

Future Astronomers Strut Their Stuff

With Jeff Adkins

June 26, 2007

Doors open at 6:45 p.m.

Concord Police Association Facility 5060 Avila Road, Concord

"The mind is not a vessel to be filled, but a fire to be kindled." — Plutarch

What's the best way for students to understand science and astronomy? By DOING it!

On June 26th, Jeff Adkins, our own MDAS member and 2007 Amgen Award for Science Teaching Excellence recipient, will accompany a few of his students from Deer Valley High School's Earth, Space and Astronomy Center for Education (ESPACE) to report on their astronomy research projects from this school year.

Jeff is a physics and astronomy teacher at Deer Valley High School. ESPACE was originally funded by the California Department of Education. Using grant funds, Jeff and his stu-



dents have constructed a school planetarium, set up a mini-exhibit hall of all the past students' science fair projects, competed in local, state, and national science fairs, and won several awards.

Jeff doesn't teach science. His students learn what science is about by experiencing the process under Jeff's guidance. As

he said in a recent interview, "The students actually do the work, not just remember the information." His students have used remote control telescopes, telescopes at major observatories, and space probes to complete projects on everything from active galactic nuclei to the growth of moss on the north side of trees.

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Upcoming Programs:

July 24: Dr. Jeffrey Moore, NASA Ames Research Center: New Horizons Mission to Pluto and Beyond

August 28: R. Jay GaBany: "Remotely Possible" Adventures with Remote Telescopes.

MDAS Outreach Update

By Jim Head

this a successful year.

Try out the warming Room! While at public starparties on Mt. Diablo, we have enjoyed using the warming room (with temporary portable lighting). It is a great addition to our programs - it allows many to warm up, while learning about astronomy!

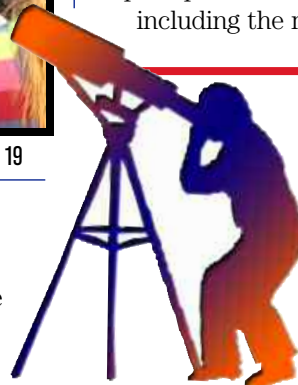
We've been testing a new NightSky kit that helps explain our solar system structure, including the motion of the

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Jim Head explaining the firmament to over 100 girl scouts May 19

Now that the school year has ended, our scheduled events are public starparties, Yosemite July 20-21, and the summer Lagoon Valley starparty for the City of Vacaville (date tbd). We have a couple signups for schools in September. Thank you everyone for making



What's Up

by Lance Schlecter

Adventures in Launching Missles at Vandenberg Air Force Base

President's Corner

My First Six Months

By Nick Tsakoyias

After getting my feet wet and adjusting to my new role as your President, my first six months have been quite busy. I wanted to share with you some of the challenges and items that the Board and I are working on for this year, some you may know of, some you may not.

First off I would like to say what an honour and pleasure it has been in serving the membership of this club, and in having such a wonderful board to work with.

As all of you know this is the 50th anniversary of MDAS, and with that the Board and I have been working very hard in making it a memorable year by having two special events for this special occasion. The first one is on June 9th at our Public astronomy event on Mount Diablo which will be starting at 7:00 p.m., with a commemoration ceremony, followed by cake cutting, refreshments, and a free raffle with plenty of great prizes, our regular program will then follow.

The second event will be at our general meeting in October. The Board has decided to start the meeting earlier, because we plan on having a catered event, which will be a sit down dinner, consisting of steak, chicken, vegetables, potato, salad, and desert, and it will be followed by our regular meeting. Right now it looks like the dinner will cost about \$10.00 per person; more details will be available as we draw closer to the October meeting.

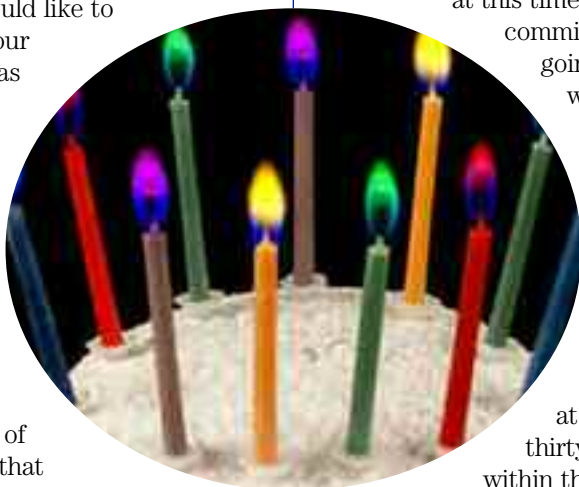
Another event that the Board and I are working on is on the November general meeting we are planning on

having our auction/swap meet, so bring whatever astronomically related things you have that you are not using and sell it for some money. This event helps the club raise some money, for a very small portion of the money you receive from your sale will go to the club.

This year the Board has set up a special committee to revamp and update our club Bylaws, which after thirty years sorely needed to be done. The Bylaws are very important to any organisation for without them the club cannot function. Special thanks, goes out to Richard Ozer and Jim Scala for putting together a new set of Bylaws, which at this time the special committee and I are going through and working out the details. This is a long and laborious task we are undertaking, we are trying to do the best job we can so it can be good for at least another thirty years. Hopefully within the next few months we can present it to the membership for approval, and starting fresh in 2008 with a new set of Bylaws.

One of the challenges I've had this year is when Rich Girard unexpectedly had to step down as secretary. Rich had been secretary for a couple of years and had done a wonderful job. He will be truly missed by the Board. I was very fortunate to have found a very capable replacement for him in Dave Williams. Dave has been a member of MDAS for about six years and is a docent for the Mount Diablo state parks system, and at this time on behave of the Board, I want to give a very warm welcome and a big "Thank You" to Dave, for volunteering to do the job as secretary.

As you can see I've had a very busy first six months as President. I have quite a bit on my plate for this year, that being said knowing that I have the full support from our Board will make my job that much easier. I look forward in serving you for the next six months and having these and other things I



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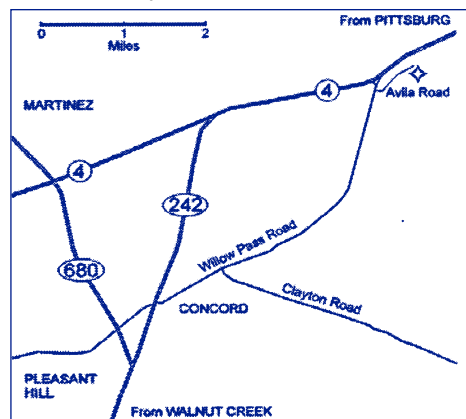
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MDAS meetings are held on the fourth Tuesday every month, except on the third Tuesday in November and December. Refreshments and conversation are at 6:45 p.m. What's Up? at 7:15 p.m. Speaker at 8:00 p.m. The Concord Police Association Facility at 5060 Avila Road is at the top of the hill east of Willow Pass Road, just south of Highway 4. Everyone is invited.

Please consider receiving the *Diablo Moonwatch* by email instead of the Postal Service. Saving in printing and postage is more than \$5.00 per member. You will receive your issue sooner, view it in color, and if you wish can be printed as well on your own printer. Please send a request by email to inquiries@mdas.net.

mentioned come to fruition, as always let me know if there is something that I or the Board can do for you to make your membership experience that much better.

A Brown Dwarf Joins the Jet-Set

From ESO News

VLT Finds Smallest Galactic Object with Jets

Jets of matter have been discovered around a very low mass “failed star,” mimicking a process seen in young stars. This suggests that these “brown dwarfs” form in a similar manner to normal stars but also that outflows are driven out by objects as massive as hundreds of millions of solar masses down to Jupiter-sized objects.

The brown dwarf with the name 2MASS1207-3932 is full of surprises [1]. Its companion, a 5 Jupiter-mass giant, was the first confirmed exoplanet for which astronomers could obtain an image (see ESO 23/04 and 12/05), thereby opening a new field of research—the direct detection of alien worlds. It was then later found (see ESO 19/06) that the brown dwarf has a disc surrounding it, not unlike very young stars.

Now, astronomers using ESO’s Very Large Telescope (VLT) have found that the young brown dwarf is also spewing jets, a behaviour again quite similar to young stars.

The mass of the brown dwarf is only 24 Jupiter-masses. Hence, it is by far the smallest object known to drive an outflow. “This leads us to the tantalising prospect that young giant planets could also be associated with outflows,” says Emma Whelan, the lead-author of the paper reporting the results.

The outflows were discovered using an amazing technique known as spectro-astrometry, based on high resolution spectra taken with UVES on the VLT.

Such a technique was required due to the difficulty of the task. While in normal young stars - known as T-Tauri stars for the prototype of their class - the jets are large and bright enough to be seen directly, this is not the case around brown dwarfs: the length scale of the jets, recovered with spectro-astrometry is only about 0.1 arcsecond long, that is, the size of a two Euro coin seen from 40 km away.

The jets stretch about 1 billion kilometres and the material is rushing away from the brown dwarf with a speed of a few kilometres per second.

The astronomers had to rely on the power of the VLT because the observed emission is extremely faint and only UVES on the VLT could provide both

reliant on excellent telescopes and instruments, such as the VLT,” says Whelan. “Our result also highlights the incredible level of quality which is available today to astronomers: the first telescopes built by Galileo were used to observe the moons of Jupiter. Today, the largest ground-based telescopes can be used to observe a Jupiter size object at a distance of 200 light-years and find it has outflows!”

Using the same technique and the same telescope, the team had previously discovered outflows in another young brown dwarf. The new discovery sets a record for the lowest mass object in which jets are seen [2].

Outflows are ubiquitous in the Universe, as they are observed rushing away from the active nuclei of galaxies - AGNs - but also emerging from young

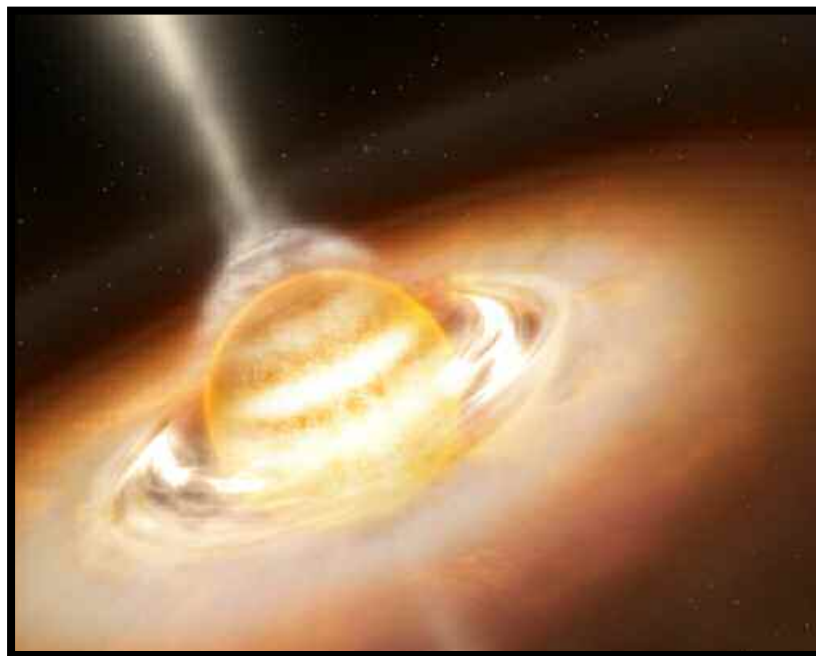
stars. The present observations show they even arise in still lower mass objects. The outflow mechanism is thus very robust over an enormous range of masses, from several tens of millions of solar mass (for AGNs) down to a few tens of Jupiter masses (for brown dwarfs).

More Information

These results were reported in a Letter to the Editor in the *Astrophysical Journal* (vol. 659, p. L45): “Discovery of a Bipolar Outflow from 2MASSW J1207334-393254 a 24 MJup Brown Dwarf”, by E.T. Whelan et al.

The team is composed of Emma Whelan and Tom Ray (Dublin Institute for Advanced Studies, Ireland), Ray Jayawardhana (University of Toronto, Canada),

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Jets from a Brown Dwarf (Artist's Impression)

the sensitivity and the spectral resolution they required.

“Discoveries like these are purely

IMPORTANT REMINDER

Just a reminder to all MDAS members, when driving up or down Mt. Diablo State park for a Public Astronomy Event or a Society Night please obey the speed limit on the mountain which is 25 MPH. Not only will you get a speeding ticket if caught by the rangers it is also unsafe to exceed that limit, being that the mountain has a very winding road and exceeding that speed may cause a serious accident to yourself and others including wildlife.

Thank you, Nicholas Tsakoyias, MDAS President

A Brown Dwarf Joins the Jet-Set continued from page 3

Francesca Bacciotti, Antonella Natta and Sofia Randich (Osservatorio Astrofisico di Arcetri, Italy), Leonardo Testi (ESO), and Subu Mohanty (Harvard-Smithsonian CfA, USA).

Notes

[1]: Brown dwarfs are objects whose masses are below those of normal stars - the borderline is believed to be about 8% of the mass of our Sun - but larger than those of planets. Unlike normal stars, brown dwarfs are unable to sustain stable nuclear fusion of hydrogen.

[2]: The brown dwarf 2MASS1207-3932 belongs to the TW Hydrae Association and is therefore about 8 million years old. Albeit this is relatively young, this also implies that this brown dwarf is one of the oldest Galactic objects with a resolved jet, highlighting the fact that outflows can persist for a relatively long time.

Technical information:

Spectro-astrometry is simply Gaussian fitting of the spatial profile of the continuum and emission line regions of a spectrum in order to very accurately

ly measure positions. In this way spatial information is recovered beyond the limitations of the seeing of an observation. For example spectro-astrometry has been primarily used to investigate binarity in sources where the binary separation is far less than the seeing and to confirm outflow activity where the line emission tracing the outflow originates at a distance again much smaller than the seeing and therefore appears confined to the source. The first step is to measure the continuum centroid i.e. the source position. The spatial profile of the continuum is extracted at many positions along the dispersion axis. Each extracted profile is fitted with a Gaussian to measure the centroid position of the continuum emission and the result is a position spectrum of the continuum. This map of the continuum position is easily corrected for curvature or tilting in the spectrum. Next the continuum is removed and the position of a pure emission line region is measured (again with Gaussian fitting) with respect to the continuum position. The presence of the continuum will tend to

drag the position of an emission line region back towards the source so it must be removed. The accuracy with which one can measure positions with spectro-astrometry is strongly dependent on the signal to noise of the observation and is given by $\sigma = \text{seeing} / [2.3548(\sqrt{N_p})]$ where N_p is the number of detected photons. For example, for a seeing of 1 arcsecond and a value of N_p of 10,000, positions can be recovered to an accuracy of less than 5 milliarcseconds. The forbidden emission lines found in the spectra of some young brown dwarfs were a strong indication of outflow activity. However the regions were not extended and therefore that they originated in an outflow could not be directly confirmed. Using spectro-astrometry the astronomers were able to show that the line regions were shifted by small amounts with respect to the brown dwarf continuum (shifts were small relative to the seeing) and therefore were indeed tracing an outflow. Please see: <http://www.nature.com/nature/journal/v435/n7042/supinfo/nature03598.html> for a more in depth discussion of the spectro-astrometric technique.

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Jeff is also one of this year's recipients of the prestigious Amgen Award for Science Teaching Excellence (<http://www.amgen.com/citizenship/aaste.html>). Recipients have demonstrated an outstanding ability to inspire their students and produce results in science education. The Amgen program is designed to recognize teachers in the K-12 grade levels in public and private schools whose dedication to their

students' education has had a significant impact on the learning and interest of the future generation of scientists.

Come hear the results of Jeff Adkins's dedication to science teaching excellence!

(Our previously scheduled speaker, Dr. Chris McKay, unfortunately had to cancel due to work-related demands.)

MDAS Outreach Update

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planets. It should arrive by summer's end. I found this kit to be very helpful in demonstrating answers to many public questions about the Solar System, such as "Why can't we see Jupiter?" .

NEW OUTREACH GROUP FORMED! SIGNUP!

If you'd like to contribute or participate to our outreach program, or just stay tuned for upcoming information on workshops and other programs, please join the MDAS outreach group at: <http://tech.groups.yahoo.com/group/mdas-outreach/> .

Marni Berendsen giving an astronomical quiz May 19



MDAS YOSEMITE STAR PARTY JULY 20—21 2007



FOR MORE INFORMATION: PLEASE EMAIL INQUIRIES@MDAS.NET

Solar System Notebook

Looking Down on Regiomontanus A; Venus Grows

By Jim Scala

The Atlas of the Lunar Terminator predicted a fine opportunity on May 24th.

Before I imaged the moon, I consulted John Westfall's Atlas of the Lunar Terminator to see what's visible and interesting along the terminator. On May 24th the Atlas indicated I'd be looking almost vertically down Regiomontanus A. Regio-A is a small 3.5 mile diameter crater at the very apex of the central peak in Regiomontanus. It's always a good seeing test and piques a visitor's curiosity because your viewer usually asks "How was that little crater formed?" Its formation is somewhat up



The walled plain Regiomontanus with a 1 X 1 arc minute field of view looking down on the small crater Regiomontanus A at the apex of the central peak. Regio-A is 3.5 miles in diameter; debate continues about its formation.

for debate because it looks more like out-gassing than an impact to me although arguments are made both ways, a literature search is rewarding if not decisive.

The walled plain Regiomontanus with a 1 X 1 arc minute field of view looking down on the small crater Regiomontanus A at the apex of the central peak. Regio-A is 3.5 miles in diameter; debate continues about its formation.

Seeing was mediocre on May 24th, but if you inspect image one carefully you can see domes that are about 1 arc second in diameter which is just under a mile. On a clear steady night at high magnification this region which is filled with interesting detail.

Venus continues gaining on us and growing as it gets closer.

Has anyone asked you, "What's that bright star in the evening sky?" Did you say, it's a planet, it's Venus? Drive west along Mt Diablo Boulevard in the evening and Venus shimmers like a diamond in the twilight. Indeed, it's hard to believe that Venus brightens even more during June. Venus reaches greatest eastern elongation on June 9th which is the night MDAS celebrates its 50th anniversary on Mt. Diablo. On June 9th Venus will be 24 arc seconds in diameter. Compare that to image two taken on June 3rd when it was 21 arc seconds and image three on April 13th when it was 15 arc seconds.

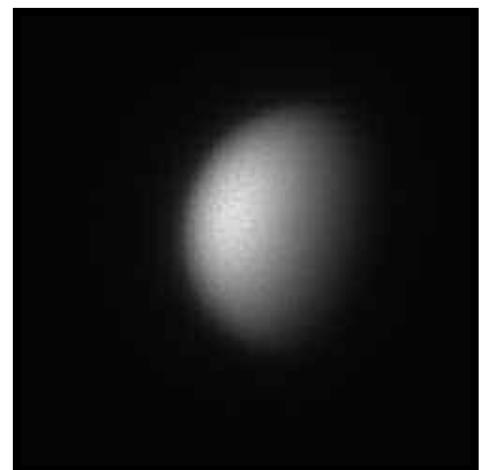
Compare image one, two and three (FOV 1' X 1') to get a feeling for size and how large Venus will appear when it's 57".

The field of view in images one, two and three is 1' X 1' (one by one arc minute) so you can compare the amount of detail available. Regiomontanus is not one of the moon's largest features; however, the wealth of detail in image one is considerable. Now consider that by late June Venus will be 42" and will reach 56" in July when it will be a slender crescent that extends from one side of the FOV to the other.

Venus is easy to observe when it's near eastern elongation, but as it approaches the sun it is best observed during the daytime. At that time it's so bright that there's no difficulty, except you must take great precautions not to get the sun in the fields of view for which you need either setting circles or a polar aligned GOTO mount. One extra



Venus on June 3rd when it was 21" and approaching greatest eastern elongation on June 9, 2007. The field of view is 1" X 1".



Venus on April 13th when it was 15" and just past its gibbous phase.

measure of precaution is worth taking: when you think your scope is set on Venus, sight along the tube to make sure the sun isn't in the field of view and after that, look at the eyepiece eyelens to make certain the sun isn't there. Once you're certain you can enjoy one of astronomy's most beautiful sights; Venus as a slim crescent against a deep-blue sky.

Think ahead to the Martian opposition of December 24th.

At it's closest on December 24th, Mars will not quite

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The Universe in a Football Stadium

By Jim Scala

Do you like to visualise complex concepts in a familiar context?

By visualising a concept in my mind's eye helps me grasp it better. While attending an important, albeit boring function in Candlestick Park, I decided to use the stadium and my mind's eye to help me picture the universe. Since all football stadiums are the same while being different, exact dimensions aren't important because it was only a general feeling I sought. Share my thoughts and see if it makes sense to you.

What would it be like if an atom filled the stadium?

Imagine a carbon atom enlarged so its outer electrons are skirting along the highest and furthest stadium stands. You can't see the electrons even when the atom is that big because they're still too small. But, on the exact center of the 50 yard line there's a small pea; that's the nucleus of the atom! In this thought experiment the nucleus and electrons are solid objects. However, quantum mechanics and string theory see them differently, but we'll go along with the old notion that they're solid objects.

To recap, enlarge a carbon atom to fill a football stadium; its nucleus is about the size of a pea even though it contains 99.999% of its mass and its electrons can't be seen at all. It follows that a typical atom is mostly (over 99.999%) empty space in spite of its mass. Now visualise a level tablespoon tightly packed with powdered charcoal which is pure carbon. The tablespoon would contain about 12 followed by 23 zeros carbon atoms! However, according to our visualisation, the tightly packed tablespoon of carbon would be about 99.999% empty space. How can that be? Simple, an atom is mostly empty space

and our tablespoon with its mind boggling number of atoms is mostly nothing! While you're thinking about that, let's segue to bigger things.

How big is the universe?

Before we put our universe in a stadium, two thought experiments help us establish some necessary common ground.

First imagine six huge telescopes spaced equally around the earth all pointing up. Two are at the Earth's poles and four are equally spaced around the equator. Through careful study and using a little radio astronomy we can prove that each telescope sees about 13.5 billion light

we'll call our 27 billion light year universe the "Visible Universe" and let other astronomers figure out its precise size.

In the second thought experiment we need a handle on the visible material in our 27 light year visible universe. The visible (emitted or reflected light) baryonic matter we see exists in galaxies and constitutes less than five percent of our universe. To visualise that in our stadium, imagine a pile under 35 feet high and 35 feet in diameter placed exactly on the 50 yard line of the stadium. That's the five percent of baryonic matter in our universe and we really don't see all of it, so our pile is really a little big. The rest of the universe is about 25 percent dark matter that we can measure but not see and the other 70 percent is dark energy. While the dark matter is collected in the galaxies, the dark energy is apparently all pervasive in space.

Continuing our thought experiment, the pile on the 50 yard line is made of small pieces of the thinnest paper possible; each piece is less than a dime in diameter. For comparison purposes it was piled neatly at the 50 yard line; now we have to get each individual piece moving around for our next step.

How does the visible universe look inside a football stadium?

Imagine that the thin small paper disks are all swirling around right to the edges of the stadium. We'd notice that each paper disk is so thin they're barely visible and are separated, on average, by about two inches in every direction. They clump together, separate, some stick together and others change clumps; their motion is apparently random and some clumps seem to persist. Think about this carefully and you'll agree that the stadium is mostly empty because the

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years distant. Hence, we can conclude that our universe is about 27 billion light years in diameter and we seem to be at its center. Now take a major thought leap in this experiment and move to a planet in a distant galaxy over 50 million light years away and set up six telescopes. Our measurements come out precisely the same in that place. Therefore, we can conclude our universe is larger than 27 billion light years and we probably aren't at its center, but we don't know for sure. So,

The Universe in a Football Stadium *continued from page 6*

disks hardly exist, are almost invisible and average over two or more inches between them. Clearly, the stadium is mostly empty.

What we can see is heavy or baryonic matter, but we said that another 25 percent of the space is dark matter that we can see by the way it causes light to bend around galaxies. However, we ask, "What is it?" Quantum mechanics and the string theory indicate that it's not solid particles we could put in a box. So, we know it exists but its actual substance is unknown.

If dark matter isn't mysterious enough, what about the 70 percent dark energy that is all pervasive? To be rigorously accurate, we'd say that our stadium is actually getting larger in every direction and its growth is accelerating thanks to the dark energy. So, while space is actually increasing,

the visible and dark matter isn't increasing, so the almost invisible paper disks are constantly getting further apart. A simple question comes to mind: Does space's intrinsic composition remain the same as it expands? In short, is dark energy increasing? Are we making a fundamental error when we



try and visualise the basic building blocks of matter as solid entities? Is dark energy just quantum fluctuations?

Can we learn anything from this "universe in a stadium?"

Our universe, starting with a modest atom and moving onto its entirety, is a mind boggling, large and empty place. Indeed, emptiness is all the more confusing when we consider that objects we can hold in our hand (a spoon of carbon) are mostly nothing. In our thought experiments we ignored the quantum world in which subatomic particles can act as waves or particles. More confusing, in string theory subatomic (also possibly atoms) particles are waves in an eleven dimensioned space. We also didn't consider that relativity proves very clearly that time is a variable we can actually measure and use. For now, why not just try and grasp the incredible emptiness?

Membership Demographic Adjustment Section.

To all members: If you have any questions or comments regarding your membership status, badges, addresses, and/or magazine subscriptions, please contact Tom Harris through www.mdas.net and/or email: memberinfo@mdas.net. *Thank you!*

AANC Conference 2007: Reach for the Stars

Join us for a full day (and night!) of astronomical talks, events, workshops, and activities for everyone. View the Sun, Moon, planets and other celestial sights first-hand through the CSM Observatory telescopes. The "Reach for the Stars" conference is sponsored by the Astronomical Association of Northern California, as well as the Astronomy department of the College of San Mateo.

For more information please see:

<http://www.aancstars2007.org/> • <http://www.aancstars2007.com/> • <http://www.aancstars2007.net/>

Looking Down on Regiomontanus A; Venus Grows *continued from page 5*

be 16" or about the size of Venus in image three. Mars will be very high in our sky during this opposition, so for us it will be a much better opposition. However, Mars is always a difficult object that requires practice in

observing detail. The moon is an excellent practice object and details such as Regiomontanus-A is just the kind of detail that will help develop your visual acuity.

From the American Association of Variable Star Observers

Remembering Dorrit Hoffleit

A lover of bright stars, and among the oldest working in the field



Dorrit Hoffleit's 77-year friendship with the AAVSO began in 1930. She was then just 23 years old, and listed her astronomical experience on her AAVSO application as "examining photographic plates to find and determine periods for variable stars."

From the beginning of her involvement with variable stars and the AAVSO, and as her career turned through its very different phases over the decades, Dorrit was present at nearly every AAVSO annual meeting and many

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2007 Public Program

Month	Date	Month	Date
June	9	August	18
July	21	September	15
		October	13

2007 Society Nights

Month	Date	Moon Phase
June	16	
July	14	New
August	11	
September	8	
October		
November	3	
November	10	New
December	1	
December	8	

Remembering Dorrit Hoffleit *continued from page 7*

spring meetings. She visited AAVSO Headquarters at every opportunity — in her later years, these visits coincided not only with AAVSO meetings but also with trips from New Haven to her Boston dentist. We were sorry she had to visit the dentist but delighted for the chances to see her!

Among the hundreds of articles on astronomy published during her career, forty appeared in the *Journal of the AAVSO* in which Dorrit was the principal author. She presented papers at every AAVSO annual meeting she attended, but Dorrit is best remembered for bringing her Maria Mitchell Observatory summer research students to the annual meetings (from 1957 to 1978) to present the results of their summer's work in the form of a scientific paper — the first such experience for most of them.

Dorrit served 8 two-year terms on the AAVSO Council: 1943-1945, 1954-1958, 1972-1974, 1977-1981, and 1989-1993. She also served an additional 7 years as an officer: 2nd Vice President 1958-1960, 1st Vice President 1960-1961, President 1961-1963, and Past

President 1963-1965. Thus, she gave 23 years to the AAVSO in an official position of leadership. Over the years, she was often approached for her thoughts on a broad range of subject affecting the AAVSO, and she was a trusted advisor and mentor to many who were responsible for the AAVSO's well-being, particularly Janet Mattei.

Dorrit's support of the AAVSO and its goals was also repeatedly demonstrated by her financial support (often anonymous). Numerous projects would not have been as successful as they were — or even possible — without her great generosity.

Among the many reasons we had to be grateful for Dorrit's presence in the AAVSO, the most important was Dorrit herself. Her beaming smile and her wonderfully infectious laughter lightened the



gloomiest day, her stories were fascinating, her breadth and depth of historical astronomical knowledge (and related fields such as astronomical politics) legendary, her wise counsel never ponderous or pompous. The example she set through the life she lived as her gracious, kind, practical self — often in the face of enormous adversity — was inspiring and enriching.

When Dorrit turned 80, minor planet 3416 was named “Dorrit” in her honor. Perhaps Dorrit is now being welcomed at Dorrit (3416) by her celestial “AAVSO neighbors”, including the residents of Cannonia (1120, Annie Jump Cannon), Swope (2168, Henrietta Swope), Fivesparks (3342, Margaret Mayall), SawyerHogg (2917, Helen Sawyer Hogg Priestley), Mattei (11695, Janet Mattei), and MarthaHazen (10024). Dorrit said, “I like to joke that [my] asteroid is where I shall go when I die, my celestial home!” What a grand reunion for Dorrit and these good friends — the heavens must be ringing with their laughter!

Michael Saladyga and Elizabeth Waagen