxies. The scope, which launched May 14, has finished its first test observations with all of its instruments. It's the largest, most powerful infrared telescope launched. Its observations in the far-infrared to sub-millimeter wavelengths will allow astronomers to study some of the coldest objects in space not visible in other wavelengths. Herschel focused on M66 and M74 for its first look at the universe. The galaxies gave astronomers their best images at these wavelengths and revealed other, more distant galaxies in the background. The pictures show M66 and M74 at a wavelength of 250 microns, longer than any previous infrared space observatory. Herschel is designed to look at star formation in the Milky Way and nearby galaxies, and search for star-forming galaxies in the very distant universe.

Venus may once have been more Earth-like, with volcanic activity and an ocean of water, a new map of the planet's southern hemisphere suggests. The map comprises more than 1,000 images, recorded between May 2006 and December 2007 by the ESA's Venus Express spacecraft. Because Venus is covered in clouds, normal cameras can't see the surface, but Venus Express used a particular infrared wavelength to see through them. New data are consistent with suspicions that the highland plateaus of Venus are ancient continents, once surrounded by ocean that might have evaporated away into space and produced by past volcanic activity. The rocks look different because of the amount of infrared light they radiate into space. The new map shows that the rocks on the Phoebe and Alpha Region plateaus are lighter in color and look old compared to the majority of the planet. If there's granite on Venus, there probably was an ocean and plate tectonics in the past. Over time, Venus's water has been lost to space, but there might still be volcanic activity. The images had variations of just 3-20 degrees C, instead of the kind of temperature difference expected from active lava flows.

Martian weather was much balmier in the recent past than scientists thought, according to new analysis of formation of certain landforms on the surface. Several recent studies have pointed to possible evidence of more recent water flow. In the newest analysis, landforms that were examined had formed by the melting of ice-rich soils during freeze-thaw cycles that continued until 2 million years ago. Pictures show polygonally patterned surfaces, branched channels, blocky debris and mound/cone structures. These are similar to Earth landforms where permafrost is melting. All landforms observed are in an outflow channel, believed active as recently as 2 million-8 million years ago. Since the landforms exist within, and cut across, the channel's pre-existing features, this implies they were created within this timeframe.

The military ended an informal arrangement that allowed scientists access to data on incoming meteors from classified surveillance satellites. This is a blow to astronomers and planetary scientists who used the information to track space rocks, especially those that burn up over the oceans or in other remote locations. Since 1970, 23 infrared satellites in the series have gone into geosynchronous orbit to monitor the globe for missile launches or nuclear blasts. The same infrared sensors were perfect for spotting fireballs streaking across the atmosphere.

New computer simulations show a slight chance that a disruption of planetary orbits could lead to a colli-

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sion of Earth with Mercury, Mars or Venus in the next few billion years. Despite its small size, Mercury poses the greatest risk. There's a 1% chance that elongation of Mercury's orbit will increase to where its path around the Sun crosses Venus'. While most simulations don't involve crashes, about 25 led to large disruption of Mercury's orbit. If the increase in elongation of Mercury's orbit results in its collision with the Sun or Venus, simulations showed the rest of the solar system wouldn't be affected much. But in some less-likely scenarios, the change to Mercury's orbit leads to total destabilization of the inner solar system in about 3.3 billion years, possibly triggering collisions of Mercury, Mars or Venus with Earth. In simulations involving a close approach of Mars and Earth, five set-ups would lead to Mars being flung from the solar system. Of nearly 200 cases where two bodies will collide, 48 involve Earth.

NASA's newest spacecraft in orbit around the Moon last month sent its first snapshots of the surface. Lunar Reconnaissance Orbiter images revealed a Moon bathed in light and shadow in Mare Nubium, or Sea of Clouds. First images were taken along the Moon's terminator, the dividing line between day and night. Two images were taken from a larger strip of terrain. They're NASA's first clear, up-close look at the Moon in a decade, though the orbiter's partner probe beamed home grainy views from much farther away when both spacecraft arrived at the Moon June 23. The images show cratered regions that span an area just under a mile across. The orbiter will seek potential landing sites for future astronauts, as well as build new maps of the Moon's surface, temperature extremes and radiation. It will also hunt for water ice in the permanently shadowed craters of the Moon's south pole.

Charles F. Bolden, Jr. was confirmed by the Senate July 15 as NASA's 12th administrator. This will be his second stint with NASA. The 62-year-old Bolden's 34-year career with the Marine Corps, where he rose to major general, included 14 years as a member of NASA's Astronaut Office. After joining the office in 1980, he traveled to orbit four times aboard the space shuttle, commanding two missions. His flights included deployment of the Hubble and the first U.S.-Russian shuttle mission. After being confirmed, Bolden called for, among other efforts, building on investment in the ISS

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and procurement of next-generation launch systems to enable expansion of human exploration. ■.

safely required humans on board. Of necessity, Apollo was a manned mission

But even as Apollo yielded spectacular lunar landings, we were scouting our solar system's planets with unmanned craft. Manned flight was impossible to these locations since the spacecraft wouldn't return to Earth.

There were many problems to overcome. Early on, the technology to carry out course corrections from Earth was developed. This led to the Pioneer and Voyager missions and the first close-up views of Jupiter, Saturn, Uranus and Neptune. These craft could be aimed precisely as they passed a planet, enabling them to take advantage of its gravity to direct them to the next target.

The downside was the spacecraft shot past each planet quickly. For extended observations, the craft would have to be decelerated as it approached a planet, allowing it to be captured by the planet's gravity. This technology was developed in Mariner and Viking voyages to Mars.

Finally NASA figured out how to make soft landings on the surface of the planet, and developed sophisticated rovers. The tremendous increase in knowledge of our solar system vindicates NASA's decision.

Are we losing something by sending machines, not people? Probably. Computers can't replicate everything a human can do. But consider the expense of sending astronauts to Mars. This would be a two-year mission, not the two-week missions of Apollo. Astronauts need food and water. Supply ships would have to be sent to Mars before astronauts arrive. The trip to Mars would also need to carry supplies since it would take a few months.

Surely astronauts are the best we have to offer. But can't we also admire the scientists and engineers working in anonymity who have made space flight possible.

Manned space flight will return to prominence. Already millionaires pay to be sent to the space station. Eventually we may head to Mars to turn it into a place where humans can live. It will take time and new advances in technology to "terraform" Mars, but it can and probably will happen. ■

Events on the Horizon
August 2009

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.

Wednesdays August 5, 12, 26, and Saturdays, September 1, 8, 22, 29, 8:30-10:30 p. m.
Observing at Inwood Hill Park, Manhattan, P, T, C
Next dates: Wednesdays and Saturdays in September.

Thursdays, August 6, 13, 20 and 27, 6-11 p. m.
"Movies with a View" at Brooklyn Bridge Park, Brooklyn, P
Free music, short film, featured film. AAA will staff telescopes. Info: http://www.brooklynbridgepark.org.

Friday and Saturday, August 7 and 8
Astronomical League convention, Hofstra University, Hempstead, N. Y.
Tickets required. Info: http://www.alcom2009.org/.

Wednesday, August 12, 8 to 11 p. m.
Observing at Prospect Park, Brooklyn, P, T, C
Next date: Sept. 23.

Thursday, August 13, 6:30-8:30 p. m.
Recent Advances in Astronomy Seminar, M, HQ
NOTE SUMMER LOCATION. Dinner at 5:30 at Gee Whiz Diner, Warren and Greenwich streets. Next date: Sept. 10.

Friday, August 14, 8:30 p. m.
Free Lecture at Pupin Hall, Columbia University, P
Columbia Ph.D. candidate Andrew Brown will discuss "Teaching Old Stars New Tricks: The Cataclysmic Fate of Low-Mass Stars." Guided stargazing after the talk. Info: http://outreach.astro.columbia.edu.

Saturday, August 15, dusk
Observing at Great Kills Gateway National Park, Staten Island, P, T, C Next date: Sept. 19.

Tuesday, August 18, dusk to 10 p. m.
Observing at Cadman Plaza, Brooklyn, P, T, C
Next date: Sept. 22.

August 19, 7 p. m.
Quarterly AAA board meeting, HQ
All members are invited to attend.

Saturday, August 22, dusk
Observing at Great Kills Gateway National Park, Staten Island, P, T, C Next date: Sept. 19.

Saturday, August 22, arrive before 9 p. m.
Observing at North-South Lake in the Catskills
Info: president@aaa.org. Next date: Sept. 19.

Tuesday, August 25, 6:30-8:30 p. m.
Observers' Group, M, HQ
Dinner at 5:30 at Gee Whiz Diner, Warren and Greenwich streets. Next date: Sept. 29.

Friday, August 28, dusk to 10 p. m.
Observing at Carl Schurz Park, Manhattan, P, T, C
Next date: Sept 25.

Friday, August 28, 8:30 p. m.
Free Lecture at Pupin Hall, Columbia University, P
Columbia Ph.D. candidate Jessica Werk will discuss "Tales from the Universe: Infinite Alter Egos, Parallel Universes and Other Disconcerting Astrophysical Predictions." Guided stargazing after the talk. Info: http://outreach.astro.columbia.edu.

Saturday, August 29, 10 a. m. to noon
Solar Observing, Central Park, P, T, C
At the Conservatory Waters. Next date: Sept. 26.

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who came to the campus. The most striking thing about the event is how interested people were in extrasolar planets. Earths around other stars grab the imagination like nothing else. With so many questions, and judging by how on topic they were, people were truly fascinated. Afterwards, the Columbia crew opened up their scopes on the roof and invited the public to take in the stars. Attended by about 200 people, the event was a great success.

But that wasn't the whole evening. I announced that I'd take anyone interested up to Inwood to look at Jupiter and Neptune, which were in conjunction that evening. That turned out to be an excellent adventure. Taking two trains and a long walk through CUNY, we followed Bruce, who helped lead us on a long trek to Inwood. When we finally arrived, and I grabbed my scope, it was 1:30 a. m. and clouds were rolling in.

In the park, our band of 12 people who made that long trek were joined by 12 area kids. Having never looked through a telescope, many of the kids were entranced by the Moon and Jupiter. Too tired to stay past 2, I packed it up, and left four intrepid observers in the park who decided they'd turn the evening into an overnight event. They told me the next day they stayed up until dawn with star charts and a pair of binoculars.

It was a great evening which inspired many people to dive into the stars. With visions of planets around other stars and local celestial wonders in their heads, they joined Kepler in a waking "Somnium," again proving the

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The relationship of climate to sunspot activity is rather complex. This is especially true because climate is affected by a variety of other phenomena, such as volcanic activity and cyclic swings of ocean currents. In any case, it will be interesting to see if global warming may have peaked at the turn of the millennium and if perhaps we're in for a reversal of the trend—in other words, global cooling. ■

Contacting the AAA

If you want to join, volunteer, participate in events, have a question or change your address, e-mail members @aaa.org, or leave a message at AAA hq: (212) 535-2922. Also, visit us on the web at www.aaa.org. If you want to write an article for *Eyepiece*, contact editor Dan Harrison at editor@aaa.org or (914) 762-0358. ■

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