

East Valley Astronomy Club

July

Newsletter

1996

EVAC MEETING HIGHLIGHTS

The June meeting was started by Robert Kerwin at 7:30 p.m. with 61 people attending, 10 of whom were guests. Robert talked about the scheduled events for EVAC.

7/6 Florence Junction Star Party

7/10 EVAC Club Meeting at SCC

7/20 Lowell Observatory Tour

Robert is going to be the coordinator for the Observing Programs unless someone else volunteers. A foreign exchange student is looking for a place to stay for the next few months. She is from France and interested in Astronomy. Contact Robert Kerwin for more information. Robert will also be running the party line for the summer monsoon season. (Editors Note: Hello out there, the president of our club can't do it all. Surely, someone out there has some spare time and can take one of these tasks from him.)

Sheri Cahn, who is coordinating the Lowell Observatory Trip, will be out of town. She will be gone from July 8 - 17. So if you are thinking about going on the trip, contact her immediately. Sheri also reported that Sky and Telescope subscriptions have been increased to \$27, effective June 1, 1996. This is still a good deal, when compared to the regular subscription rate of \$36.

FEATURED PRESENTATIONS

Since tonight was Members Show and Tell, Tom Polakis informed us that there was to be nine presenters. Of which, eight of them had shown up.

Don Wrigley talked about how to improve the accuracy of your setting circles. He started by showing us how to convert a telescope to a transit instrument. The telescope is locked down so that it can only move in declination at the meridian. When a star across the meridian, look up its Right Ascension. That Right Ascension is the local sidereal time. Then with a timepiece set it to the local sidereal time (remember a

sidereal hour is 10 seconds shorter than a clock hour). By using this method you can have your Right Ascension accurate to within 20 seconds. Typically, your circle is only accurate to about 5 minutes. Once you have determined your meridian's sidereal time, you can locate any object using the hour angle method. By subtracting the object's R. A. from your local sidereal time, you have the hour angle. That is how far east or west your object is from the meridian.

Bob Uhrhammer talked about a telescope he is building. He got the idea for the telescope from Sky and Telescope March 1983 issue by Jim Daley. It is called The Schupman Telescope. It is also referred to as a Medial Refractor. Only a 12.7 inch survives in Germany. Jim Daley also wrote Amateur Construction of Schupman Medial Telescope. Bob's telescope will be 7.8". He will be using BK-7 glass. So far the glass has cost him \$153. Compare that to any other 8" refractor. The color correction is balanced by using the same glass. The primary lens Convex (positive) adds the errors, then a Concave (negative) second surface mirror with a field lens subtracts out the errors. Since this telescope uses both lenses and a mirror it is a catadioptric. But since the objective is a lens, it is called a Lens Catadioptric. Bob has kindly written an article about his telescope for this newsletter.

Chris Schur showed us 10 of his latest pictures. They were, for the most part, 1 hour exposures on hypered Tech Pan film. Several of the shots were of spiral galaxies showing great detail. The Ring nebula was over exposed so that IC 1296 would show. A 15th magnitude galaxy. He also had a interesting shot of the Ghoul Nebula. Look that up in your Uranometria.

IN THIS ISSUE

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- CALENDAR OF EVENTS AND MORE

Tom Polakis had a well done multimedia program for us. He showed 75 of his best astronomy related slides with music. It was very fast paced and left you wondering. The group enjoyed it immensely.

Tony Ortega is experimenting with a Photographic Version of the Uranometria. Actually, he discovered that the frame of 35mm film corresponds closely to a plate of the Uranometria. Tony took a 10 minute exposure of the sky with 135mm lens. The picture matched closely plate 219, which is the plate with the variable star, Mira. Tony xeroxed page 219 and whited out all the celestial objects. This just left the grid and nomenclature, which he then copied onto to a transparency. (Whiteout and paper are opaque.) While exposing the image onto photo paper, he lined up the grid. The final image shows white stars on a dark background with a white grid. The photograph shows stars to about the 11th magnitude. Tony is planning on doing some 10 or so of the most interesting charts in the Uranometria.

Pierre Schwaar showed us his video on his close observations of Venus coming into conjunction with the Sun. In theory, Venus can be seen when it is in conjunction. During the first week of June, Venus was approaching the Sun. From June 3, Venus was traveling about 2° per day. Pierre was video-taping his observations. His closest approach was on June 8, when Venus was only 5° from the Sun. The crescent wasn't quite 360° or circular. Although several members of the audience thought it was. For more information, there is an article about this subject in the March 1972 issue of Sky and Telescope.

Paul Dickson discussed the Deep Sky software program that he uses to create findercharts and diagrams for the SAC newsletter and his personal use. At \$129, the recent upgrade is on CD-Rom and works on windows

95. The program plots all the NGC catalogs and more. It plots stars down to the 9th magnitude. It also allows you to add and plot new objects, as comets and asteroids. Paul used this planetarium program to create SAC's Best 110 objects of the NGC.

Russell Chmela talked about his recent experience at the Texas Star Party. He had 7 nights of relatively clear skies. He discussed virtues of going to one the big Star Parties. Everyone should go at least once. He then laid out photographs that he took at TSP.

The meeting was over at 8:50 pm, when everyone socialized with brownies and soda. All the presenters stayed and fielded questions.

JULY GUEST SPEAKER

Our speaker for the July meeting will be Marc Buie from Lowell observatory. The title of his talk is, "Monitoring the seasons on Pluto: The ultimate in taking a long view."

CORRECTION

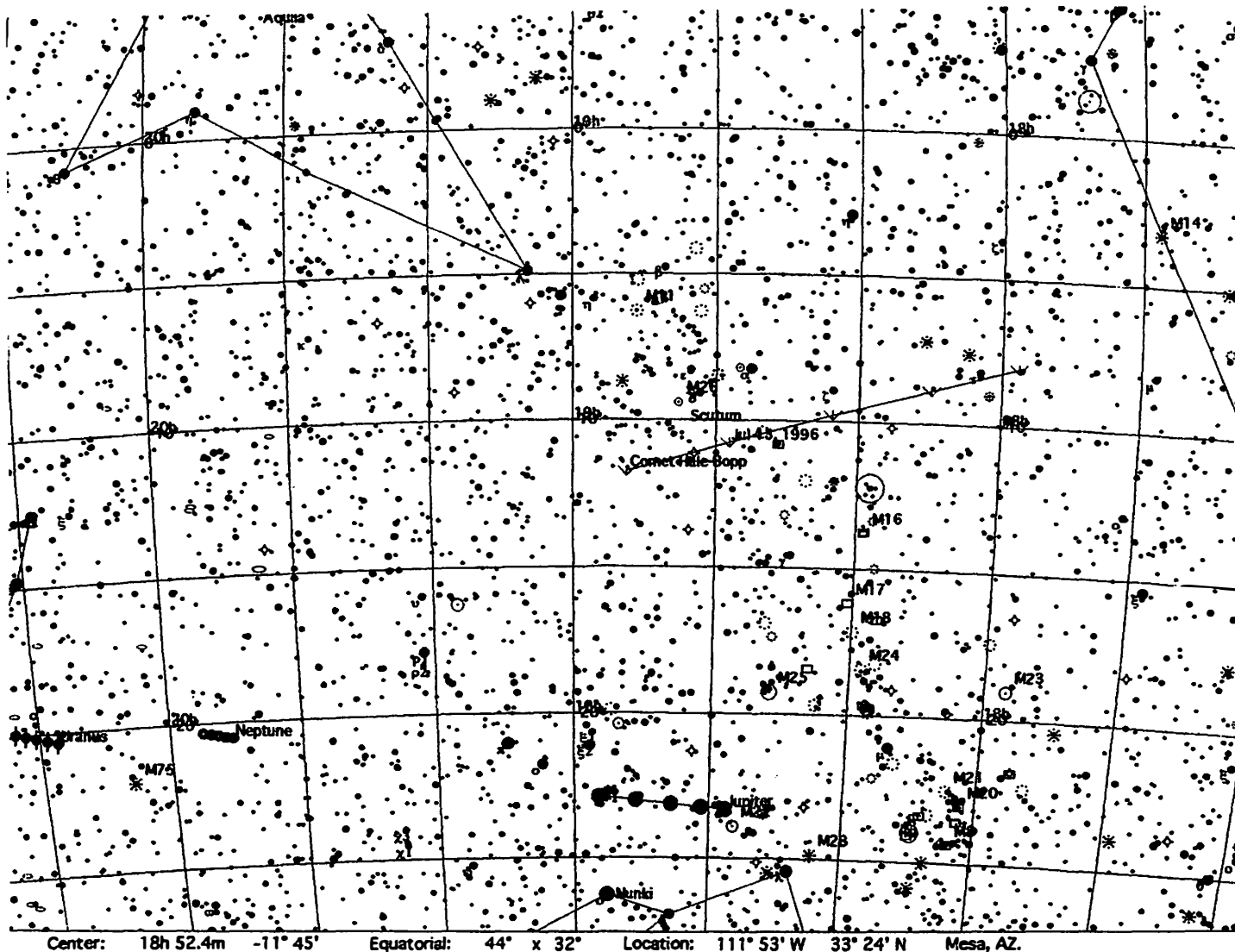
In the June issue of the newsletter, there is an error regarding the Expansion of the Universe. Galaxies are receding from us at the rate of 162,000 miles per hour for every 3.26 million light-years not miles. If it were miles, the Earth would be moving away from the Sun at 1 million miles per hour and accelerating.

I would like to thank those that told me about this glaring error. At least some one is reading the newsletter. The information that I published was received from the Space Telescope Science Institute. I made the mistake of not thoroughly editing their press release. I figured they knew what they were doing. I'll try to be more vigilant in the future. The Editor.

1996 EVAC SCHEDULE OF EVENTS

	Meeting	Local	Deep Sky	New Moon
JUL	10	6	13	15
AUG	14	10	17	14
SEP	11	7	14	12
OCT	9	5	12*	12
NOV	13	2&30	9	11
DEC	11	-	7	10

Other Events: JUL 20 EVAC Tour of Lowell Observatory
 OCT 12 *All Arizona Star Party



COMET COMMENTS for July 1996
By Don Machholz

Comet Hale-Bopp (C/1995 O1) is now visible to the unaided eye -- at least to some eyes. The rest of us will have to be content with binocular views of the comet for a while longer. This comet will likely be a naked-eye object for more than a year, the Northern Hemisphere will see it through mid-May 1997. This affords an opportunity to conduct an experiment, and to set a personal record: for how long you can follow the comet without optical aid. In 1985-86 Halley's Comet was seen for about seven months, and early in the last century the Great Comet of 1811 was a naked-eye object for about nine months. Simply record the first night you view Comet Hale-Bopp with the unaided eye, and, sometime next May, your last naked-eye viewing. The comet is presently 3.2 AU from us and 4.1 AU from the sun.

The above star chart plots the position of Comet Hale-Bopp from July 2 to August 9, 1996. The chart is from the Voyager II software by Carina Software.

EPHEMERIDES

C/1995 O1 (Hale-Bopp)
DATE(00UT) R.A. (2000) Dec. El. Sky Mag.

07-01	18h54.7m	-11°53'	168°	M	6.3
07-06	18h47.7m	-11°23'	168°	E	6.2
07-11	18h40.5m	-10°54'	165°	E	6.1
07-16	18h33.3m	-10°24'	160°	E	6.0
07-21	18h26.0m	-09°55'	154°	E	5.9
07-26	18h18.9m	-09°26'	149°	E	5.8
07-31	18h12.0m	-08°59'	142°	E	5.7
08-05	18h05.5m	-08°32'	136°	E	5.7
08-10	17h59.4m	-08°07'	130°	E	5.6

ELEMENTS

Object	Hale-Bopp
Peri. Date	1997 04 01.14561
Peri. Dist (AU)	0.9140971 AU
Arg/Peri (2000):	130.59227°
Asc. Node (2000):	282.47087°
Incl (2000)	89.42807°
Eccen:	0.9950784
Orbital Period:	3000 yrs.

NAKED EYE ASTRONOMY

M. Aaron McNeely

July 1996: month of Julius Caesar
31 Days: day 183 to 213 of the year
Julian: 2450265.5 to 2450296.5
Phoenix, Arizona
33 27'N, 112 04'W

"High o'er his head the beams of Sirius glow,
And dog of Nile, Anubis, barks below"-Admiral Smyth

Constellations and Starlore

July evenings are characterized by the transit of Scorpius above the southern horizon. Scorpius, with its bright "heart" Antares (or Cor Scorpii), is one of the few constellations that actually resemble its mythological figure. Above Scorpius lies the dim figure of Ophiuchus, the Snake Handler. The origin of Ophiuchus can be traced back to the Egyptian sage Imhotep, builder of the first pyramid, the step pyramid of Sakkara, and is one of the only constellations that was derived from a real historical figure (the other is Coma Berenices). To the left of the Scorpion lies Sagittarius, with its distinctive Teapot asterism, and to the right is the simple pattern of Libra. Hercules, with the famous naked eye globular cluster M13 located along the western edge of the Keystone, lies near the zenith, Bootes and Coma Berenices have begun to follow Leo sinking in the west. The Great Square of Pegasus is rising in the east and following Cygnus and Lyra. The ancient constellation of Draco, home of the north ecliptic pole and symbolic of the Adam and Eve myth, is culminating above Ursa Minor and Polaris. Cassiopeia is circling upward in the northeast while the Big Dipper, Ursa Major, is circling downward in the northwest. Both constellations are circumpolar and lie roughly opposite of Polaris in the center. The low part of the ecliptic, represented by Scorpius and Sagittarius, is in the south at sunset. The Full Moon of summer lies in this area and contrasts with the high Sun of summer. Recent Full Moons have been especially high due to the location of the lunar nodes near the equinox positions. The 5° tilt of the lunar orbit with respect to the ecliptic is especially evident due to this juxtaposition and the Full and gibbous phases lie an extra 5° above the ecliptic. Delta Aquarid (Southern) meteors are visible in the predawn sky of July 23-28, but the shower will be degraded by the presence of the waxing gibbous and Full Moons. The Dog Days begin on July 3rd, and July 2nd at midnight marks the midpoint of the year.

Scorpius is especially memorable in that it provides an excellent indicator of the shift of the celestial sphere with change in latitude upon the Earth. I have been in Montana, where the bottom half of Scorpius does not rise, and in Mazatlan, Mexico, near the Tropic of Cancer, where Scorpius transits much higher above the south horizon. In my home state of Indiana, Scorpius barely makes it above the horizon. From Phoenix, Scorpius is 10° higher than back home. (Interestingly, this latitudinal shift of the celestial sphere was used by ancients such as Aristotle and Ptolemy to logically

conclude that the Earth is a sphere.) I enjoy seeing stars below Scorpius, as well as southern sky treats such as Omega Centauri and NGC 253 (I had observed NGC 253 from Indiana, but it is much easier here).

"Dog Star, that burning constellation, when he brings drought and diseases on sickly mortals, rises and saddens the sky with inauspicious light."-Virgil

The Dog Days, the period from July 3 to August 11, follow the reappearance of Sirius in the morning sky right before sunrise, the stars heliacal rising. It was a common belief in ancient Greece and Rome that the combined heat of the Sun and Sirius was responsible for the intense heat of summer. Not all held to this belief however, Geminus of Rhodes, a Greek astronomer of the first century B.C., stated that "Sirius...merely marks a season of the year when the sun's heat is the greatest." In Egypt, the heliacal rising of Sirius coincided with the annual flooding of the Nile river, an event of much importance because it fertilized the land for agriculture. In Egyptian mythology, Sirius represented the goddess Isis and the wife of Osiris, seen in the stars of today's Orion.

In astronomical history: July 4th marks the anniversary of the 1054 A.D. supernova that produced the Crab Nebula and that was possibly observed by Native Americans of the Southwest; Newton's Principia was published on July 6th, 1687; Vega became the first star other than the Sun to be photographed, July 16th, 1850, Harvard Observatory; Edward Pickering was born on July 19th, 1846; July 20th marks the anniversary of the Apollo 11 lunar landing in 1969, the first humans on the Moon, and the landing of Viking 1 on Mars, 1976.

Planets, Moon, Sun

Mercury achieves superior conjunction on the 11th and passes into the evening sky. The planet will be visible towards the end of July low above the west-northwestern horizon. Mercury lies within one degree of Regulus on the evening of the 31st.

Jupiter achieves opposition on July 4th and will be visible all night. On the evening of opposition Jupiter transits at a height of 34° above the south point of the horizon. The planet is positioned near the low point of the ecliptic in Sagittarius and lies just above the Handle of the Sagittarius Teapot. Jupiter will be 0.2 south of 5th magnitude Nu1 Sagittarii on the evening of the 6th. Comet Hale-Bopp, positioned against the stars of Scutum, also achieves opposition on the 4th and lies about 20° north of Jupiter. At this time the comet will have achieved the naked eye and binocular visibility of 6-7th magnitude.

Neptune is in eastern Sagittarius and achieves opposition on July 18th, Uranus lies in Capricornus and achieves opposition on the 25th. Both planets are visible in binoculars and exhibit magnitudes of 7.8 and 5.7 respectively.

Saturn, in Cetus, rises a bit past midnight at the beginning of July and about an hour earlier at month's end. For the telescopic observer, Saturn's rings achieve their greatest tilt from the horizontal in July for the year. Saturn is stationary on July 19th and begins retrograde motion. Saturn achieves opposition in September.

Venus entered the morning sky last month to become a prominent Morning Star for July and the rest of the year. The planet quickly ascends in altitude during July and achieves greatest brilliancy, magnitude -4.5, on the 15th, and appears as a thick crescent in binocular and telescope. Venus appears against the backdrop of Taurus during July and lies 2.4 east of Aldebaran on July 3rd. Mars is also nearby, and Venus was 4 southeast of Mars on June 28th. Venus undergoes a beautiful conjunction with the waning crescent Moon on the morning of the 12th.

Mars, in the morning sky, lies between the Horns of Taurus during July and passes 2 north of Zeta Tauri on the morning of the 18th.

In universal time the Moon is Full on the 1st of July, in American time zones this falls on the 29th of June. On June 29th the Full Moon lies near Jupiter, on July 1st it lies above Neptune, and on the 6th the waning gibbous Moon approaches the vernal equinox position of the celestial sphere.

The First Quarter Moon of July 7th lies 3 northeast of Saturn and on the 9th the waning crescent lies north of the Head of Cetus. On the morning of July 11th the waning crescent is positioned to the upper right of the Hyades while Venus is positioned to the lower left and on the morning of the 12th we are treated to a close conjunction of the crescent moon and Venus. The separation is about 1/2 , the Moon actually occulted Venus in daylight in Europe. After this morning spectacle the thin waning crescent lies near the Club of Orion in morning twilight on the 13th.

New Moon occurs on the 15th, and afterward the waxing crescent appears southeast of Regulus on the 18th. On the 20th the Moon approaches the autumn equinox position of the celestial sphere, a reflection of the fact that the nodes of the lunar orbit lie near the equinox positions, and lies south of Porrima in Virgo on the 21st.

The First Quarter Moon of July 22nd lies near Spica, on the 25th the waxing gibbous Moon lies above the Crown of Scorpius and close to Graffias. The swelling gibbous disk is positioned to the upper right of Jupiter on the 27th and in roughly the opposite position on the 28th. The nearly Full Moon of the 29th lies very close to Dabih in Capricornus. The Moon is Full on the 30th, a Blue Moon in universal time. A Blue Moon is the second Full Moon within the span of one calendrical month, and the Blue Moon for the Americas occurred last June 29th.

On July 15th, the day after New Moon, the Moon achieves its farthest apogee of the year. Just over two

hours before Full, the Moon achieves its closest perigee of the year on the 30th. The coincidence of this perigee with the Full phase will result in the highest tides of the year.

This year the Earth achieves aphelion, its farthest distance from the Sun each year, at 11:00 am, MST, July 3rd, at a distance of 94,509,780 miles.

The sunrise positions in azimuth for July 1st and July 31st are 62 and 68 , and the sunset positions are 298 and 291 respectively. On July 20th the Sun enters the constellation Cancer at ecliptic longitude 190.6 .

Astro Quiz: What celestial object was named the "Star Queen" by Robert Burnham?

**LAST CHANCE
EAST VALLEY ASTRONOMY CLUB
TOUR OF LOWELL OBSERVATORY
SATURDAY JULY 20, 1995**

The East Valley Astronomy Club will be taking a busload of people to Flagstaff to tour Lowell Observatory. We will visit the original site in Flagstaff at Mars Hill and the dark-sky site at Anderson Mesa, 20 miles to the south. The tour promises to be more behind-the-scenes than the typical tour.

Cost: The tour will cost you \$15, which will pay for the charter bus fare and tour guide expenses.

Where/When: We will meet at 7:00 a.m. sharp at the Valley Fair Shopping Plaza, on the southeast corner of Mill and Southern, in Tempe. We should get back by 9:00 p.m.

Bring: A sack lunch, for a picnic area in Flagstaff.

Warm clothes and an umbrella - it's the monsoon season at high elevation.

Money - we'll make a fast food stop on the way back. Also, Lowell has a new visitor center and gift shop.

Here's how to get on board this trip. Contact Sheri (see phone and address below). Space is filling up. Write a non-refundable check to East Valley Astronomy Club" for \$15 per person.

Sheri Cahn
3721 W. Hayward Ave.
Phoenix, AZ 85051
246-4633

Subject: Press release on Natue paper on z=1.55 galaxy

From: SMTP%"ISPSNK@ASUVM.INRE.ASU.EDU"
12-JUN-1996 16:41:04.63

**ASTRONOMERS ADD TO PROBLEM OF COSMIC
PROPORTIONS**

The conflict between the age of the universe and the age of its oldest stars just got worse. A faint galaxy at the far reaches of the universe has joined the list of objects that appear to be older than the universe itself.

An international team of scientists, including Arizona State University's Rogier Windhorst, has determined that the galaxy is about 11 billion years old. The age of the universe as measured by the Hubble Space Telescope, however, is just under 10 billion years.

The finding reinforces a major problem in cosmology, the study of the universe's origin. Windhorst and his co-authors, led by the University of Edinburgh's James Dunlop, reported their finding in the June 13 issue of the journal *Nature*.

One way to solve the age problem: assume that what Albert Einstein considered to be his greatest mistake was no mistake at all. But that solution has problems of its own.

Astronomers already were puzzling over the age of the Globular Clusters, collections of hundreds of thousands of stars in the Milky Way Galaxy. The Globular Clusters appear to be about 14 billion years old, based on a well-developed understanding of how stars evolve.

"We now know that the Globular Cluster age problem is not just a fluke," Windhorst said. "We believe it's a serious problem that indicates fundamental uncertainty in cosmology."

As members of the Milky Way Galaxy, Globular Clusters are sitting in Earth's astronomical backyard. The 11-billion-year-old galaxy described in *Nature* is much farther away, providing an independent verification of the same problem posed by the Globular Clusters.

Windhorst discovered the distant galaxy, designated 53W091, in 1986 with David Koo of California's Lick Observatory. Windhorst and Koo originally imaged the galaxy on the 200-inch telescope at Palomar Observatory near San Diego. But even with the 200-inch telescope, one of the largest in the world at the time, they still could not measure its distance from Earth.

Then last year, members of Dunlop's team -- Hyron Spinrad and Daniel Stern of the University of California, Berkeley, and Arjun Dey of Kitt Peak National Observatory -- made additional observations of the galaxy using the larger, specially equipped 10-meter Keck Telescope at Mauna Kea, Hawaii. The team found remarkable similarities in the light waves emitted by galaxy 53W091 and galaxy M32, a well-studied galaxy in Earth's neighborhood.

M32 is a dwarf, elliptical galaxy about 3.5 billion years old. Galaxy 53W091 appears to be about the same age, except that it is more than 7 billion light years from Earth. Astronomers see the galaxy today as it looked when the universe was only one-fourth as old as it is now. A galaxy that old at that distance from Earth would make the universe about 14 billion years old.

To illustrate the problem, Windhorst drew an analogy to the historical calendar. Let's pretend that the

universe was born about 2,000 years ago, in the year zero. Astronomers living in the year A.D. 1996 figured out that the Globular Clusters were born 2,500 years ago, which is the year 500 B.C.

Then astronomers come across a reliable document telling them that galaxy 53W091 was found to be 900 years old in the year A.D. 500. The galaxy's birthdate would be 400 B.C., nearly as old as the Globular Clusters. Now astronomers must come up with a theory that brings creation back in time by at least 500 or 600 years.

"People have suggested that perhaps the easy way out is to say in hindsight that Einstein was never wrong," Windhorst said. The universe should be expanding, according to Albert Einstein's theory of general relativity. But when Einstein proposed the theory in 1917, scientists believed the universe was static. He took care of the problem by introducing a force in his equations called the cosmological constant.

In 1929, astronomer Edwin Hubble discovered that the universe does expand. Hubble found that as a result of the Big Bang, all galaxies move away from each other with a speed that is proportional to their distance. Einstein then recanted his cosmological constant, calling it his greatest mistake.

Nevertheless, the cosmological constant would help solve the age problem presented by the Globular Clusters. If the cosmological constant were valid, the universe could have expanded more slowly for a long period early in its history than it did later. Following this scenario, the Globular Clusters could indeed be 14 billion years old.

Unfortunately, scientists prefer simple, elegant theories. The cosmological constant complicates the simple, elegant and widely accepted model of an expanding universe.

There is yet another complication identified by Simon Driver, a former ASU postdoctoral researcher, now with the University of New South Wales in Sydney, Australia. He, Windhorst and two colleagues at the University of Bristol laid out the problem in the April 20 issue of the *Astrophysical Journal*.

Driver counted fewer galaxies of certain types in Hubble Telescope images than would be expected if the full value of Einstein's cosmological constant were valid. A partial value of the constant does account for the number of observed galaxies, however.

In that case, Einstein could be partially correct, but that would still leave a universe younger than the Globular Clusters. "We've basically enhanced the problem," Windhorst said. "We've made it worse instead of making it better."

Steve Koppes, assistant director

Editor's Note: Rogier Windhorst was the guest speaker at our April Meeting.

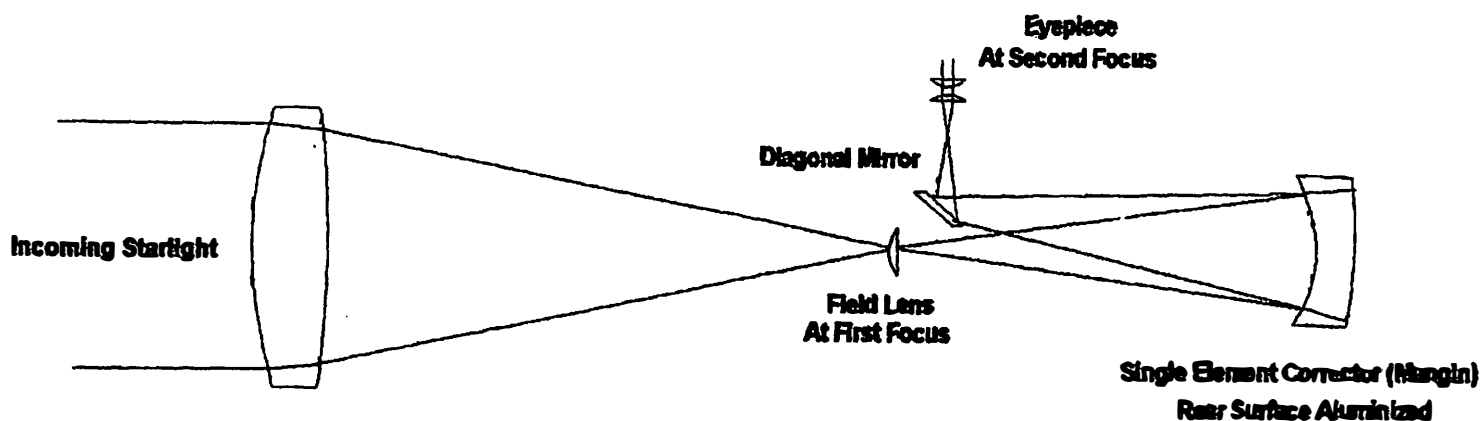
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30 ☉	1 *ALL MONTH NOTES	2	3	4 *Jupiter at Opposition	5 *3:16, 4:36 AM Occ *10:28, 11:47 PM →	6 Local 5 Party *12:46, 2:42 AM Gal Moons
7 ☉ *9:02, 9:13, 9:28 PM →	8 *12:59 AM Gal Moons Sunset 7:41 PM Sunrise 5:26 AM	9	10 EVAC Meeting	11 *Mercury-Superior Conjunction	12 *9:30, 10:25 PM → *4:00 AM Venus/Moon Conjunction	13 Deep Sky 5 Party *12:12, 12:31, 2:02, 2:40 AM Gal Moons *9:27, 9:41, 11:42, 11:57 PM Gal Moons
14 *8:29, 9:00, 9:09, 11:15, 11:47 PM →	15 *12:45 AM Gal Moons Sunset 7:35 PM Sunrise 5:35 AM	16 ☉	17 *Venus at greatest brilliancy-mag -4.5 *8:08 PM Occ	18 *Neptune at Opposition	19	20 EVAC Lowell Tour *Ceres Stationary *11:11, 11:36 PM →
21 *1:27, 1:52 AM Gal Moons	22 *8:22, 10:43, 11:03, 11:34 PM → Sunset 7:35 PM Sunrise 5:35 AM	23 ☉ *1:30, 2:22 AM Gal Moons	24	25 *Uranus at Opposition	26 *7:30 PM SAC Mtg	27
28 *10:07 PM → *10:40 PM Occ *4 AM - S. delta Aquarid Meteors	29 *12:57, 12:59, 2:09 AM Gal Moons *5 AM - alpha Capricornid Meteors	30 ☉	31 *8:00 PM Mercury/Regulus Conj.	1 *8:00 PM Mercury/Regulus Conj.	2	3 

Date	Start	Title	Description
7/1/96	12:00 AM	ALL MONTH NOTES	<p>CALENDAR NOTES: See 1996 EVAC Occultation Predictions in the February newsletter for details on lunar "Occ" events. "Gal Moons" refers to at least 3 events of Jupiter's satellites. See Sky&Telescope (S&T) and Astronomy (Astro) magazines for more info. There are no meetings of the Phoenix Astronomical Society (PAS) until September.</p> <p>PLANETS: This month, max lunar librations all occur when the applicable limb is not sunlit. MERCURY moves from a difficult morning object to a difficult evening object. VENUS moves rapidly away from the solar glare in the morning sky and is easy to spot at a brilliant white -4.5 magnitude. MARS is still low, small, and difficult in the morning sky. JUPITER reins all night, rising in the southeast at sunset. SATURN rises about midnight as a pale yellow 1st magnitude "star" in the southeast. The classic look of this planet is returning as we leave the plane of the rings. URANUS, NEPTUNE, and PLUTO are all well placed for observation right after dark. See pg 64 of the July Astro or pg 70 of the April S&T for findercharts.</p> <p>OBJECTS OF INTEREST: Comets Hale-Bopp and Kopff (pg 70 and 66 of the July Astro). Minor Planets Ceres (pg 77 July S&T), Pallos (pg 66 July Astro).</p>
7/26/96	7:30 PM	7:30 PM SAC Mtg	Saguaro Astronomy Club meeting, Grand Canyon University, Fleming Bldg, Rm 105. Camelback and 33rd Ave.
7/28/96	4:00 AM	4 AM - S. delta Aquarid Meteors	Moonlight will prevent seeing faint members of this shower, but increased meteor activity (up to 20/hour) is expected around this date.
7/29/96	5:00 AM	5 AM - alpha Capricornid Meteors	Full Moon will wash out most of the 8 or so meteors/hour associated with this shower.
7/31/96	8:00 PM	8:00 PM Mercury/Regulus Conj.	Mercury is only 1 degree north of the star Regulus low in the west (5 degrees up).
8/1/96	8:00 PM	8:00 PM Mercury/Regulus Conj.	Tonight Mercury is 1 degree east of Regulus.

JULY 1996

	START OF DARK	9P	9:30	10P	10:30	11P	11:30	12M	12:30	1A	1:30	2A	2:30	3A	3:30	4A	4:30	END OF DARK	TOTAL DARK
THURS NITE	7/4 9:24 PM EOT	<--	<--	<--	<--	<--	<--	<--	<--	<--	<--	<--	<--	<--	<--	<--	<--	7/4 10:32 PM MR	1:08
FRI NITE	7/5 9:23 PM EOT																	7/5 11:11 PM MR	1:48
SAT NITE	7/6 9:23 PM EOT																	7/6 11:49 PM MR	2:26
SUN NITE	7/7 9:23 PM EOT																	7/8 12:26 AM MR	3:03
MON NITE	7/8 9:22 PM EOT																	7/9 1:04 AM MR	3:42
TUES NITE	7/9 9:22 PM EOT																	7/10 1:44 AM MR	4:22
WED NITE	7/10 9:21 PM EOT																	7/11 2:26 AM MR	5:05
THURS NITE	7/11 9:21 PM EOT																	7/12 3:10 AM MR	5:49
FRI NITE	7/12 9:20 PM EOT																	7/13 3:49 AM SOT	6:37
SAT NITE	7/13 9:19 PM EOT																	7/14 3:49 AM SOT	7:08
SUN NITE	7/14 9:19 PM EOT																	7/15 3:50 AM SOT	7:08
MON NITE	7/15 9:18 PM EOT																	7/16 3:51 AM SOT	7:10
TUES NITE	7/16 9:17 PM EOT																	7/17 3:52 AM SOT	7:12
WED NITE	7/17 9:16 PM EOT																	7/18 3:53 AM SOT	7:14
THURS NITE	7/18 9:20 PM MS																	7/19 3:54 AM SOT	7:10
FRI NITE	7/19 9:53 PM MS																	7/20 3:55 AM SOT	6:38
SAT NITE	7/20 10:26 PM MS																	7/21 3:56 AM SOT	6:06
SUN NITE	7/21 11:00 PM MS																	7/22 3:57 AM SOT	5:33

EOT = End of Astronomical Twilight MR = Moonrise SOT = Start of Twilight NOTE: Applicable to Phx Metro area. Times are Mtn. Std. Time Bernie Sanden 6/96



Single Element Objective lens

Schupmann Medial Refractor

(Not To Scale) R. Uhrhammer 06/26/96

The Schupmann Medial Refractor

The medial refractor was invented in the late 1890's by Ludwig Schupmann, A German architectural engineer. Like most of us, his work in optics was as a hobby. The outstanding feature of the instrument is that it achieves perfect color correction using a single element objective lens.

The key to accomplishing this feat is the fact that the starlight is brought to a focus twice. The first focus occurs at the field lens or mirror (the lens version is illustrated). At this point all of the aberrations inherent in a single element lens are present. The most serious of these are Chromatic and Spherical aberration. The front and back curves of the objective are set to a ratio of about 10.4 to 1 which eliminates Coma, the other serious aberration that plagues Newtonian telescopes.

The focal plane is then re-imaged by the corrector or Mangin (Schupmann's "kompensator"). The corrector introduces exactly the same aberrations as the objective but with the opposite sign. The second lens in a conventional refractor attempts to cancel the color errors in a similar way. However, since regular refractor lenses are made of different glass types the match of the "partial dispersions" can never be perfect. Great strides have been made through the use of fluorite and other exotic and incredibly expensive glasses but the problem of partial dispersions remains. Since the Schupmann uses exactly the same glass (preferably from the same melt) for objective and corrector all of the partials are by definition perfectly matched and PERFECT color correction may be achieved.

The role of the field lens is a bit more obscure. The field lens however provides the crowning touch by eliminating several higher order aberrations which would otherwise still be present. These include chromatic difference of magnification and lateral color off axis. The field lens accomplishes it's magic by projecting the image of the objective exactly onto the corrector. This occurs because the other elements are at conjugate foci of the field lens. This is how any projection system works (slide, overhead, movie, etc.).

The result of this is that the entrance pupil at the objective is recreated on the surface of the corrector. Lets just say that this does wonders for the higher order aberrations and leave it at that.

Of course the Schupmann does have disadvantages such as being cumbersome and a bit complex. It is also limited to higher focal ratios such as $f/10$ and above. However when truly diffraction limited performance is needed such as lunar and planetary observing it will certainly be a major competitor.

For my own system I chose an aperture of 7.8 inches and a focal ratio of $f/14$. I am introducing one flat before the first focus to fold the system and keep the tube length to about 80 inches. As for the glass, one wants to use grade A "objective quality" optical glass to avoid problems with striae (streaks), bubbles and non-homogeneous glass. Pyrex would be terrible because it's full of bubbles and streaks.

About the cheapest glass of sufficient purity is BK-7 commonly known as crown glass. I ordered the disks for the main elements from Schott glass technologies in Duryea, Pennsylvania. For the objective I specified 200 mm by 20 mm thick and for the corrector 120 mm by 20 mm thick. It is also very important to request matching both from the same melt or matching indices to .00001. This glass cost \$153 including shipping. I already happened to have some 8 inch plate glass disks to use as tools and some miscellaneous abrasives left over from other projects. Since I already have a set of eyepieces and a spare focuser I believe that I can complete this project for a total cost of about \$350 to \$450. That makes it competitive with a medium size Newtonian for cost.

As of this writing I am nearly finished with the objective. The back side is polished and I'll start polishing the front side tonight. I'm hoping to have the telescope finished by sometime this fall. When it's finished, I'll bring it to one of the star parties and everyone can take a look. I think it's going to make a perfect compliment to my 17 1/2 inch light bucket.

Bob Uhrhammer June 96



EAST VALLEY ASTRONOMY CLUB
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EAST VALLEY ASTRONOMY CLUB

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MEMBERSHIP&SUBSCRIPTIONS: \$20.00 annually. Reduced rates available to members for *Sky&Telescope* and *Astronomy*. Contact Sheri Cahn, 3721 W. Hayward Ave., Phoenix, AZ 85051, (602)-246-4633.

CLUB MEETINGS: Second Wednesday of every month at the Scottsdale Community College, 7:30 PM. Normally Room PS 170 or 172 in the Physical Sciences Building.

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EVAC LIBRARY: The library contains a good assortment of books, downloaded imagery, and helpful guides and is usually brought to the Club meetings. Contact Steve O'Dwyer for complete details, (602)-926-2028.

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