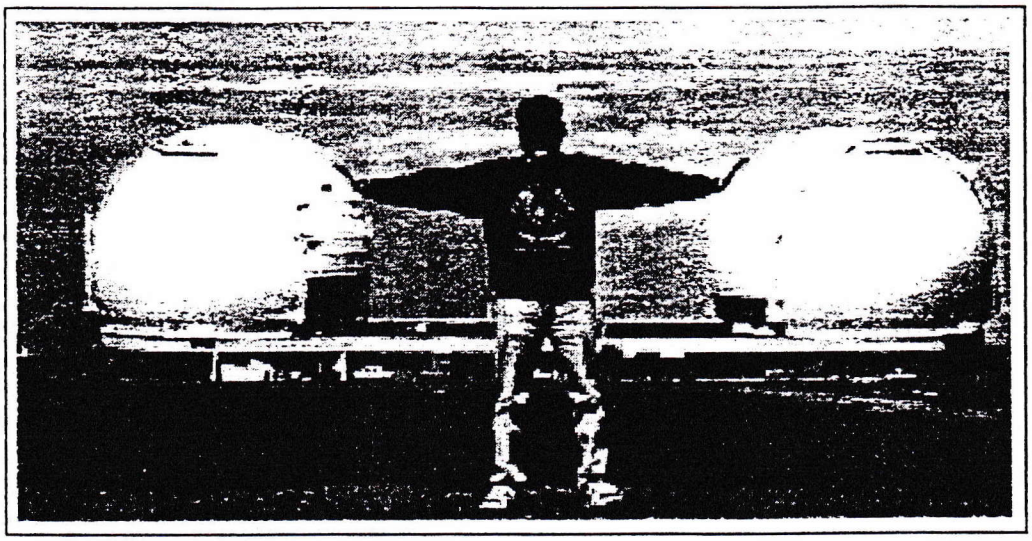
REFLECTIONS



REFLECTIONS

November 1995

Which is true ? Mark Vincent is BIG on astronomy. The Kecks are really a hoax as evidenced by Mark's photo of the model. The sweatshirt is more traveled than most Lowbrows.

Chris Sarnecki Editor

Of the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of Astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy building (Dennison Hall, Room 807). Meetings begin at 7:30 pm and are open to the public. Public star parties are held twice a month at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; further directions at the end of the newsletter) on Saturdays before and after the new Moon. The party is canceled if it's cloudy or very cold at sunset. For further information call Bill Razgunas at (313) 995-0934.

This Month:

November 17 - Meeting at 807 Dennison. A video - Leon Lederman (Author, Nobel Physicist, former Director of Fermilab) as recorded from a recent lecture at Lawrence Technological University. Afterwards if it's clear we will reconvene at Peach Mtn to watch the Leonids.

November 18 - Public Star Party at Peach Mountain Observatory. Peak of Leonid meteors shower occurs at pre dawn today.

November 22 - New Moon at 10:43 am EST

November 25 - Public Star Party at Peach Mountain Observatory. Five planets are low in the western sky plus Saturn in the SSE.

Next Month:

December ? - Computer Subgroup Meeting. Mark Vincent will host a working session at the Space Physics Lab. Date to be determined.

December 15 - Meeting at 807 Dennison It's a mystery to me - speaker and topic yet to be determined.

December 16 - Public Star Party at Peach Mountain Observatory. Jupiter is fading fast.

December 21 - New Moon at 9:22 pm EST

December 23 - Public Star Party at Peach Mountain Observatory. Venus in SW above a close pair, Mercury and Mars, low on the horizon with a slim crescent Moon between.

Saturday Morning Physics - Dennison Hall Auditorium at 10:30 am, info: 764-4437
November 18 - The Physics of Cosmic Rays (part 3) - Dr. Stephane Coutu.
December 2, 9 - Where is 90% of the Universe ?,The Dark Matter Puzzle - Dr. Shawn Mckee

Site Seeing at Mauna Kea (or what I did in Hawaii at Taxpayer's Expense)

by Mark Vincent

Yes! I just got back from Hawaii (thank you taxpayers). I did have a reason for going and that was this year's Division for Planetary Sciences meeting held at the Ritz-Carlton, Mauna Lani (October 8 - 13). It is located on the north-west coast of the big island. John Clarke, Gilda Ballester, Daniel Rego, Kandislea Jessup and I all went. I presented a poster comparing the morphology of the SL-9 impact sites taken with different far and near UV filter of WFPC2.

On Saturday night before leaving, I used Sky-on-Line to get the coordinates for Comet De Vico. The comet was to rise in the morning twilight. Normally, I'm NOT a morning person so I wouldn't expect to see it but, there is a little point of a 6 hour time difference between here and Hawaii. This guaranties that anyone becomes a morning person, since one tends to wake up around 3 am! I made good use of this on Monday morning by walking out onto the 3rd floor balcony with my 7x50 binoculars for a bit of observing. Could someone tell me why Polaris was misplaced? The comet nucleus was readily visible in the binoculars. Unfortunately, the morning twilight and the large, gibbous moon did not help seeing the tail, of which I only got a few glimpses.

As you might imagine, I definitely wanted to go to Mauna Kea Observatory (MKO). The March 1995 issue of Reflections that had an article on getting to MKO helped in planing the trip. Tony Mallama, an Astronomer from Hughes STX and I went up on Tuesday morning. Forget about what you've heard about needing a 4WD to get there. We took his rented Chevy Corsica (he didn't tell the rental company) and followed a GEO METRO down! Yes, you read right, an underpowered, 3 cylinder, 2WD GEO METRO with 3 big hikers in it, was seen going down the mountain. Note, what went down must of went UP. The Corsica came close to overheating several times on the way up. Apparently there just isn't enough air up there to cool the radiator. Turning the heater on full blast helps keep the engine cool. Rolling down the windows helps keep the passengers cool.

The first telescope we went to was the James Clerk Maxwell 15m diameter millimeter and sub-millimeter telescope. We just drove up and waited for an Astronomer to show up. While standing outside JCMT, I took a great stereographic pair of the Japanese 8m Subaru telescope. The stereo pair allows one to view THROUGH the unfinished cylindrical 'dome'. I'll bring this and the rest of the prints (5 rolls total) to the next meeting. After a few minutes, an Astronomer did show up. He gave us a nice tour of the telescope and explained how the telescope was being improved for even shorter wavelength observations. This effort may include heating and cooling truss in the dish support structure to alter their lengths and thus actively controling the figure of the parabolic dish. This is not to compensate for atmospheric distortion, just gravitation distortion as the dish changes elevation. Further repair work was going on to foundation just below the mount, since it had become warped enough to affect tracking.

Next we moved onto the area around the United Kingdom Infrared Telescope (UKIRT), Gemini (presently just a foundation) and the Canadian, France, Hawaii telescope (CFHT). This area provides a great view of some cinder cones and a chance to look DOWN at the clouds rolling in over the base of Mauna Kea. Its neat to be able to walk around a bit and see both the east and west coasts within a few minutes. Since we didn't see anyone but the Gemini construction works and a few tourist around, we didn't get into any of the observatories this time.

Now on onto Infrared Telescope Facility (IRTF) which is run by NASA. Again, we didn't see anyone around but, this time we tried the door. It was unlocked so, we walked in and said hi. The tour was brief, but good. IRTF has 4 instruments, mounted on rails, near the focal plane to permit rapid changes between cameras and spectrometers.

Now, on to the Holy Grail(s) of telescopes, KECK I & II. As we drove up, there was a

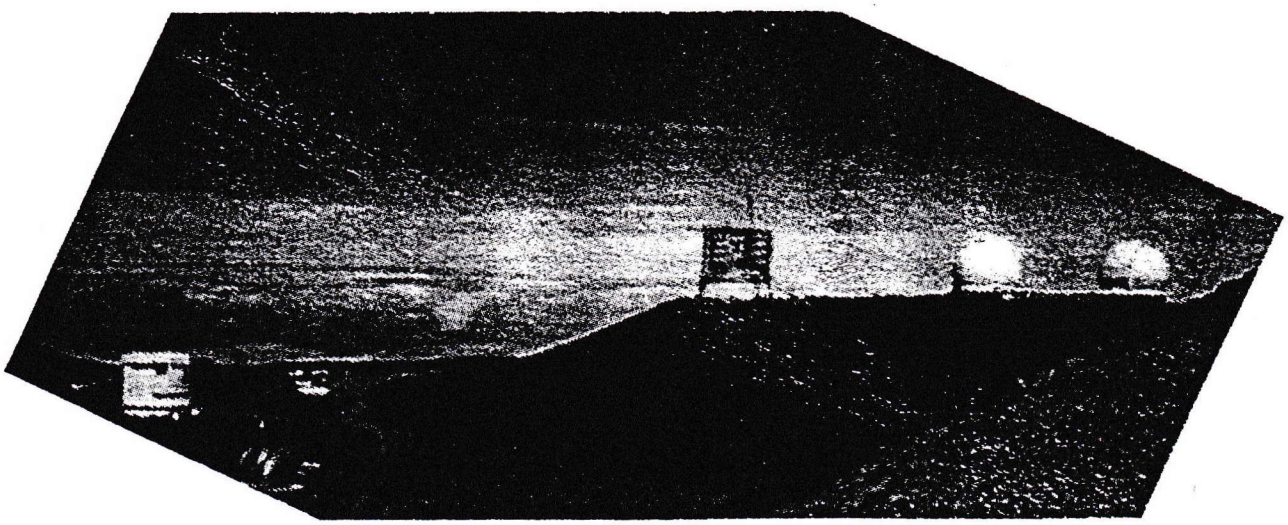
double door open at the ground level of Keck II. Standing in this doorway provided a nice view of the backside of the uncompleted telescope. The interior was well light by sunlight shining through the partially open shutter. I knew it would be huge, and it is. But, it didn't seem as huge as I expected. Standing off to the side at ground level, the good lighting, and the fact that the telescope fills the dome somehow made it look well, not so gigantic. I think the real reason for this impression was the fact that I could not see the front side where the mirror will be installed. Had I seen the primary... Keck I has a small visitor center at ground level. It's more like a visitor 'cage' (no, not an observer's cage mounted to the scope like Polamar) and was about 8x5 feet with plexiglass walls and bars over the roof. To get a better view, Tony climbed through the bars and I soon followed.

We doubled back and visited UKIRT. We started talking to one of the Engineers who is bringing the telescope up-to-date. They are installing 88 air bags behind the 3.8m primary which will be able to apply up to a total of about 50 pound force. The figure will be corrected by selectively adjusting the pressure in groups of air bags. As we were talking, the subject of telescopes on that hill north of Ann Arbor came up, as well as that local astronomy club! I wonder if my Lowbrow sweatshirt helped? It turns out that he had spent a year in Ann Arbor. Now I only wish I could remember his name. I guess it is a small, small world after all.

I next tried to get into the University of Hawaii 88" but the technicians who had just shown up said that they could not let anyone in. At CFHT I caught a few Astronomers leaving but, the there was an equipment change-out going on so they were too busy for a tour. As I returned to where Tony parked the car, it wasn't there. Now, I'm on top of Mauna Kea about 50 miles from the Hotel and there is no car. Time for some more site seeing! Tony showed up in a little while after he did some more site seeing at Keck.

I continued to do some observing whenever the frequently partially cloudy skies and the waning Moon would allow. The state park, about a quarter mile from the hotel provided a dark site for viewing with my 7x50's. I couldn't find the North American Nebula right away because there was another bright nebula. Oh, the Pelican Nebula. Ok, the NGC-7000 should be over there. On Saturday and Sunday Kandislea, Daniel and I visited Kilauea Volcano and the Hawaii Tropical Botanical Garden. It was raining both nights. The plane flight home was a lllongggg red-eye with a south facing window seat. By using my jacket as a light shield, about 4.5 magnitude stars were visible to the naked eye and about 5-6 mag objects with 7x25 binoculars. I watched Orion and Sirius rise and saw 3 meteors. Unfortunately, I didn't see any big deep south sky objects like the Magellanic Clouds.

The next DPS meeting is the week of October 23rd in Tucson. It'll be my second time to see Kitt Peak. I'm already planing on putting my 13" in the station wagon and driving out a week early for some dark-sky observing. Unfortunately, the full Moon is on the Saturday just after the meeting. This means that the night sky will get progressively brighter during the meeting. Does anyone have suggestions as to where to spend a few dark nights near Tucson?



Physics in the Morning

by Christopher Sarnecki

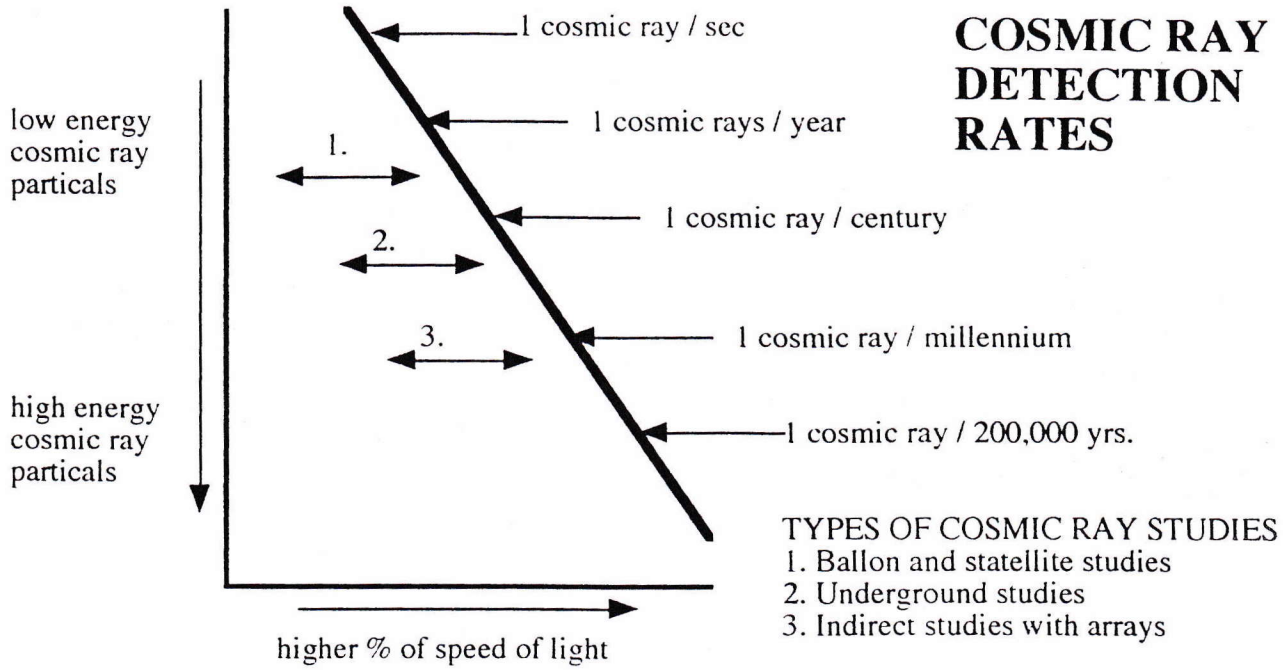
The University of Michigan, Physics Department is currently hosting Saturday Morning Physics - a three part series of presentations open to the general public each Saturday at 10:30 am in Dennison Hall auditorium. (See the schedule at the bottom on this month's cover of Reflections for a schedule of the remaining lectures). Billed as multimedia presentations that explores contemporary physics in clear non-technical terms, I can attest that this is certainly the case having attended two of the lectures as of this writing. The October series, presented by Dr. Robert Welsh was on Medical Physics and Medical Imagining. I attended the second lecture on the physics of MRI (magnetic resonance imaging). Dr. Welsh did a fine job of explaining the molecular physics behind this newer form of medical imaging using experiments, overheads, slides, and also presented actual on-going research currently being conducted by the department. The November series is being presented by Dr. Stephane Coutu on The Physics of Cosmic Rays. Below is a synopsyis of his first talk.

Studying the Universe with Cosmic Rays - Begin with a short thought experiment. The Earth is a sphere approximately 6400 Km in radius. A car traveling at 60 mph would require 17 days to circle the planet. The Solar System is a disk 7.4 billion Km in radius. If the Earth is a pea then the Solar System is the size of Ann Arbor. The Milky Way is a disk 500 quadrillion Km in radius. If the Solar System is a dime the Milky way is the size of the State of Michigan. The nearest star is a half of football field away from the dime. Next comes clusters of galaxies and super clusters of galaxies. Stop and reflect for a moment on this - *The Universe is a VERY big place.* Continue on with this thought experiment. The typical size of a molecule is 3 angstroms (an angstrom is equal to 10^{-10} meters). Approximately 10^{25} molecules are contained in a glass of water. Each atom is comprised of a negatively charged electron cloud surrounded by a positively charged nucleus. If the nucleus is the size of a pea then the electron cloud is the size of the Michigan stadium. *Matter is mostly empty space.* Quarks and anti-quarks as-well-as other elementary particles extend from the components of atoms. *The world of elementary particles are tiny and empty.*

The Universe is made up of 90% dark matter and 10% of luminous mater (stars, galaxies...the same stuff as the Earth - H, He, Li, Be, B, C, O...). Cosmic Rays are particles from space (atomic nucleus, electron, positron, gamma ray, neutrino). Cosmic rays are constantly raining down on the Earth and us. Cosmic rays are believed to originate from supernovas, neutron stars, and supernova shock wave interactions with interstellar gas. A neutron star interacting with a binary star can also produce cosmic rays. These particles poses high energy levels due to the fact that they are accelerated to relativistic speeds by their association with supernovas, neutron stars, and perhaps black holes.

Cosmic rays are composed of 98% atomic nuclei (of which 85% are hydrogen, 12% helium, and 1% heavier elements), 2% are electrons and positrons, and a smaller amount comprising neutral particles (such as x-rays, neutrinos). The composition of cosmic rays change with energy levels. Cosmic rays are propelled around the galaxy by galactic magnetic fields. Positively and negatively charged particles respond to local magnetic fields and may have a circuitous path. Low energy cosmic rays generally travel with in the galaxy of thier origin. If a cosmic ray possesses sufficiently higher energy then the particle can escape the galaxy of it's origin and travel intergalactic space. Cosmic rays can travel for 10 million years and a distance of 10,000 times the thickness of the plane of a galaxy. The origin of individual cosmic rays are difficult if not impossible to determine due to this circuitous path through space.

The Earth acts like a huge bar magnet. Magnetic field lines extend around the Earth with north and south magnetic fields approximately corresponding to the geographic poles of the planet. Low energy cosmic rays are channeled to through the north and south magnetic fields and can produce auroras. High



As you look at Cosmic Rays with higher energies you see less of them

energy cosmic rays are not effected by the Earth's magnetic field and can arrive from any direction. When a cosmic ray arrives in the upper atmosphere it generally collides with another atom. A cascade of sub-atomic particles, called an air shower, is generated by this interaction. Physicist studying the air shower will use a variety of instruments to detect the individual particles from an air shower. Cosmic ray detectors traditionally have been launched from balloons and later satellites to get the detectors above the atmosphere. High energy cosmic ray detectors can be located on the ground (See September *Sky & Telescope's* article on Gamma Ray Astronomy for examples) or underground to detect neutrinos. Dr. Coutu's next presentations are expected to explore high energy cosmic ray detection.

Doug's (not to be confused with Steven) hawkings

Congratulations! We've sold all our shirts but one, a medium silhouette T-shirt. We do have lots of calendars, though. I'll be bringing them to the November meeting. Again. prices are $8.00 for club members, $9.00 for non-members. Consider selling some where you work, plus they make great stocking stuffers, hint hint. Also, in case you missed last month's message, I will order RASC Observer's guides only for those who specifically ask for them and give me the $16.95. I'll order them shortly after the November meeting so that I can get them to you before January. For your convenience, I'll bring a copy of the 1996 Sky catalog to the meeting, in case there are other things you'd like to order as well. - Doug Scobel

What's Up Tonight ?

by Doug Scobel

Often, at observing sessions, other club members see me huddled at my telescope, not saying much, but looking, writing things down, looking some more, writing some more, until finally they ask "Just what ARE YOU UP TO over there?". And then, they find out that instead of M13 or some other showpiece object, I'll show them some obscure, thirteenth magnitude fuzzball that you can hardly see and that almost no one's ever heard of. What I thought I'd do here is share with you what I've been doing, and how I go about doing it. Hopefully, I'll be able to stretch this out into a series of articles in which I can pass along to you what I've learned and experienced while observing.

You've probably discovered by now, astute reader that you are, that typically I don't go after the brightest, most spectacular objects in the sky. Instead, I usually like to spend the initial portion of a session going after deep sky objects that I have not seen before. It's usually later, when my energy level starts to drop off, that I go after the familiar showpieces. (Note that this philosophy does not apply at public open houses, where we try to grab the public's attention with the most spectacular objects available.) Since I've already observed all the Messier objects except M83 and M40, and many of the brighter NGC objects, what's left are the more obscure, but still rewarding to observe (at least to me) objects.

So how do I figure out what faint fuzzies are up there on a given night? In the past, I would look through various handbooks (such as Burnham's and others), and manually create a list of potential targets for a night's observing. This got old real fast, because I had to determine data such as rise/set times, altitudes, sky atlas chart numbers, etc., by hand. A long, tedious process. When Doug Nelle acquired a computerized copy of a deep sky database for me, my prayers were answered. I quickly went to work and wrote a computer program to search the database for "what's up tonight?".

I now use this program to plan all my observing sessions. It creates a record for each object that fits the criteria I specify, and that will be in the sky during the time I'll be out observing. Criteria for selecting objects include object type (Bright Nebula, Cluster with Nebulosity, Galaxy, Globular Cluster, Open Cluster, Planetary Nebula, Asterism, Dark Nebula, Galaxy Cluster, Quasar, Messier object, and more), limiting magnitude(s), and whether or not I want to include objects I've already observed.

Besides providing the obvious data (such as name, coordinates, and brightness), it calculates rise, set, and peak times, average surface brightness (handy for planetaries and globulars), and provides chart numbers for both Sky Atlas 2000 and Uranometria 2000. The list is sorted according to peak and/or setting times so that objects appear in more or less the same order in which they will be best observed.

Here's an example of the output the program generates:

```
OBSERVING SITE    : PEACH MOUNTAIN
   LATITUDE       : 42^24' 0"
   LONGITUDE      : 83^27' 0"
   HOURS FROM GMT     : 5
   START TIME         : 11-22-1995  @19:0
   FINISH TIME        : 11-22-1995  @22:0
   OBJECT CLASS       : Bright Nebula
   FAINTEST MAGNITUDE     : 12.0
   BRIGHTEST MAGNITUDE : No limit
   ALTITUDE THRESHOLD     : 25 degrees


   M1-92 ()  Bright Nebula
     Coordinates        : 19h36m 29^32'
     Magnitude          : 11.7
     Size               : 8.0"
     Surf brightness    : 16.0 mag/sq"
     Constellation      : Cygnus
     U 2000 #(s)        : 118/119
     SA 2000 #(s)       : 8
     Rise data      : 52.6^  11-22-1995 @19: 0
     Set data       : 25.3^  11-22-1995 @21:30
     Peak data      : 52.6^  11-22-1995 @19: 0
     SAC notes      : Footprint Neb, looks like
Dbl*,30" East of * of equal mag
```

vdB 20 () Bright Nebula
Coordinates : 3h44m 24^07'
Magnitude : 11.6
Size : 20.0'
Surf brightness : 26.8 mag/sq"
Constellation : Taurus
U 2000 #(s) : 132
SA 2000 #(s) : 4
Rise data : 26.3^ 11-22-1995 @19:10
Set data : 57.2^ 11-22-1995 @22: 0
Peak data : 57.2^ 11-22-1995 @22: 0
SAC notes : Electra nebulosity

vdB 23 () Bright Nebula
Coordinates : 3h47m 24^05'
Magnitude : 11.9
Size : 27.0'
Surf brightness : 27.7 mag/sq"
Constellation : Taurus
U 2000 #(s) : 132
SA 2000 #(s) : 4
Rise data : 25.8^ 11-22-1995 @19:10
Set data : 56.7^ 11-22-1995 @22: 0
Peak data : 56.7^ 11-22-1995 @22: 0
SAC notes : Alcyone nebulosity

So, now you know what I'm up to. Just a few key presses at the computer and voila!, [I think he means eureka ! - Ed] I have a list of up to literally hundreds of targets that are easily visible in my telescope (a 13" f/4.5 dob). Armed with the list at the telescope, I select an object to find, find and observe it, record the observation for my log, and go on to to the next one. In a single night, I can easily grab a dozen or more objects that I have not seen before. Using this program over the past three years, I've logged more than three hundred different deep sky objects. And, because the database I use contains more than ten thousand deep sky objects, it will be a long, long time before I run out of new things to look for.

If you think you can use observing lists like this, then let me know. Unfortunately, the program is written in Applicon's (the company for which I work) proprietary Pascal, for VMS and UNIX workstations (Digital and HP). Sorry, no PC or Mac version :(, so I suspect most of you cannot use a copy of the program. Maybe someday I'll convert it to C so that it can be ported to the PC world (perhaps someone would be willing to ;) pay me?). If you have access to electronic mail, then I could generate lists for you and send them to you that way. Feel free to contact me at djscobel@ann-arbor.applicon.com if you're interested.

EMBRYONIC STARS EMERGE FROM INTERSTELLAR "EGGS"

Press release from The Space Telescope Science Institute

Eerie, dramatic new pictures from NASA's Hubble Space Telescope show newborn stars emerging from "eggs" -- not the barnyard variety -- but rather dense, compact pockets of interstellar gas called evaporating gaseous globules (EGGs). Hubble found the "EGGs," appropriately enough, in the Eagle nebula, a nearby star-forming region 7,000 light- years away in the constellation Serpens.

"For a long time astronomers have speculated about what processes control the sizes of stars -- about why stars are the sizes that they are," said Jeff Hester of Arizona State University, Tempe, AZ. "Now in M16 we seem to be watching at least one such process at work right in front of our eyes."

Striking pictures taken by Hester and co-investigators with Hubble's Wide Field and Planetary Camera 2 (WFPC2) resolve the EGGs at the tip of finger-like features protruding from monstrous columns of cold gas and dust in the Eagle nebula (also called M16 -- 16th object in the Messier catalog). The columns -- dubbed "elephant trunks" -- protrude from the wall of a vast cloud of molecular hydrogen, like stalagmites rising above the floor of a cavern. Inside the gaseous towers, which are light-years long, the interstellar gas is dense enough to collapse under its own weight, forming young stars that continue to grow as they accumulate more and more mass from their surroundings. Hubble gives a clear look at what happens as a torrent of ultraviolet light from nearby young, hot stars heats the gas along the surface of the

pillars, "boiling it away" into interstellar space -- a process called "photoevaporation. "The Hubble pictures show photoevaporating gas as ghostly streamers flowing away from the columns. But not all of the gas boils off at the same rate. The EGGs, which are denser than their surroundings, are left behind after the gas around them is gone.

"It's a bit like a wind storm in the desert," said Hester. "As the wind blows away the lighter sand, heavier rocks buried in the sand are uncovered. But in M16, instead of rocks, the ultraviolet light is uncovering the denser egg-like globules of gas that surround stars that were forming inside the gigantic gas columns."

Some EGGs appear as nothing but tiny bumps on the surface of the columns. Others have been uncovered more completely, and now resemble "fingers" of gas protruding from the larger cloud. (The fingers are gas that has been protected from photoevaporation by the shadows of the EGGs). Some EGGs have pinched off completely from the larger column from which they emerged, and now look like teardrops in space. By stringing together these pictures of EGGs caught at different stages of being uncovered, Hester and his colleagues from the Wide Field and Planetary Camera Investigation Definition Team are getting an unprecedented look at what stars and their surroundings look like before they are truly stars. "This is the first time that we have actually seen the process of forming stars being uncovered by photoevaporation," Hester emphasized. "In some ways it seems more like archaeology than astronomy. The ultraviolet light from nearby stars does the digging for us, and we study what is unearthed." "In a few cases we can see the stars in the EGGs directly in the WFPC2 images," says Hester. "As soon as the star in an EGG is exposed, the object looks something like an ice cream cone, with a newly uncovered star playing the role of the cherry on top." Ultimately, photoevaporation inhibits the further growth of the embryonic stars by dispersing the cloud of gas they were "feeding" from. "We believe that the stars in M16 were continuing to grow as more and more gas fell onto them, right up until the moment that they were cut off from that surrounding material by photoevaporation," said Hester.

This process is markedly different from the process that governs the sizes of stars forming in isolation. Some astronomers believe that, left to its own devices, a star will continue to grow until it nears the point where nuclear fusion begins in its interior. When this happens, the star begins to blow a strong "wind" that clears away the residual material. Hubble has imaged this process in detail in so-called Herbig-Haro objects.

Hester also speculated that photoevaporation might actually inhibit the formation of planets around such stars. It is not at all clear from the new data that the stars in M16 have reached the point where they have formed the disks that go on to become solar systems," said Hester, "and if these disks haven't formed yet, they never will."

Hester plans to use Hubble's high resolution to probe other nearby star-forming regions to look for similar structures. "Discoveries about the nature of the M16 EGGs might lead astronomers to rethink some of their ideas about the environments of stars forming in other regions, such as the Orion Nebula," he predicted.

Access NASA's Archives

by Douglas Warshow

NASA now has an on-line archive (called the National Space Science Data Center) available to anyone with a modem. The on-line data storage has a size of about 1.5 terabytes (one and a half trillion bytes) covering the realms of astrophysics, space plasma physics, planetary physics and some Earth sciences. The World Wide Web address is:

http://nssdc.gsfc.nasa.gov

One topic that you may wish to look at is the Galileo probe page, seeing how the Jupiter encounter is next month. That address is:

http://ccf.arc.nasa.gov/galileo_probe/

There is no charge for downloading information from this source; NASA is a government agency, so you have already paid for it with your tax dollars.

Places:

Dennison Hall, also known as The University of Michigan's Physics and Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. It is found in Ann Arbor on Church Street about one block north of South University Avenue. The meeting is held in room 807.

Peach Mountain Observatory is the home of The University of Michigan's 25 meter radio telescope as well as the University's McMath 24 inch telescope which is maintained by the Lowbrows. The observatory is located northwest of Dexter. The entrance is on North Territorial Road, 1.1 miles west of Dexter-Pickney Road. A small maize-and-blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.

Times:

Monthly meetings of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM in 807 Dennison Hall. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.

Computer subgroup meetings are held on the first of each month, rotating among member's houses. See the calendar on the cover page for the location of next meeting.

Public Open House/Star Parties are held on the Saturday before and after each new Moon at the Peach Mountain Observatory. Star Parties are canceled if the sky is cloudy at sunset or the temperature is below 10 degrees F. Call 480-4514 for a recorded message on the afternoon of a scheduled Star Party to check on the status. Many members bring their telescopes and visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitos - bring insect repellent, and it does get cold at night so dress warmly !

Dues:
Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students. This entitles you to the monthly REFLECTIONS newsletter and the use of the 24" McMath telescope (after some training). Dues can be paid to the club treasurer Doug Scobel either at the monthly meeting or by mail at:
Doug Scobel
1426 Wedgewood Drive
Saline, MI 48176

Magazines:

Members of the University Lowbrow Astronomers can get a discount on these magazine subscriptions:
Sky and Telescope: $24 / year
Astronomy: $20 / year
Odyssey: $16.95 / year
For more information contact the club Treasurer. Members renewing subscriptions are reminded to send your renewal notice along with your check when applying through the club Treasurer.

Newsletter Contributions:

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call the Newsletter Editor Chris Sarnecki at 426-5772 or e-mail to chrisandi@aol.com to discuss length and format. Announcements and articles are due by the first Friday of each month. Articles should be mailed to:
Christopher Sarnecki
4835 Holly Way
Ann Arbor, MI 48103

Telephone Numbers

President:	Bill Razgunas	995-0934
Vice Pres:	Mark Cray	283-6311
	DC Moons	254-9439
	Tom Pettit	878-0438
	Tom Ryan	662-4188
	Randy Stevenson	429-5099
Treasurer:	Doug Scobel	429-4954
Observatory Director:	Bernard Friberg	761-1875
Newsletter:	Chris Sarnecki	426-5772
Peach Mtn Keyholder:	Fred Schebor	426-2363

MONTHLY MEETING:

November 17 - 7:30 pm at Dennison Hall - A Video Presentation of a lecture by Physicist Leon Lederman, and then it is out to Peach Mtn for some Leonids observing (assuming it is clear).

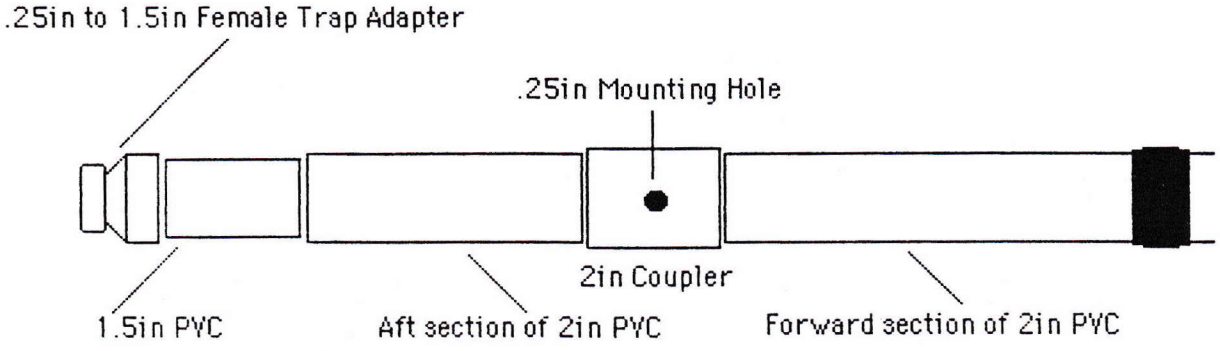


Fig. 15:Exploded View of the PVC Telescope

From the Frugal Telescope Maker by Rico Tyler, C/O Project SPICA Office

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University Lowbrow Astronomers
1740 David Ct.
Ann Arbor, MI 48105

Check your membership expiration date on the mailing label !