FRIDAY Jan. 21
1001 Malott—7:30 PM
ORIGINS—The PBS Series: Part II

No Open House at Memorial Stadium in JANUARY

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Report From the Officers on the December Meeting:
The December meeting was a holiday from our usual set of talks with a video presentation from the PBS series, ORIGINS. Neil Tyson did a nice job laying out the basics of Big Bang Cosmology and giving a sense of the amazing breakthroughs in the field over the last decade. As a followup, the January meeting will have a second segment from the 4-part series, this one on the ORIGINS/possibility of life in the Universe. This should be an excellent complement to the presentation in the Fall by Dr. Steve Shawl. Note that the date of the meeting is a little later than usual due to the holiday break and the desire to begin the year after classes at KU have restarted. Once again, we lucked out—there is no basketball game scheduled for Jan. 21!

More important, we had just enough Door Prizes (~12) that everyone in attendance in Dec. went home with something other than fond memories.

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Speaking of prizes, you will note that this month’s newsletter includes a return envelope for you annual dues. For those of you who may have joined recently, we now collect the dues once a year, in January, to minimize the bookkeeping and confusion. Simply go to the last sheet in the newsletter, fill out the bottom half of page 9 (it includes your address label on the bottom half of page 10) if any changes are required in your info as given on pg. 10 or if you haven’t provided it yet, e.g., your email address. Tear off the bottom half of the page and return it, along with a check made out to KUEA (NOT AAL) for the appropriate amount. (If you haven’t received email from me in the last 6 months, it probably means I don’t have your address!)

If you have any questions about your dues, the club, any part of the info or suggestions or comments, don’t hesitate to contact us by phone or email. The addresses are given on pg. 1. **As an incentive to return your dues quickly, the first five members to send back their completed forms will receive a poster highlighting the GALEX Space Mission for NASA.**

Our bad luck at observing continues. There will be no open houses at the Stadium in January. Apparently the Athletic Dept. decided, correctly, that the semester break was an ideal time to repair the windows of the skyboxes. To do so requires suspended platforms that hang over the front of the skyboxes. As you can guess, these platforms are held by ropes that cross over the observing platform and are bolted on the west side of the roof. In short, the roof of Memorial Stadium is off limits until this job is completed. Weather permitting, it should be done in January, though the likelihood of clear, dry weather from mid-December to mid-January is small to nil. We will keep you posted.

**Coming next month**, some exciting updates on the progress of astronomical observing by two groups in the eastern half of the state.

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 couple of weeks. 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](http://www.ku.edu/~aal).

Copies of the *Celestial Mechanic* can also be found on the web at [http://www.ku.edu/~aal/celestialmechanic](http://www.ku.edu/~aal/celestialmechanic)
The rings of Saturn are part of a young and evolving system, according to the latest observations that suggest a snowball fight is going on around the giant planet. Portions of the rings, which are predominantly made of ice, may be only 10 to 100 million years old, which is a brief period of time compared to the four and a half billion-year-old solar system.

Data from the Ultraviolet Imaging Spectrometer (UVIS) on the Cassini space probe show fluctuations in the amount of neutral gas surrounding the planet. In one instance, oxygen levels increased by about 50 percent in a region around the outermost E-ring. Scientists aren't sure what's going on.

"A possible explanation for the fluctuation in oxygen is that small, unseen icy moons have been colliding with Saturn's E ring," said Larry Esposito from the University of Colorado, Boulder.

These smaller satellites can't be seen with current technology, but astronomers assume they are there from the distribution of larger moons and other recent Cassini data that have suggested the presence of unseen moons influencing the shape of the rings. Astronomers have long assumed Saturn's rings are composed of various-sized objects, from tiny frozen grains to mountain-sized chunks of ice and rock.

The smashing of giant snowballs produces small grains of ice, the thinking goes. The increased surface area speeds up a process by which plasma particles -- essentially superheated gas -- zip along Saturn's magnetic field strip oxygen atoms from the ice. Besides helping release oxygen, though, the break up of these icy moons may also explain how the rings maintain their youthful appearance.

**Ring Eating**

On Cassini's approach to Saturn, the UVIS detector imaged a large cloud of neutral oxygen in the shape of a doughnut, or torus, ringing the planet. Extending from three to eight times the radius of Saturn, the cloud approximately overlaps the E ring, but it is much wider – puffing out of the plane by a distance of two Saturn radii. The radius of Saturn is about 36,000 miles (58,000 kilometers).

The oxygen atoms in the torus absorb solar radiation and re-emit light in the ultraviolet part of the spectrum. Fluctuations in reemitted light are due to changes in the number of oxygen atoms. A large peak in the number of oxygen atoms was observed around February 2003. The implication is that the plasma stripped away about a billion pounds (500 million kilograms) of oxygen from the outermost E ring over a two-month period.

"Presumably, what is happening is the plasma system is eating the rings," said Donald Shemansky from the University of Southern California. "It does this by eroding water from the grains."

Shemansky explained – in a telephone interview with Space.com – that the plasma particles can only penetrate a short distance into the ice, so the erosion rate increases with surface area. A chunk of material has more surface area when it is broken into smaller fragments.

The large fluctuation seen in the oxygen data presumably followed the breakup of a big chunk of ice – either from a collision with another icy moon or an impact from a meteorite. Shemansky and his colleagues have estimated from the loss rate of oxygen that the entire mass in the outermost E ring would disappear in a matter of 100 million years – if there were nothing to replenish it.

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The Astronomy Associates of Lawrence present

origins

II

From the PBS NOVA Series:
VIDEO PRESENTATION
A 2nd serving of the 4-part series
Origins: Life In the Universe

FRIDAY, JANUARY 21, 2005
7:30 PM,
1001 Malott Hall
University of Kansas
FREE & OPEN TO THE PUBLIC
Yerkes Observatory On the Block

By Joshua Roth—skypub.com

Yerkes Observatory may soon have a new owner. The University of Chicago has considered selling the observatory's telescopes, buildings, and about 80 acres of lakefront property in southeastern Wisconsin “for decades,” says director Kyle M. Cudworth, the only astronomer still working full time at the former research powerhouse. Now a sale seems imminent, and it remains unclear what the future holds for the observatory's century-old refractor (the world's largest), its Romanesque main building, and its two dozen employees.

Cudworth first learned in July that the university had received — and was close to accepting — an unsolicited offer for Yerkes from a developer hoping to build houses on the observatory's landscaped grounds. (Two sources peg the sale price at about $10 million.) Shortly thereafter, rumors of a likely sale prompted area resident Larry Larkin and a handful of neighbors to make a counteroffer. Larkin and his colleagues hope to acquire the property for Aurora University, whose George Williams campus abuts Yerkes on three sides. Both offers remain in effect, and several sources say that the University of Chicago may choose between them by late January.

If the University of Chicago accepts the overtures being made by Larkin and his fellow would-be buyers, says Cudworth, a consortium of institutions would probably operate the observatory as a center for astronomy education and outreach. Downtown Chicago's Adler Planetarium and Astronomy Museum, a likely participant, wants to expand its highly ranked collection of astronomical artifacts while conducting more research on science and education, says Adler's vice president for research, Lucy Fortson, and "Yerkes fits smack dab in the middle of all that." However, "we have to come up with a business [plan] before we accept any role in operating" the facility, she cautions. "We can't afford to do something that's going to be a resource drain."

A consortium or perhaps a single institution like Adler also could operate Yerkes as a learning center if the unidentified developer acquires the property. But this presumes that the University of Chicago will protect Yerkes Observatory from demolition even if offered a premium to sell the entire property with no strings attached. After all, "to a developer, the best thing would be to tear down the building and the telescopes," says one interested party.

University of Chicago spokesperson Larry Arbeiter concedes that he "can't make ironclad guarantees" that the university will preserve the observatory as a publicly accessible astronomy museum. But, he adds, "we consider it highly desirable that the facility be made use of

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The basic sketch you'll find there of galaxy formation is fairly simple: a vast cloud of diffuse hydrogen and helium gas condenses under gravity, and dense spots in the cloud collapse to form stars. Voila! A galaxy.

But real galaxies are much more complex than that. A galaxy is a swirling "soup" of billions of stars and roaming black holes, scattered clouds of gas and dust, random flashes of star birth and exploding supernovas, and an unseen and mysterious substance called "dark matter." Over time, all these ingredients mix and interact-pulling and compressing and colliding-and somehow that interplay leads to the galaxies we see today. No wonder it's such a hard problem to solve!

Just over one year into its three-year mission, GALEX is already shedding some new light on the problem.

"Some of the discoveries GALEX has made will change our understanding of how galaxies develop and when, where, and why stars form in galaxies," says Peter Friedman, a researcher at Caltech and Project Scientist for GALEX.

This small space telescope, called the Galaxy Evolution Explorer (GALEX for short), makes its discoveries by taking pictures of millions of galaxies scattered over the whole sky. Some of these galaxies are close by (at least by astronomical standards of "close"), while others are as much as 10 billion light-years away. Because light takes time to travel through space, we see these distant galaxies as they appeared billions of years ago. Comparing young galaxies from the distant past with older, modern galaxies will teach scientists about how galaxies change over time.

Looking at these pictures, scientists were surprised to find many newborn stars in the outer parts of old, mature galaxies. Scientists had assumed that as a galaxy ages, the clouds of gas needed to form new stars in these outer reaches either got used up or blown away. Finding so many new stars in these regions of old galaxies (such as Centaurus A, Messier 101, and Messier 81) shows that, apparently, they were wrong.

Friedman says that astronomers don't know yet how to explain these new findings. Rethinking and improving theories to explain unexpected discoveries has always been the way science makes progress-and GALEX is certainly making progress.

One thing is certain: It's time to re-write some old textbooks.

For more information, see http://www.galex.caltech.edu/ . Kids can do a galaxy art project and learn more about galaxies and GALEX at http://spaceplace.nasa.gov/en/kids/galex/art.shtml .
A Review of the book
How to Build a Time Machine
by Paul Davies

Australian physicist Paul Davies has written a short, pleasant book that surveys the thinking of the few scientists who have seriously considered the possibilities of human travel into the past and future. In 132 pages, with 35 clever, mostly line drawings, the author uses the results of a century of research in relativity and quantum mechanics to outline possible approaches. All current ideas face formidable gaps in theory and engineering capability. Davis does not go into great detail with the physics, noting the availability of many books on relativity and quantum mechanics at various levels.

Time travel is conceptually based on very strong gravity fields, which slow local time allowing travel into the future, or on the geometry of spacetime near an extremely dense object, which can result in an X-shaped tube separating two surfaces. This is an Einstein-Rosen bridge, or “wormhole.” Light travels faster to a point by going through the quantum vacuum of the wormhole than it does in bypassing the hole. Conditions are thus set up for potential one- or two-way time travel through the hole.

Davies uses his book's first 30 pages to correct our common-sense errors about time and space. He then discusses what is known of black holes, and how wormholes might originate. After outlining qualitatively how the properties of very strong gravity fields and/or the likely properties of wormholes and their connection to other “universes” could mathematically permit time travel, he uses the rest of the book to speculate on engineering solutions to the obvious problems. The problems center about holding on to the needed quantum-scale properties as the worm hole is enlarged to say, 10-meter diameter, the kind and origins of the exotic matter likely needed, and overcoming damaging gravity and quantum vacuum effects on a fragile human traveler.

Even a hand-waving book must introduce hard-to-grasp ideas to discuss machines for time travel. Davies cannot bring the reader depth of understanding. These include anti-gravity, negative mass, negative energy, the quantum vacuum, and parallel universes. A look at possible contributions from string theory is included. He does offer attractive explanations of why, if future civilizations did develop travel into the past, we see no time tourists. His classification of most time machine compositions in terms of successively a collider, an imploder, an inflator, and a differentiator adds clarity.

In his conclusion, the author gives reasons for serious study of this arcane subject and admits that science may eventually conclude that time travel fits in a class of taboos that includes perpetual motion machines and naked singularities. I enjoyed this book and think you will too.

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Solar Ultrasound: Bass Note In Music Of The Spheres
By Bill Christensen

Ancient cosmology held that each of the planetary spheres corresponded to a different note in a universal musical scale. The tones emitted by the planets depended on the ratios of their different orbits in the same way that the length of a lyre-string determines its tone. The music of the spheres was contemplated by many respected philosophers, like Pythagoras, Plato, Pliny and Ptolemy. The English hermetic philospher Robert Fludd devised celestial scales that spanned three octaves, linking sub-planetary elemental worlds to angelic choruses beyond the stars.

Now, in a letter published on December 10th in Astrophysical Journal Letters, researchers report that the Sun's atmosphere is filled with ultrasound-like waves at a frequency of about 100 millihertz - every ten seconds. "At 10-second period, these waves qualify as ultrasound because individual atoms on the Sun experience only a few collisions during the brief passage of each wave, just as with
"There has to be regeneration," said Shemansky. "Otherwise, [the rings] would drop dead on us."

**Regeneration**

The same process that may be exposing the ice to the plasma may also be rejuvenating the rings. Evidence for this comes from the beautiful bands of colors in the rings. The colors are thought to be due to "pollution." When a meteor crashes into Saturn, it can deposit some of its material in the rings. Lower density bands in the rings would get dirtier faster, and the more gunk on the ice, the darker the band will be.

But because the meteor dirt would spread out over time, this mechanism cannot explain how thin the color bands are — unless clean ice is added to the rings from time to time.

"The evidence indicates that in the last 10 million to 100 million years, fresh material probably was added to the ring system," said Esposito, the lead author of an article Dec. 16 in the online version of the journal *Science*.

The interiors of moonlets would be uncontaminated by the incessant meteor bombardment. The researchers, therefore, explain the brightness of the A-ring by postulating the relatively recent demise of a moon with a radius of about 12 miles (20 kilometers).

"Both the oxygen fluctuation and the spectral variation in Saturn's rings support a model of ring history in which small moons are continually destroyed to produce new rings," Esposito said.

According to Shemansky, the moon-smashing idea is still speculative. There are other processes that might be involved, like volcanoes on Saturn's larger moons spewing out slushy material. His team is continuing to monitor the oxygen around Saturn, but now from much closer — since Cassini is now in orbit around the planet.

"We are in the midst of it," he said, referring to the oxygen torus.

From this vantage point, they hope to be able to map out the three dimensional structure of the neutral gas. They also want to determine how often the oxygen level fluctuates.

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ultrasound here on Earth," says Dr. Craig DeForest, a senior research scientist in the SwRI Space Science and Engineering Division. DeForest found the signature in data collected in January 2003 in the TRACE program.

"These ripples seem to be carrying about 1 kilowatt of power per square meter on the surface of the Sun," says DeForest. "That is similar to the sonic energy you might find coming out of the speakers at a rock concert. Very loud."

Of course, sound cannot travel through the vacuum of interplanetary space. The TRACE spacecraft, in orbit around the Earth, is an ultraviolet telescope trained on the sun. TRACE data shows small fluctuations in the brightness of solar ultraviolet emissions. Solar ultrasound waves are too faint to be seen directly by TRACE. So, DeForest looked for patterns in the background noise of the telescope.

TRACE is the Transition Region and Coronal Explorer mission; it has an open data policy. TRACE data is available to anyone on the web. The intent of the program is to explore the magnetic field in the solar atmosphere; TRACE was launched in 1998 and uses a 30 centimeter aperture telescope with a 1024x1024 CCD collecting images over an 8.5 arc minute square field of view.

The waves or "ripples" are most likely created by the sudden collapse of magnetically induced electric currents (magnetic reconnection) or by lower frequency sound waves that crash like ocean waves as they make their way up from the surface of the Sun. Both of the sources are likely candidates for the source of the solar atmosphere's mysterious extra heat, making the new waves a valuable tool for exploring a decades-old mystery. "By examining these waves more closely, we should be able to discern the source of energy release in the solar atmosphere, just like you can tell by listening whether the car is running in a dark garage," says DeForest. "In both cases, something is releasing energy into the environment, and that release has a recognizable sonic signature."

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Astronomy Associates of Lawrence

ANNUAL DUES FORM: Please return by Jan. 31, 2005

Dues for 1 Year: Regular Members/Families = $12.00, Students = $6.00.

Checks should be made out to KUEA.

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