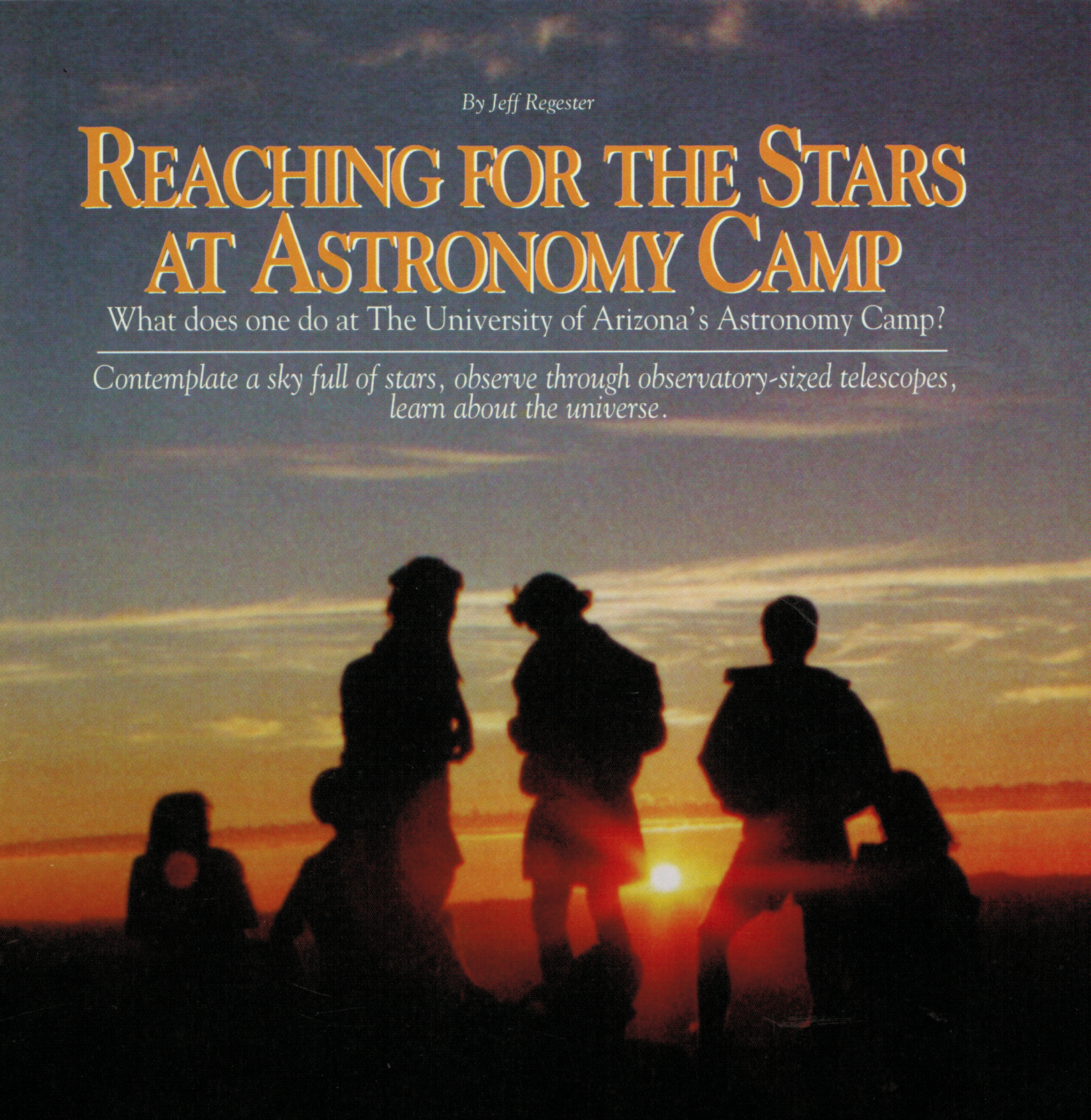
By Jeff Regester

Reaching for the Stars at Astronomy Camp

What does one do at The University of Arizona's Astronomy Camp?

Contemplate a sky full of stars, observe through observatory-sized telescopes, learn about the universe.



Come the end of the week, campers present their project results. A graduation ceremony concludes the camp, after which campers and counselors head home by plane, train, car, or foot for some well-earned sound sleep.

Excerpts from a Camper's Journal

The following excerpts are from the journal of Leisa Glennie, who attended the Advanced Teen Astronomy Camp in June, 1991.

Monday, June 17, 1991

Today was the first day of Dr. McCarthy's Advanced Astronomy Camp. I arrived at the Alumni Building at about 3:30 p.m. and said hi to Dr. McCarthy and met some of the counselors and other students. After getting our materials—a huge notebook, a schedule, a tee-shirt, a little flashlight, and an observer's handbook, I sat down in the lounge and talked to another student

At about 4 p.m., Dr. McCarthy came in and talked to us for a while. Then we piled into the vans with our stuff and started up the mountain. We stopped at Rose Canyon for a picnic dinner. We moved into the dorms up here at about 7:30 and then took a walking tour of the facility. At about 10 p.m. Curt Henry from the Jet Propulsion Laboratory gave a talk on NASA and the kind of spacecraft on the agenda for the future. He was a funny guy.

Tuesday, June 18, 1991

We met in the library for Dr. McCarthy's

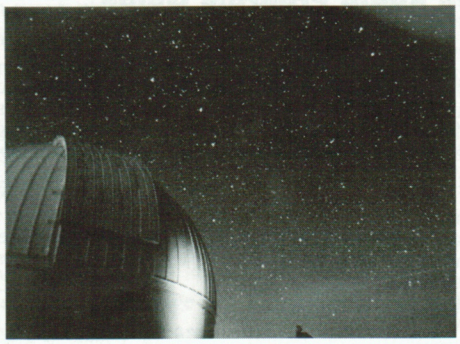
Sequestered atop a chilly mountain, far from the spilled light of cities, inhabited by only a few busy scientists and technicians—an astronomical research observatory is usually a rather quiet place. Not so, however, when some thirty teenagers are given reign of the place. The eerie whistling of the wind, usually dominant, is then but background to gasps of amazement, shouts of excitement, howls of laughter, and the occasional predawn yawn.

So it is for several weeks every year, as the University of Arizona's Astronomy Camps take over the research telescopes of Mount Lemmon and Mount Bigelow. The telescopes are the 40-inch and 61-inch Cassegrains and 16-inch Schmidt of the University of Arizona Observatories, the 60-inch Cassegrain of NASA, and the 60-inch Cassegrain of the University of Minnesota. The telescope time has been generously donated by these institutions for this educational venture, which has been operating now for five years.

The camps are administered by Donald McCarthy of the U of A's Steward Observatory. Other faculty from Steward, Pima College, Flandrau Planetarium, and national research centers serve as guest speakers; Steward graduate students serve as camp counselors. There are actually two levels of camp: Beginning and Advanced. The Beginning Camp is for those teens who have no experience in astronomy. The camp serves as an intense introduction to astronomy in particular and science in general. The Advanced Camp is for previous attendants of a Beginning Camp or teens with amateur astronomy experience and knowledge of algebra and geometry. These camps each last a week. Details vary due to facility and people scheduling, but the following is a typical camp.

Camp begins with ice-breaking activities to let everyone, counselors and campers, get to know each other—picnic or pizza dinner, games both cooperative and competitive, and discussion of the coming week's activities. Each camper is given a set of supplies, including a notebook with many astronomy related articles and reference materials. Campers are encouraged to keep a detailed journal of their activities and observations during the coming week. (See "Excerpts from a Camper's Journal.")

The group is divided into research teams of four campers and a counselor, who will work together on research projects and compete together in games. In an Advanced Camp, everyone then proceeds directly to the Santa Catalina Mountains where the telescopes they'll soon be using are located. Beginning Camps spend the first three nights in Tucson, housed in Coronado Hall on the U of A campus.



The dome of the 60-inch on Mt. Lemmon.

These first days are filled with an intense introduction to astronomy—the basics as well as the frontiers. Lectures on light, time, and telescopes are interspersed with activities such as volleyball, model rocket building and flying, physics games, and behind-the-scenes tours of Kitt Peak National Observatory, Flandrau Planetarium, and the Steward Observatory Mirror Lab spin-casting facilities. During eveningtime, constellation learning, satellite watching, and observing with the 21-inch telescope on the U of A campus prepare campers to use the big telescopes in the Catalinas.

The two Catalina observatory campuses are at an altitude of approximately 8,700 feet, nestled in the alpine Coronado National Forest. The researchers' dormitories on Mount Lemmon provide housing, cooking facilities, and an indoor gym; the surrounding forest provides numerous opportunities for outdoor activities, such as orienteering and hiking to several dramatic lookouts.

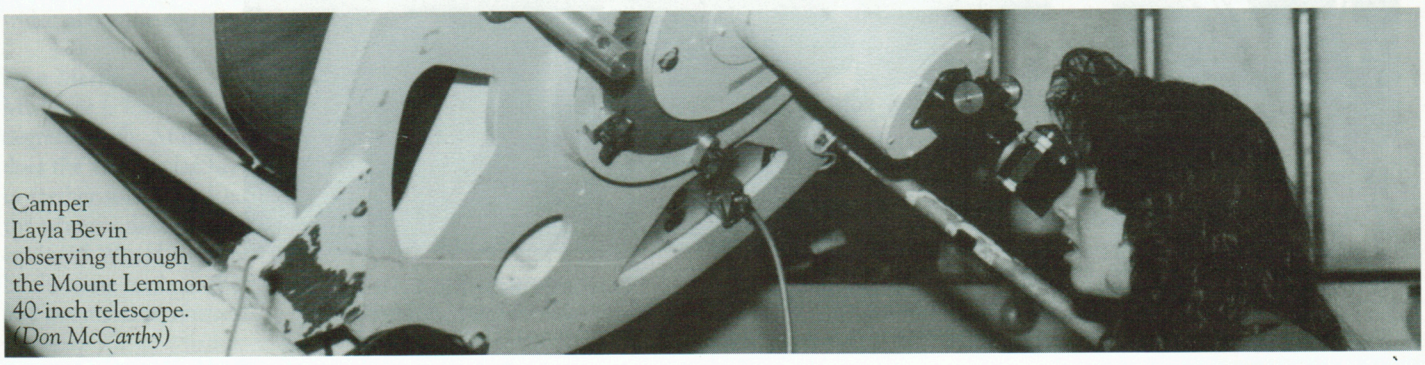
The astronomers' schedule begins when they arrive at the mountain: up 'til dawn and sleep 'til noon. Daylight hours are spent with numerous activities, such as hiking and orienteering, lectures on stellar evolution, black holes, galaxies, and painting with noted space artist Kim Poor. A popular modeling activity teaches concepts of scale and the vast distances separating Earth from other planets and the far vaster distances between stars.

The real activity begins at sundown, of course. The 60- and 40-inch telescopes are on Mount Lemmon; the 61-inch telescope and the 16-inch Schmidt camera are on Mount Bigelow, a short drive away. Several portable telescopes and binoculars are also available. Campers operate the telescopes, which vary in the degree to which they are computerized, and learn to find objects by hand-slewing a telescope (operating manual controls that in turn move the telescope incrementally) and "star-hopping" (moving the telescope's field of view from one star to another until the desired object is found) as well as by punching coordinates into a control system and seeing their object drift onto the TV monitor. Once an object is acquired, eyepieces, photographic cameras, CCD cameras, photometers, and spectroscopes are available to view and record it. While viewing a variety of objects and using different instruments, individual research teams may also have an ongoing observing project to study one object in detail. Obtaining variable-star light curves, determining the orbital parameters of an asteroid, and tracking the moons of Jupiter are just a few possibilities.

The vagaries of the weather are another aspect of astronomy that campers sometimes get to experience. Making simple telescopes and spectroscopes, using astronomical computer programs, and experimenting with liquid nitrogen are among the options during overcast skies.

Come the end of the week, campers present their project results. A graduation

Opposite: Sunset from Kitt Peak during the 1991 Beginning Astronomy Camp. *(Photo by Diana Johnson)*



Camper Layla Bevin observing through the Mount Lemmon 40-inch telescope. *(Don McCarthy)*

talk on light and telescopes. He brought out a Celestron 8-inch Schmidt-Cassegrain and showed us how it works. Then Davy, Todd [counselors], and Dr. McCarthy talked about our research projects for the week. Each group will do a variable-star photometry project, and then we can pick from a list of other projects. I think I would like to work on globular clusters and maybe the orbits of asteroids.

After lunch Davy and Todd led us in a scale-modeling activity where we each represented a planet in the solar system and we scaled the sizes and distances and then walked out to the spots where our planets would be. Boy, is there a lot of empty space in between the planets! We put the sun outside of the UM gym, and Neptune was all the way outside of the gate to the observatory and down the road.

My research team met in the UM gym at 4:30 to discuss our projects. Chris and I (one of my teammates) want to work on globular clusters and possibly asteroids. Cindi (my roommate) wants to study the way the terminator moves across the moon. Tonight the group whose variable star is RR Lyrae will be at the 40-inch, so maybe Chris and I will get some pictures of globs. Davy said he will help us.

After a delicious dinner, Liz Matty from Pima College showed us how the photometer works. Clouds appeared at about 8 p.m., so Chris and I went back to the Library to play with the telescope simulator on the IBM. After a while everyone headed back to the gym for Dr. McCarthy's liquid-nitrogen demonstration. Todd decided to do his "star party," which was very funny.

Soon, the sky began to clear and we headed up to the 60-inch.We took a couple of exposures of the globular cluster M13, and Davy asked if I wanted to take some pictures of M51, my favorite spiral galaxy. But the clouds reappeared and were being stubborn, so we called it quits around 4:15 a.m.

It is cold at night. When we are busy, I don't notice the chill. But I can't sit down and rest or I freeze.

Wednesday, June 19, 1991

Today we woke up at 11:30 a.m. and had brunch at noon. Jill [guest speaker] did her talk on Mars and Earth topographic mapping. Neat Stuff!

After her lecture, Jill took us out near the edge of the observatory and showed us how to use a compass. Then we had a race in the woods!

We walked to the 60-inch and saw Venus in the daytime. Todd talked to us about comparative planetology, and we did an activity where we found the height of some mountains on the moon from a picture. Then Sally [counselor] talked about spectroscopy and nebulae.That was one of my favorite lectures so far.

First Chris and I went to the 40-inch where Cindi was taking photos of the moon. Io passed in front of Jupiter at 9:45, but we missed it.

We took three groups of three observations each of the star Beta Lyrae, and Cindi worked the computer while I did the photometer. We really learned how to do it fast—I had no problem finding the comparison star after a while, and we finished in record time.

Eric [counselor] is a neat guy, very funny. He really helped me understand the crazy finder charts and all of the little scopes on the

40-inch. While Liz was fixing the computer Eric and I were talking about astronomy as a career.

Thursday, June 20, 1991

Here we go to Tucson! We got to the Lunar and Planetary Laboratory and Dr. Robert Strom showed us some images and the JPL movies. Then we set out for Kitt Peak. Grace took us up to the 12-meter radio telescope. It is so huge! We took a group picture outside of it.

After the gift shop, we travelled to the Steward 90-inch, and John Waack talked to us about astrophotography. Davy is going up to the Multiple Mirror Telescope (MMT) tomorrow to work on his thesis. Wow!

After talking, we all walked up to the 4-meter telescope. We went through a series of elevators and then finally emerged in the dome. There is a mammoth telescope in there. I can barely imagine how wonderful it would be to observe on this telescope. Davy, Jill, and I sat down at the edge of the dome and just looked at it, while the men who were getting ready to observe were cooling their instrument.

When it got dark, we watched the observers do their thing in the 90-inch, and talked to Dr. Tom Gehrels, who is using the other Steward telescope to look for near-earth asteroids. Towards 11:30 we left for Tucson. We met Todd and Davy at the Alumni Building, switched drivers, and wished Davy good luck at the MMT.

We got to the observatory at about 2:30 a.m. and immediately Eric and I went to the 40-inch. The computer was balking but Sally finally came over and we fixed it.

Friday, June 21, 1991

We opened up the dome of the 40-inch and aimed at Venus to calibrate the sidereal time and the hour angle. The "seeing" is a little bad tonight but there are no clouds.

When it was dark enough, we fired up the photometer. We found Beta Lyrae relatively quickly and began to take measurements. Jeremy has been bringing me hot chocolate periodically, and now it is around 12:30 a.m.

We will be up for another 5 hours or so...

Don took Carrie, Jeremy, Rob, and I down to the Schmidt to take a 1/2-hour exposure of the Andromeda Galaxy. We got back here at 5:30 a.m. and immediately went to bed.

Using an instrument, whether a photometer, a CCD, or whatever is much more real than just looking through a telescope and taking pictures.

Saturday, June 22, 1991

Eric gave a talk on cosmology at 1:00. At about 3:15 we started a game of balloon volleyball. After dinner James Christy talked to us about how he discovered Pluto's moon Charon. Afterwards, we drove up to Mount. Bigelow to use the Schmidt and the 61-inch telescope. We found M51, Pluto, and Saturn, then put the photometer on RR Lyrae. That was great because the 61-inch is entirely guided by the computer. Chris, Kim, Jill, and I went camera happy.

M31 and M32

Got to sleep just as the sun was rising.

Sunday, June 23, 1991

After brunch we all worked on our projects. I made the light curve for Beta Lyrae. At around 3:30 we started our presentations. They went very well and were very funny at times. I think Don enjoyed it a lot. Then we had a volleyball tournament.

We tried another exposure of M51, but it was sort of cloudy again so I don't know how it will turn out. Don gave a wonderful lecture in the 61-inch cabin, and we all talked about the universe afterwards. I watched Eric develop some prints in the darkroom.

Monday, June 24, 1991

Cindi and I woke up at 7:00 a.m. and packed. The counselors had a gag award for each camper, and they were funny. Mine was the "Scandinavian-camper" award, because when it gets late I talk with a strange accent.

After graduation we went on a tour of the mirror lab; the furnace was turning for a test.

We drove back to the Alumni Building and saw off the people who had to catch a plane home. Lisa drove them to the airport.

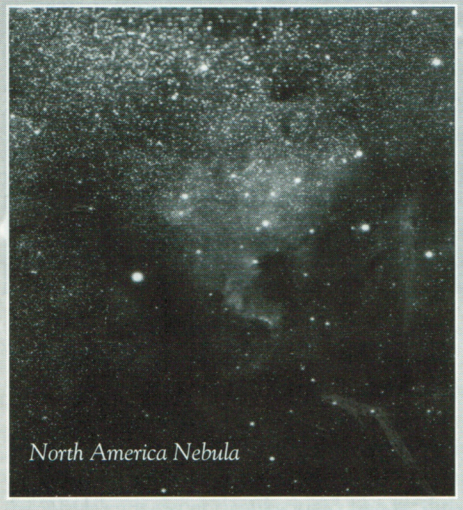
Steward Observatory also runs Beginning and Advanced Adult Astronomy Camps. Similar in content to the Teen Camps described above, they run three days and are typically held in the spring and fall. The schedule of upcoming Astronomy Camps is:

Beginning Adult Camp—October 2,3,4

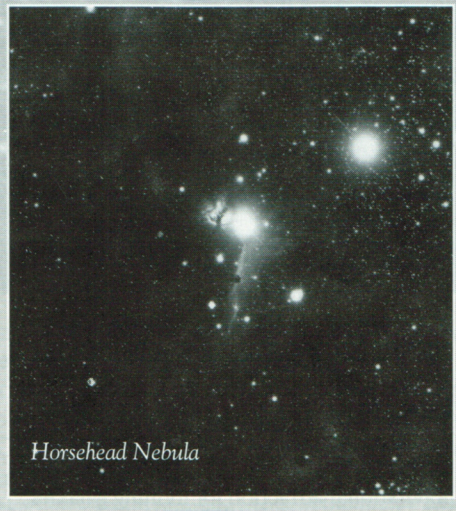
Beginning Adult Camp—October 30, 31, November 1

Advanced Adult—February 19-21 (tentative)

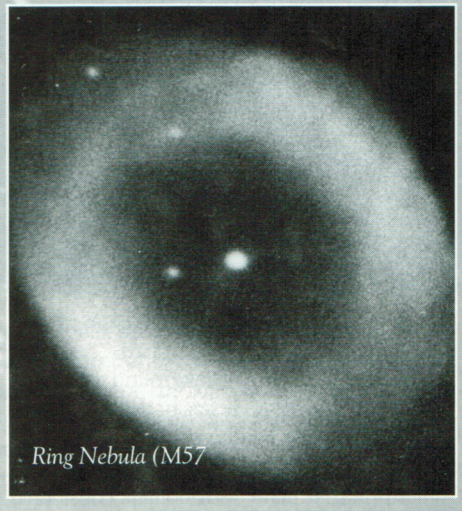
For more information and application materials, contact Lisa Roubal at the Arizona Alumni Association (602) 621-5233 or 1-800-BEAT-ASU (outside Arizona) or Don McCarthy at (602)621-4079.



North America Nebula



Horsehead Nebula



Ring Nebula (M57

Photos Taken by Campers at Astronomy Camp