

The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Volume 30 Number 12 DECEMBER 2004

Calendar of Events

FRIDAY DEC. 10
 1001 Malott—7:30 PM
ORIGINS—The PBS Series & End-of-Year Holiday Meeting

No Open House at Memorial Stadium in December

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From the Officers



Report From the Officers on the November Meeting:


The November Star Party planned at the Adams Campus was cancelled due to poor weather conditions. The skies were 75% covered at 6PM; by midnight there was some clearing, but not enough to justify spending 4 hours out in the cold waiting for an opening. Note that the weather call isn't based simply on the way the skies look, but also on the satellite imagery for the previous few hours. This can be seen by looking at the web site <http://www.rap.ucar.edu/weather/satellite/> clicking on *loop-small*, then *ICT* on the map. Hopefully we will have better luck in the new year.

The presentation by Dr. Anthony-Twarog was well received by those in attendance and clarified a number of the more confusing points about why the time system works the way it does, particularly the analemma known to anyone who has seen the correction figure for using a sundial.

For the December meeting: **DECEMBER 10** (NOTE: this-
(Continued on page 2))

COMING IN DECEMBER TO NOVA:

A repeat of the hit series based upon the book:
The Elegant Universe.




The Elegant Universe: Einstein's Dream and String's the Thing—
December 21 from 8 to 10 pm

The Elegant Universe: Welcome to the 11th Dimension—December 28 at 8 pm

&

Welcome to Mars—January 4 at 8 pm
 Two rovers roaming the surface of Mars find proof that it was once awash in water.



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From the Officers, continued

coming up quickly because of the squeeze caused by the Thanksgiving & Christmas Holidays), we plan to show an episode of the 4-part series **Origins**, which aired on PBS Nova a couple of months ago. It stars the dynamic speaker, Neil DeGrasse Tyson, who is currently head of the Hayden Planetarium in New York City. More importantly, we will have some holiday refreshments and **DOOR PRIZES!!!!** So come out and spend an hour or so enjoying the company of your fellow amateur astronomers and join in the planning for next year.

As a preview (warning), the January issue will include the form to identify your membership class and an envelope for returning the annual dues. We are now collecting the dues once per year in January, so those of you who have been waiting to pay up and officially become a member, your time is coming.

From the Editor: Other items of interest: PBS is rerunning everyone's favorite NOVA series from last year, **The Elegant Universe**, in two parts over two weeks in late December. If you didn't see it on TV or as part of our showing last year, it comes highly recommended. **As an enticement, one of the door prizes at the December meeting will be a slightly used copy of the book by Brian Greene**, so you can also read the material as you follow along with the series.

Included in this issue is an extended article on the American Physical Society report on the current NASA-Bush Administration plans for a return to the moon and a future manned flight to Mars. This has been a controversial redirection for NASA and the APS report highlights many of the key issues. I know that some of you have expressed an interest in having a public forum about this, so this may provide some new insight into how, at least, one portion of the scientific community views the proposal.

If you have any suggestions for talks, speakers, or public events, please feel free to contact us, particularly Rick Heschmeyer, the events coordinator for the club. ALL for now. See you in a week. We will, as always, have refreshments so bring a friend and socialize.

About the Astronomy Associates of Lawrence

The club is open to all people interested in sharing their love for astronomy. Monthly meetings are typically on the second Friday of each month and often feature guest speakers, presentations by club members, and a chance to exchange amateur astronomy tips. Approximately the last Sunday of each month we have an open house on Memorial Stadium. Periodic star parties are scheduled as well. For more information, please contact the club officers: Hannah Swift at hkswift@ku.edu, Gary Webber at gwebber@ku.edu, our faculty advisor, Prof. Bruce Twarog at btwarog@ku.edu, or our events coordinator, Rick Heschmeyer at RCJBM@aol.com. Because of the flexibility of the schedule due to holidays and alternate events, it is always best to check the Web site for the exact Fridays and Sundays when events are scheduled. The information about AAL can be found at

<http://www.ku.edu/~aal>.

Copies of the *Celestial Mechanic* can also be found on the web at
<http://www.ku.edu/~aal/celestialmechanic>

Spitzer Sees Ice and Warm Glows in Dark and Dusty Places

Press Release: Spitzer Space Telescope—11/09/04

Two new results from NASA's Spitzer Space Telescope are helping astronomers better understand how stars form out of thick clouds of gas and dust, and how the molecules in those clouds ultimately become planets.

Two discoveries -- the detection of an oddly dim object inside what was thought to be an empty cloud, and the discovery of icy planetary building blocks in a system believed to resemble our own solar system in its infancy -- were presented today at the first Spitzer science conference in Pasadena, Calif. Since Spitzer science observations began less than one year ago, the infrared capabilities of the space observatory have unveiled hundreds of space objects too dim, cool or distant to be seen with other telescopes.



In one discovery, astronomers have detected a faint, star-like object in the least expected of places -- a "starless core." Named for their apparent lack of stars, starless cores are dense knots of gas and dust that should eventually form individual newborn stars. Using Spitzer's infrared eyes, a team of astronomers led by Dr. Neal Evans of the University of Texas at Austin probed dozens of these dusty cores to gain insight into conditions that are needed for stars to form.

Starless cores are fascinating to study because they tell us what conditions exist in the instants before a star forms. Understanding this environment is key to improving our theories of star formation, said Evans.

But when they looked into one core, called L1014, they found a surprise -- a warm glow coming from a star-like object. The object defies all models of star formation; it is fainter than would be expected for a young star. Astronomers theorize that the mystery object is one of three possibilities: the youngest "failed star," or brown dwarf ever detected; a newborn star caught in a very early stage of development; or something else entirely.

This object might represent a different way of forming stars or brown dwarfs. Objects like this are so dim that previous studies would have missed them. It might be like a stealth version of star formation, Evans said. The new object is located 600 light-years away in the constellation Cygnus.

In another discovery, Spitzer's infrared eyes have peered into the place where planets are born -- the center of a dusty disc surrounding an infant star -- and

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The Astronomy Associates of Lawrence
present

ORIGINS

*From the PBS
NOVA Series:*

**VIDEO PRESENTATION
&
END-of-the-YEAR
HOLIDAY MEETING!
Refreshments & Door Prizes!!!**

FRIDAY, December 10, 2004

7:30 PM,

1001 Malott Hall

University of Kansas

FREE & OPEN TO THE PUBLIC

NASA's Moon-Mars Initiative Harms Science: American Physical Society Report

By Leonard David
Senior Space Writer – Space.com

A new report released by an American Physical Society (APS) Special Committee on NASA Funding for Astrophysics has questioned the space agency's Moon, Mars and Beyond initiative. The APS assessment warns that the cost of overcoming technological challenges to make real the plan could far exceed budgetary projections and that numerous approved science programs could be jeopardized.

“Returning Americans to the Moon and landing on Mars would have a powerful symbolic significance,” the APS report observes, “but it would constitute only a small step in the advancement of knowledge, since much will already be known from exploration with the robotic precursor probes that are necessary to guarantee the safety of any human mission.”

The APS report was authored by a 10-person group, with the committee chaired by Joel Primack, a professor of physics and a leading astrophysicist at the University of California, Santa Cruz. According to their web site, the American Physical Society is the world's largest professional body of physicists, representing more than 45,000 physicists in academia and industry in the United States and internationally. It has offices in College Park, Maryland and Ridge, New York.

Negative ripple effect

To underscore their concerns, the APS reports that in the wake of the Moon-Mars initiative, NASA's “readjusted priorities” have already created a negative ripple effect for space science: For instance, the Laser Interferometer Space Antenna (LISA) has been delayed a year while Constellation X (Con-X) has been delayed until at least 2016. LISA will use an array of free flying satellites to carefully measure the baseline expansion or contraction due to the passage of gravitational waves while Con-X will perform X-ray spectroscopic studies of some of the most extreme objects in the Universe. Both instruments received high priority from the astronomy community for construction in the current decade.

Furthermore, other scientific missions have been delayed indefinitely, cites the APS report. Among them the Einstein Probes, which are moderate sized missions aimed at determining the nature of dark energy, observing regions near black holes, and studying the imprint of cosmic inflation on the cosmic background radiation. Also, NASA's Explorer program is another activity that is being affected by the Moon-Mars program.

Ill-defined Moon-Mars initiative

On January 14, U.S. President Bush announced a new vision for NASA that incorporated a human return to the Moon by 2020, follow-on exploration of Mars and other destinations. In the view of APS, the impact of the President's proposal on scientific programs within NASA and other agencies “could be substantial and must be assessed carefully,” the report stresses. Key findings noted in the APS report are:

- Human exploration has a role to play in NASA, but it must be within a balanced program in which allocated resources span the full spectrum of the space sciences and take advantage of emerging scientific opportunities and synergies.
- The recent spectacular successes of NASA's space telescopes and the Mars Rovers amply demonstrate that we can use robotic means to address many important scientific questions.
- Astronauts on Mars might achieve greater scientific returns than robotic missions, but they would come at such a high cost that scientific grounds, alone, would probably not provide a sufficient rationale.

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- The scope of the Moon-Mars initiative has not been well-defined, its long-term cost has not been adequately addressed, and no budgetary mechanisms have been established to avoid causing major irreparable damage to the agency's scientific program.
- To accommodate the Moon-Mars initiative, NASA has already begun to reprogram its existing budget, resulting in indefinite postponement or serious delay of science programs that were assigned high priority by the National Academy of Sciences decadal studies.
- In addition to affecting NASA's internal priorities, an ill-defined Moon-Mars initiative of very large scale could harm programs in other science agencies.

Budgetary impact

In wrapping up its findings, the APS report makes a trio of recommendations regarding the Moon-Mars initiative.

First of all, NASA should continue to be guided by the priorities recommended in the National Academy of Sciences (NAS) decadal studies in formulating its science programs. The NAS should also review the Moon-Mars proposal in regards to its science impact before the United States commits to the initiative.

Similarly, the APS report recommends that the Government Accountability Office should estimate the budgetary impact prior to the United States green-lighting the Moon-Mars proposal.

Critical reaction

The APS report has met with some disapproval. One critic is former Congressman Robert Walker, a member of the Presidential Commission on the Implementation of the United States Space Exploration Policy in 2004 – also known as the Aldridge Commission given its chairman, Pete Aldridge.

“The APS report ignores the contention of the Aldridge Commission that the Moon to Mars and Beyond Vision is enabled by science and enables science,” Walker told *SPACE.com*. “It is the present mission at NASA that lacks direction and focus. The Moon to Mars and Beyond program is an attempt to re-focus NASA in a positive way,” Walker said.

“The APS report is a defense of the NASA that “has been” rather than an effort to create the NASA that “can be,”” Walker concluded.

Robot versus human explorers

The strong pro-robot message of the APS stirred up a response from Robert Zubrin, President of the Mars Society.

“The APS report is false on its face,” Zubrin told *SPACE.com*. “In fact, NASA's most cost-effective science program to date has been the Hubble Space Telescope, a human spaceflight activity. Hubble may have cost twice the Galileo mission to Jupiter, but it has returned more than 100 times the science. This is proof that when human spaceflight activities are properly targeted, they can achieve far more science return than is possible with robotic means,”

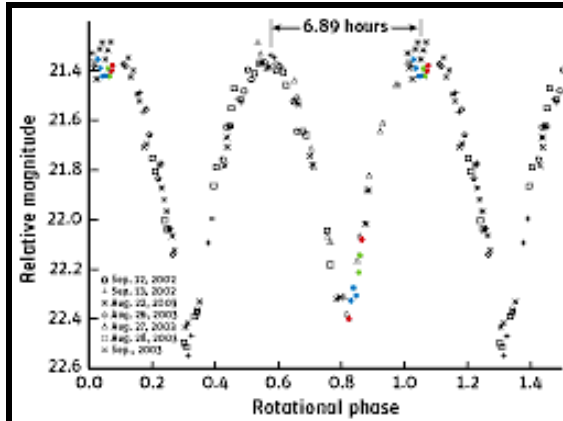
One of the central questions confronting science today is the origin of life, and the uniqueness or generality of the processes that allow it, Zubrin said. “The answers in this matter can best be found by sending human explorers to Mars, who can search the environment for fossils and set up drilling rigs to reach liquid ground water where extant life may yet exist. By sampling such life and examining its biochemistry we can find out fundamental truths about the nature of life in the universe. This can only be done by human explorers,” Zubrin explained.

Kissing in the Kuiper Belt

By Robert Naeye, skypub.com

Among the strangest denizens of the solar system are contact binaries. In these systems, two minor planets orbit each other so closely that they literally or nearly touch end-to-end — resulting in a peanut-like overall shape. Until now, astronomers had found only two possible contact binaries of relatively large size: the main-belt asteroid 216 Kleopatra and the Trojan asteroid 624 Hektor. Now Scott S. Sheppard (Carnegie Institution of Washington) and David C. Jewitt (University of Hawaii) may have found a third example: a Kuiper-Belt object orbiting beyond Pluto.

The object, 2001 QG298, orbits so far from the Sun that even the Hubble Space Telescope has no chance of resolving a peanut shape. But after measuring the object's changing brightness in 2002 and 2003 with the University of Hawaii's 2.2-meter telescope and the 10-meter Keck I telescope, Sheppard and Jewitt noticed something unusual. Its brightness varies by a whopping 1.14 magnitude every 6.89 hours. Yet the object's colors do not change, which suggests that dark spots rotating in and out of view are not causing the brightness changes.



When phased to a 6.89-hour period, the light curve of 2001 QG298 displays a pronounced range in variation of 1.14 magnitudes. This is a likely signature of a contact binary whose two members eclipse each other. *Courtesy Scott S. Sheppard.*

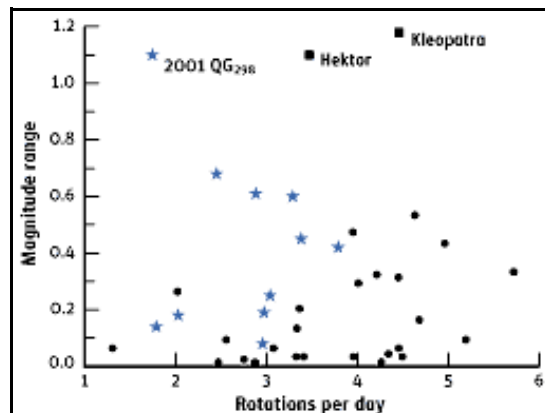
With an average diameter of about 180 kilometers, 2001 QG298 is large enough that it should be nearly spherical. But the object is not spinning fast enough for rotation to whirl it into an elongated shape. The simplest explanation for the brightness variations is that two roughly spherical and equal-sized bodies eclipse each other periodically every 6.89 hours, which means they must be very close together. We view them along their equators, which maximizes the eclipsing effect.

"We believe 2001 QG298 is a contact binary," said Sheppard, as he reported the team's findings at the November meeting of the American Astronomical Society's Division of Planetary Sciences in Louisville, Kentucky.

Sheppard and Jewitt have found other possible contact-binary Kuiper Belt objects (KBOs). Given the number of KBOs they have observed, and the fact that other KBO contact binaries might be viewed pole-on (which makes them harder to categorize), Sheppard and Jewitt estimate that at least 10 to 20 percent of all large KBOs might be contact binaries with similarly-sized components. "The number of contact binaries with

Only three other solar-system objects larger than 50 kilometers across range in brightness by more than 1 magnitude. Two of them are Kleopatra and Hektor; the third is Saturn's peculiar moon Iapetus, which displays a very dark leading hemisphere and a very bright trailing hemisphere. But Iapetus represents an unusual case because it is locked in synchronous rotation with Saturn, so its leading edge may be sweeping up dark material kicked off from Saturn's outer satellites.

With



The brightness and rotation rates of relatively large asteroids (black circles) and Kuiper Belt Objects (blue stars) are plotted in this diagram. The three objects that exhibit anomalously large brightness variations are possible contact binaries. *Courtesy Scott S. Sheppard*

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Huge Black Holes Formed Quickly After Big Bang

Press Release from CHANDRA X-Ray Observatory



Incredibly massive black holes had fully matured just a billion years after the birth of the universe, according to two separate studies.

Scientists already had strong evidence that black holes grew to gargantuan heft early in the universe. Several have been found to pack the mass of hundreds of millions of Suns or more. But now scientists are pushing the limit of how far back in time they spot such objects and improving the firmness of their measurements.

In a study announced today, a black hole catalogued as SDSSp J1306 appears to be about one billion times as massive as the Sun. It is 12.7 billion light-years away, meaning the light just recorded - by NASA's Chandra X-ray Observatory -- took 12.7 billion years to reach the vicinity of Earth. The universe is thought to be 13.7 billion years old.

A similarly massive and distant black hole was studied recently with the European Space Agency's XMM-Newton X-ray satellite. The object, SDSSp J1030, is 12.8 billion light-years away.

"These two results seem to indicate that the way supermassive black holes produce X-rays has remained essentially the same from a very early date in the universe," said Daniel Schwartz of the Harvard-Smithsonian Center for Astrophysics. Schwartz was involved in the Chandra study. "This implies that the central black hole engine in a massive galaxy was formed very soon after the Big Bang."

The Big Bang is the leading theory for the origination of the universe as we know it.

Black holes can't be seen, because light and everything else that gets too close to them falls in and becomes trapped. But as gas approaches a black hole, it is superheated, making it glow in X-rays.

To find and measure black holes, astronomers examine these X-rays, along with the gravitational influence of a presumed black hole on the galaxy in which it resides. The results of both studies were reported in recent issues of the *Astrophysical Journal*.

The black hole in the Chandra study is producing energy at the rate of twenty trillion Suns.

How such massive and energetic structures formed so quickly remains a major puzzle for scientists. Mergers of smaller galaxies and their black holes may have played a role. Researchers suspect that black hole formation and galaxy development go largely hand-in-hand, but they cannot say which comes first.

QUOTE for the MONTH:

We are at the very beginning of time for the human race. It is not unreasonable that we grapple with problems. But there are tens of thousands of years in the future. Our responsibility is to do what we can, learn what we can, improve the solutions, and pass them on.

Richard Feynman

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spied the icy ingredients of planets and comets. This is the first definitive detection of ices in planet-forming discs.

This disc resembles closely how we imagine our own solar system looked when it was only a few hundred thousand years old. It has the right size, and the central star is small and probably stable enough to support a water-rich planetary system for billions of years into the future, said Dr. Klaus Pontoppidan of Leiden Observatory in the Netherlands, who led the team that made this discovery.

Previously, astronomers had seen ices, or ice-coated dust particles, in the large cocoons of gas and dust that envelop young stars. But they were not able to distinguish these ices from those in the inner planet-forming portion of a star's disc. Using Spitzer's ultra-sensitive infrared vision and a clever trick, Pontoppidan and his colleagues were able to overcome this challenge.

Their trick was to view a young star and its dusty disc at "dawn." Discs can be viewed from a variety of angles, ranging from the side or edge-on, where the discs appear as dark bars, to face-on, where the discs become washed out by the light of the central star. They found that if they observed a disc at a 20-degree angle, at a position where the star peeks out like our Sun at dawn, they could see the ices.

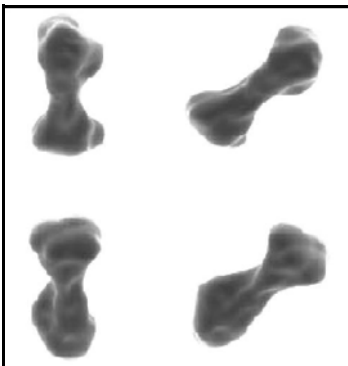
"We hit the sweet spot," said Pontoppidan. "Our models predicted that the search for ices in discs is a problem of finding an object with just the right viewing angle, and Spitzer confirmed that model."

In this system, astronomers found ammonium ions as well as components of water and carbon dioxide ice.

The Spitzer science conference, "The Spitzer Space Telescope: New Views of the Cosmos," is being held at the Sheraton Pasadena hotel.

JPL manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington, D.C. Science operations are conducted at the Spitzer Science Center, Pasadena, Calif. JPL is a division of Caltech. For more information about Spitzer visit www.spitzer.caltech.edu.

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one component much larger than the other is probably much higher," says Sheppard, "but these don't make as large brightness variations and thus are not as easy to distinguish."

These close pairs probably formed early in the solar system's history when two bodies approached each other and went into mutual orbit after exchanging orbital energy with other bodies nearby.

Arecibo Observatory radar reflections from 216 Kleopatra enabled astronomers to assemble this computer model, which shows the asteroid's rotation. The model suggests that the New-Jersey-sized body might actually be one object that is so elongated that it resembles a dog bone. But it could also be a contact binary. *Courtesy Arecibo Observatory / JPL / NASA.*

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