



# SAN FRANCISCO AMATEUR ASTRONOMERS

*Sharing the Wonders of the Universe*

August 1992

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The SFAA Board of Directors meets on the second Wednesday of each month at 8:00 PM at the Randall Museum, 199 Museum Way, San Francisco. All Club members are welcome at Board meetings.

The SFAA Bulletin is a forum in which club members may share their ideas and experiences in astronomy. We encourage you to participate and welcome your letters, sketches and articles on astronomical subjects. Please send your contributions to: SFAA Bulletin Editor, 190 Chilton Avenue, San Francisco, CA 94131. Deadline is the 18th of the month before publication.

## An Amateur HST Proposal

The San Francisco Amateur Astronomers holds lecture meetings on the third Wednesday of each month at 8:00 PM at Morrison Planetarium, California Academy of Sciences, Golden Gate Park. On **August 19** long-time SFAA member Nancy Cox will be telling us about her proposal for observing time on the Hubble Space Telescope. Her talk, accompanied by descriptive slides, is titled: *Exploring Regions of Star Formation: An Amateur HST Proposal.*

Nancy is a full-time registered nurse, a dedicated amateur astronomer (since 1968) and an avid naturalist. She is currently working toward a degree in marine biology at San Francisco State University. She is a former vice-president of the SFAA and our current AANC representative.

Nancy's special interests in astronomy are the moon, planets, solar eclipses and deep-sky objects. These interests brought her to a study of star-forming regions and the submission of her proposal to use the HST to study ultraviolet emission in the Lagoon Nebula (M8). Her proposal is being actively considered by NASA.

As part of her presentation, Nancy will also give us her first-hand reports on two important conferences she recently attended: the ASP annual meeting in Madison, Wisconsin, and Cosmocon '92 in San Jose.

## Mount Tamalpais

The next star party at Rock Springs on Mount Tamalpais is on Saturday evening, **August 29**. At 8:00 PM Richard Shaffer of Zoltch Astro-Instruments will talk on *The Ulysses Mission* in the nearby Mountain Theatre. Bring along your binoculars and telescopes, knowledge and love of the night sky to share with other SFAA members and the general public after the lecture.

## Sky Watch

★ The Perseid meteor shower is worth checking out, even though the moon is nearly full at the time of its predicted maximum, the evening of **August 11–12**. The shower may be unusually rich this year as a result of the return of its source, Comet Swift-Tuttle, for the first time since 1862.

★ Don't miss the close conjunction of Venus and Jupiter on **August 22**. Look for the two bright planets near the western horizon just after sunset.

★ August is a great month to explore the Summer Triangle. At 9:00 PM on **August 29** the bright star near the zenith is Vega in the constellation of Lyra.

## Upcoming Speakers

Director Irving Hochman has just released a tentative line-up of speakers for the regular SFAA monthly meetings for the rest of the year. Here's what we have to look forward to between now and Christmas:

SEPTEMBER 16

*Famous Physicists I Have Known*  
Dr. Max Dresden  
Stanford physicist & researcher at SLAC

OCTOBER 21

*Seeds of the Modern Universe  
in the Ancient Microwave Sky*  
Dr. George Smoot  
Principal investigator COBE satellite

NOVEMBER 18

*SETI—The Search Begins*  
Dr. Jill Tarter  
Research astronomer at UC Berkeley  
& NASA-Ames Research Center

DECEMBER 16

*To Be Announced*  
Dr. Dale Cruikshank  
Planetary astronomer at NASA-Ames



Smile

## Observing at Sugar Loaf

In early July of this year I began looking for an alternative viewing site to Mount Tam and other nearby but sadly deficient places such as my back yard. My prerequisites were that the location be relatively close to San Francisco, have dark skies, be at a moderately high elevation and be easily accessible. Sugar Loaf State Park near Sonoma met all my requirements.

The need for an alternative to Mount Tam had become painfully apparent to me at the star party on May 30. Only a handful of SFAA members were present; many others had gone to Fiddletown. After the lecture I set up my large aperture scope in what I thought was a relatively obscure spot away from the crowds. I was on a ladder adjusting the secondary mirror when I looked down and saw some 200 people milling around below me. There were no other amateur astronomers nearby and no one to control the crowd.

It was like being in Times Square during a blackout. I did my best to be a good host, but the *jerks* and *bores* and *boobs* were in abundance. Someone even rummaged through my equipment and personal effects. I understand that such problems at Mount Tam during the summer are well known to other SFAA members.

Oh, for the peace and quiet of Sugar Loaf State Park! Campsites surround a large open meadow where another SFAA member, Bill McClure, and I set up the 20" scope. Only a couple of the campsites were in use. Further back there is a group campsite available by reservation. There were an abundance of deer, lots of jack rabbits, a few coons and even a skunk. The sky was surprisingly dark and the viewing conditions were very good, with fine contrast and only minor turbulence. We were protected from the wind and not bothered by passing car lights. M11 and M87 looked great, and the star fields in Aquila and Scutum were shockingly abundant.

It takes about an hour and a half to get to Sugar Loaf State Park from San Francisco. It's a very pleasant drive through bucolic settings. From the town square in Sonoma, take Highway 12 north for about ten miles. Near Kenwood, turn east on Adobe Canyon Road and continue about two miles to the park entrance. (The route is well marked.) It's a great observing site. I'm hoping to return there soon.

—Jim Webster

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## Einstein Defended

During its June 23 meeting at UC Santa Barbara, the American Association for the Advancement of Science sponsored a session airing the views of people who questioned the Special Theory of Relativity. During the three hour session there were at least four talks against "the Einsteinians." I was the only speaker invited to defend Special Relativity, presumably because I authored the book, *Relativity Visualized*. It was an unusual experience. I had never before spoken to a large group of people who felt so strongly that a basic part of physics was wrong.

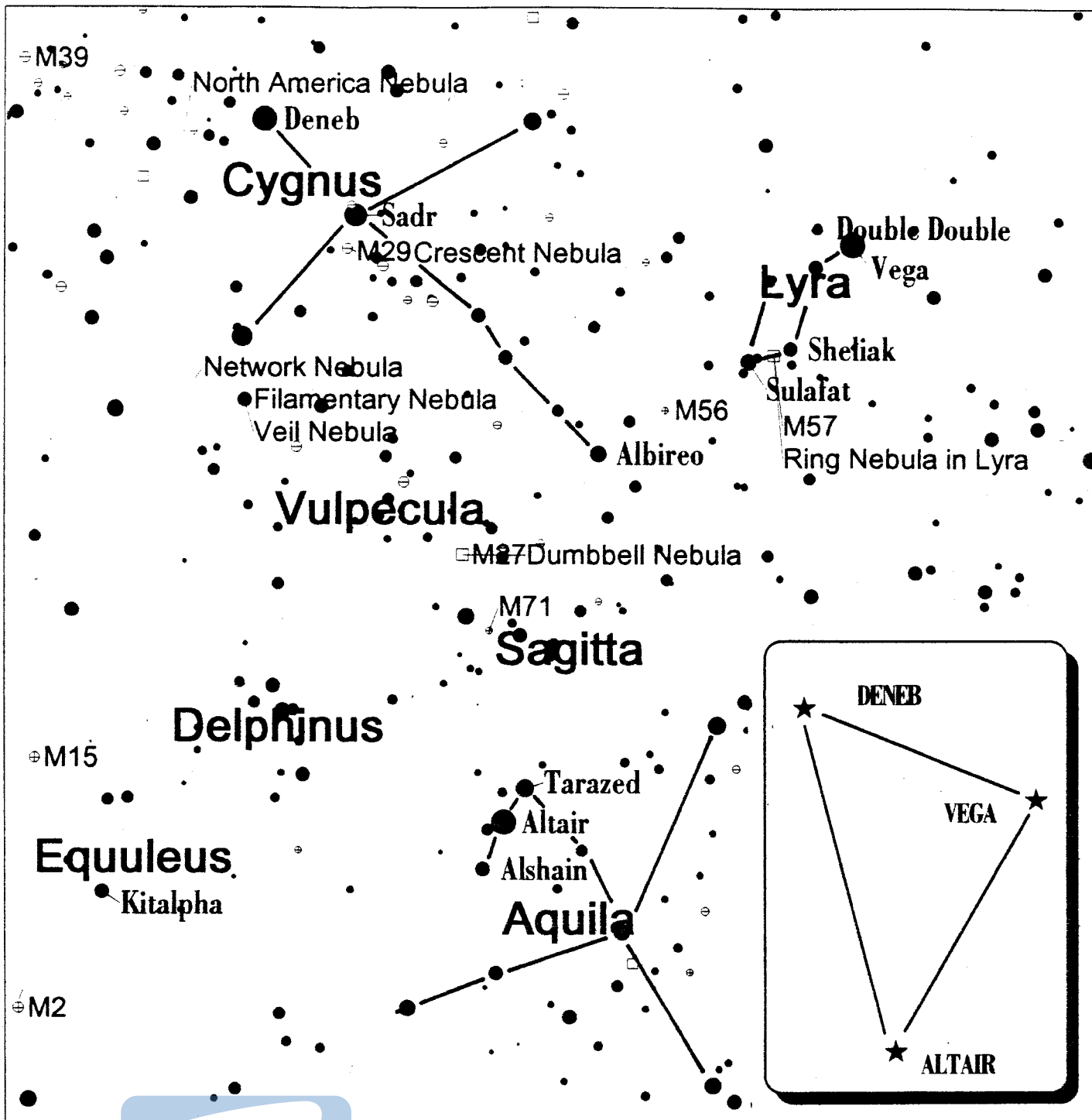
—Lewis Epstein

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## Astronomy Explained

On June 21 I presented an astronomy program at the Unitarian Chapel on Franklin and Geary in San Francisco, at the invitation of LaVerne Guilfoyle of the Unitarian Church. The talk was accompanied by slides portraying the composition and shape of the Universe, star formation, red shift and the tides. After refreshments, we set up a sun telescope outside in the courtyard. There were lots of sunspot clusters visible and one giant spot that measured at least four Earth diameters. The program elicited many interesting questions from an enthusiastic audience, and an invitation to come back for a repeat performance next year. Many thanks to all you Unitarians for having me.

—Bill Cherrington



THE SUMMER TRIANGLE

Stars:

- 9.5 ● 5.0
- 9.0 ● 4.5
- 8.0 ● 3.8
- 7.5 ● 3.1
- 7.0 ● 2.8
- 6.0 ● 2.5
- 5.6 ● 2.0
- 5.3 ● 1.8

NGC Objects:

- Galaxy
- ⊖ Open Cluster
- ⊕ Globular Cluster
- Planetary Nebula
- ◇ Nebula
- ⊞ Cluster+Nebulosity
- Star
- Other NGC Objects

Solar System Objects:

- ☉ Sun
- ♁ Mercury
- ♀ Venus
- ♂ Mars
- ♃ Jupiter
- ♄ Saturn
- ♅ Uranus
- ♆ Neptune
- ♇ Pluto
- ☾ Moon
- ☄ Comet
- ♁ Asteroid

Center @ RA:19h40m42s Dec:+22d08'00"

# Russian Space Science:

## *Teetering on the Edge*

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It seems only yesterday that the Soviet Union had a robust and healthy space program second to none. With a functioning space station (Mir) in orbit and a splendid roster of space science projects in the offing, the Soviets seemed poised to capitalize on America's indecisiveness, if not malaise, and lead the way in planetary and cosmic exploration. Their roster of projects for this decade included missions to Mars in 1994 and 1996, which would land rovers on the surface to cruise the terrain and analyze soil, and a host of "spectrum" satellites for observing everything from the background microwave radiation to x-rays and gamma rays. The atmosphere at Moscow's Space Research Institute (IKI) was very upbeat because the nation seemed committed to maintaining its position in the vanguard of space science.

All that changed with the political upheaval and economic collapse that signalled the disintegration of the USSR. Now astrophysicists earn less than bus drivers and an annual inflation rate in the neighborhood of 1000% has Russian scientists worrying more about buying the necessities of life than about space projects. Without assistance from the West the Russian space program would be in complete disarray, but western countries have fortunately invested heavily as partners in some of the ventures and this may ultimately save the day. Projects like the microwave satellite, which could have checked NASA's COBE satellite findings of irregularities in the background radiation with a more sensitive detector, may have to be scrapped for lack of funds, but the Mars missions have heavy western backing and are expected to fly, albeit perhaps on a somewhat delayed schedule.

Western interest in the two Mars missions has resulted in capital investment by 20 countries, including some \$150 million from Germany alone. Money talks, and this cohort participation by the West should salvage the planetary exploration projects. Interest is high because the probes will be equipped to possibly resolve questions about Martian geologic history and whether the enigmatic planet has ever been a suitable abode for life. Those prospects depend on the spacecraft carrying a full complement of experiments and that, in turn, depends on a timely launch of the first of the two missions in 1994. The urgency is based on a favorable launch window in 1994 with a minimum energy trajectory to the Red Planet, but if the project is delayed the next available window will be in 1996 with a less favorable trajectory. That means that extra fuel will be required, displacing some of the scientific instruments and compromising the potential payoff of the mission, so time is literally of the essence. Hence, planetary scientists everywhere are finding themselves in the somewhat unfamiliar position of pulling for the Russians at this point, hoping they can get their act together in time for a 1994 curtain call.

—Joel W. Goodman



# Astronomy Software for PCs

## *The\_Sky for Windows*

Software Bisque  
912 12th Street, Suite A  
Golden, CO 80401

**\$100–\$200**

## *Buil-Thouvenot CCD Atlas of Deep-Sky Objects*

Sky Publishing Corp.  
P.O. Box 9111  
Belmont, MA 02178

**\$240–\$250**



Smile

If you've glanced through the advertisements in *Astronomy* or *Sky & Telescope*, you may have noticed the proliferation of new astronomy software for IBM-compatible home computers. It's quite a chore to figure out which programs to buy. Just as with buying a telescope, it's only sensible to decide what your interests are before you buy anything. Being mostly interested in deep-sky observing, I recently purchased two software programs that would help me plan my observing sessions, find new and interesting objects to look for, and generally make astronomy more fun.

Although it has many other features, one of the things *The\_Sky for Windows* does best is sky charts. The Level III version has a database of 259,000 stars and 13,000 deep-sky objects, including the entire New General Catalog and Index Catalogs. It's the practical equivalent of the *Uranometria*. So why bother? First, because the program includes magnitudes, sizes, even spectral types and NGC descriptions, which can be displayed and printed on the charts themselves. Second, because star charts can be viewed and printed from seven different projections and on any scale from full sky to less than one degree. In fact, you can even print a wide-field finder chart with an insert showing the telescopic field of view. This is one of the fastest astronomy programs and a math coprocessor is not required.

It's great fun to compare photographs of galaxies and nebulae with one's first-hand visual impressions, but it's always been hard to find pictures of any but the very brightest objects. Not any longer! The Buil-Thouvenot Atlas is an incredible treasure chest of CCD photos of more than 3,000 deep-sky objects. It typically includes nearly all the items on my observing lists—peculiar and interacting galaxies, Abell galaxy clusters and obscure planetaries as well as Messier objects. The atlas will delight armchair astronomers as well as observers. It's a real pleasure just to browse, switching between black & white and the two false color palettes, and examining details pixel by pixel in the 4X zoom box. VGA graphics are required to access the color palettes.

I've really enjoyed using these astronomy programs. If your interests are anything like mine, you would too. If you've used other astronomy software, let us know about your experiences.

—Jim Shields

# Quintets, Sextets and Septets

by STEVE GOTTLIEB

Compact galaxy groups hold a special fascination and challenge for many deep sky observers. I've often heard someone call out at a star party "Who know how to find Stephen's Quintet?". A more experienced observer responds, "Near NGC 7331 in Pegasus. Let's see if you can find it in your new scope." This compact group has become a standard test object for amateurs and can be glimpsed in scopes as small as 6". After 15 minutes of searching, I'll hear shouts of joy as someone has bagged their first tough deep sky object. Although the unimpressive view consists of only a few dim patches, this catch has confirmed your finding techniques, telescope optics and visual acuity and being a fascinating interacting galaxy group adds to the excitement.

Perhaps you've wondered whether there are other lesser known compact galaxy groups which could provide a more challenging test than Stephen's Quintet? The best source to turn to is Paul Hickson's list of Compact Groups of Galaxies. His original paper in the *Astronomical Journal*, 255:382-391, 1982 provides catalogue data and identification charts for 100 very compact groups based on a systematic search of the POSS red prints. In a follow-up article in *Astrophysical Journal Supplement Series*, 70:687-698, 1989 detailed photometric data is presented on the 463 galaxies comprising these 100 groups. To qualify for inclusion a compact group had to meet 3 rigid criteria: 1) population—at least 4 members, 2) compactness—surface brightness greater than  $26.0/\text{arcsec}^2$  averaged over the smallest circle containing their geometric centers, 3) isolation—to exclude condensations in rich Abell galaxy clusters. A few of the Hickson groups are well-known to amateurs. Three of my favorites are the N4169 group = Hickson 61a-d, the N5353 group = Hickson 68a-e and of course, Stephen's Quintet = Hickson 92a-e. But let's move on to more challenging fare.

Just 7' south of the barred spiral NGC 3718 in Ursa Major is a lesser-known quintet—Hickson 56a-e with coordinates of 11h32.6m +52°27' (2000). This compact group has several other catalogue designations including UGC 06527, VV 150, Markarian 176 and Arp 322. The UGC notes section describes Hickson 56 as "a nonlinear chain of 4 galaxies... These four are connected and cover a length of  $90'' = 48\text{kpc}$ . The fifth galaxy is about  $65''$  from the nearest member of the chain and is possibly at the same distance."

To visually resolve all of the members would be quite a challenge! The brightest member, Hickson 56b, shines at only 15.0B (Hickson uses the total blue magnitude within the mag  $24.5/\text{arcsec}^2$  isophote). With my 13" at 166X, this compact group merges into a very faint glow about 1 arc minute in length, elongated roughly east-west in a 3:1 ratio. With careful attention, this glow resolves into 2 "knots" which are just detectable at the east (Hickson 56b) and west ends (Hickson 56c at 15.9B). The three remaining members, including the nearby edge-on spiral at 16.4B were not seen. Keep in mind that the field of N3718 was examined 4 times between 1852 and 1868 by the observers using Lord Rosse's monstrous 72-inch speculum mirror reflector in Parsonstown, Ireland and did not pick up the Hickson 56 group.

Seyfert's Sextet (NGC 6027) was actually discovered by our friend Edouard Stephen, director of the Marseilles Observatory, in June of 1882 using an 0.8 meter (31.5") reflector. Even in this large scope Stephen described his discovery as "Excess, excess, faible" and logged it as a single object. N6027 was discovered to be an extremely compact galaxy group as recently as 1951 on a Harvard Schmidt plate by Carl Seyfert. A stunning photo taken with the 200" on Mt. Palomar can be found on page 1793 of Burnham's *Celestial Handbook* where the group is apparently resolved into 6 com-

ponents squeezed into a mere 2 arc minutes of sky! Interestingly, Stephen also mentions in his observation that "...very faint star involved, 2 very faint stars near." This suggests to me that Stephen may have unknowingly resolved several members but recorded them as stars due to their extremely compact dimensions.

Actually, Seyfert's N6027E is likely a tidally distorted portion of N6027 and both components receive a single Hickson entry 79b. In addition, galaxy N6027D has a discordant redshift three times the other members and hence is probably a background object. Still, the average 3-dimensional separation of the members is extremely small and it is a more compact group than Stephen's Quintet. You can locate Seyfert's Sextet at 15h59.2 +20°46' (2000), northeast of the distinctive asterism of stars forming the head of Serpens.

Using Seyfert's original designations, the brightest member N6027 (Hickson 79b) has a  $B_{24.5}$  magnitude of 14.55. At 220x in my 13" this galaxy appeared "faint, very small and slightly elongated east-west". Just 30" south-southwest is mag 15.12 N6027A (Hickson 79a). Visually it appears a very faint knot, just non-stellar. Finally, a third member N6027B (Hickson 79c) at mag 15.48B is just visible with averted vision a mere 0.3' west of N6027. My 17.5" fails to reveal any additional members although at magnitude 16.9B and 16.6B, N6027C (Hickson 79d) and N6027D (Hickson 79e) should prove quite a challenge in any scope. I'd highly recommend using at least 200X on this group as the three galaxies described above are separated by less than 1 arc minute!

For a final challenge there is Hickson 57a-h, better known as "Copeland's Septet". This group was discovered on February 9, 1874 by Ralph Copeland, at the time an assistant on Lord Rosse's 72" and consists of 7 galaxies NGC galaxies. (NGC 3745, 3746, 3748, 3750, 3751, 3753, 3754) contained within a

5' circle! Unfortunately, Copeland confused the field with another nearby containing two faint galaxies (N3743 and 3758) and incorrectly reduced the positions using the wrong reference stars. In fact, the composite sketch done at Birr Castle shows 9 members including these 2 extra galaxies. In compiling the NGC, Dreyer used these incorrect positions and this caused the authors of the *RNGC* to classify the entire group as nonexistent! Actually, Dreyer corrected the positions in the notes section of the IC I. More recent catalogues and atlases including the *Uranometria 2000.0* list Copeland's Septet at Dreyer's corrected position.

N3753 is the brightest member of Hickson 57 at 14.7B. In my 17.5" I logged it as "faint, fairly small, elongated 5:2 WNW-ESE, bright core." N3750 is a very faint companion (15.2B) just 0.7' southwest which appears simply as a very small, round knot. Even dimmer at 15.2B is N3754, just off the northeast end of N3753. A second close trio is located about 3' northwest. The brightest of these three, N3746, glows at 15.15B and although photographs reveal a barred spiral, I only noted a very small, round, featureless spot. Two companions, N3745 and N3748 at 16.4B and 15.9B are situated only 1' north and 2' northeast, respectively. Both of these galaxies were extremely faint in my 17.5", requiring averted vision to glimpse. Finally, less than 3' south of N3753 is N3751, comparable in difficulty to the 2 companions of N3746.

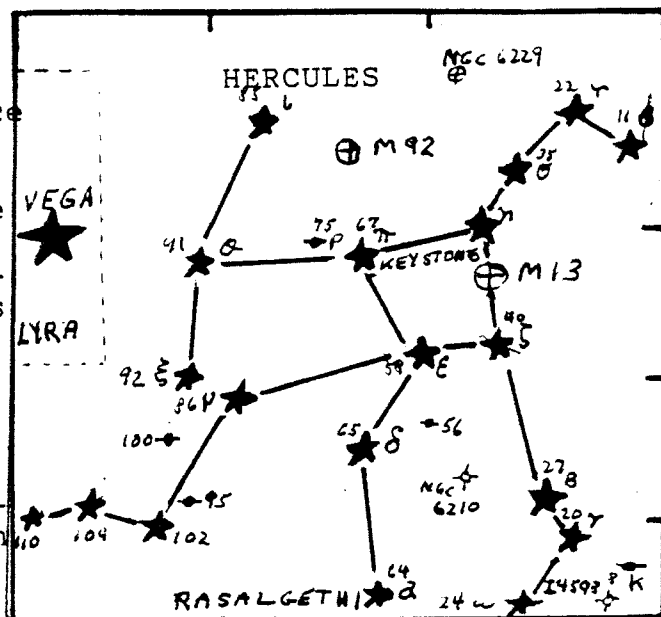
While examining the field of Copeland's Septet I was surprised to pick up an 8th galaxy-U06601-located 11' south of N3753. According to my log, this object appeared "very faint, small, oval 3:2 north-south with a gradually brighter core, an eighth magnitude star 3' south hinders the view."

Next time you're looking for new deep sky challenges, check out one of these Hickson compact groups and let's hear about your results.



## HERCULES, THE STRONGMAN, by Gordon Ridley

One of the oldest sky figures is the constellation Hercules, the Strongman. Stretching from just west of Ophiuchus to Draco, with its eastern border on the Milky Way it contains no star brighter than third magnitude, yet it has been well known for thousands of years! Its best signpost is the Trapzium, called by us, the "Keystone", lying midway between Vega and Corona Borealis. We know Hercules, the son of the god Zeus and the mortal Alcmene, as the hero, who, in the course of completing the famous twelve labors, entailed adventures wherein he defeated, among others, Leo the Lion, Hydra the Water Snake, and Cancer the Crab. To the ancients it was known to the astronomers of the time as "The Kneeling One" due to its appearance in the sky. In Euphratean mythology it was first mentioned on a cylinder seal of 3500BC during the time of the Babylonians, wherein the sun god Izhdubar, was described as resting on one knee with his foot on the Dragon's head. The name of the star Rasalgethi (ras-el-GEE-thee), Alpha Herculis, means "head of the Kneeling Man." Tablets of the seventh century B.C. refer these well known adventures to the sun's passage through the twelve zodiacal signs. This myth was later adopted by the Greeks and the solar hero changed into Hercules and his twelve labors.



To amateurs, the main attraction here are two of the very finest globular clusters in the sky, M13 and M92. M13 particularly, the largest and brightest globular in the northern sky is a truly magnificent object. Other celestial gems include NGC 6210, one of the most colorful of all planetary nebulas, plus an almost inexhaustible store of fine double stars. To enjoy Hercules to the full, the following should provide a flavorful taste of what it has to offer:

Subject	Location	Magnitude	Size or Sep.	Notes
7 $\kappa$ Her	16h08m+17°	5.3 & 6.5	28.4' @ 12°	Yellow-orange & Red
40 $\gamma$ Her	16h41m+32°	2.9 & 5.5	1.6" @ 89°	A Close Double, Only 30 LY from here
56 Her	16h55m+26°	6.1 & 10.6	18.1" @ 93°	Orange&Blue. A Beauty
64 $\alpha$ Her	17h04m+14°	3.5 & 5.4	4.7" @ 107°	Orange&Blue-green, as big as Betelgeuse!
65 $\delta$ Her	17h15m+25°	3.1 & 8.2	8.9" @ 236°	Whitish&Blue-Green
75 $\rho$ Her	17h24m+37°	4.6 & 5.6	4.1" @ 316°	Both Greenish White
95 Her	18h01m+22°	5.0 & 5.1	6.3" @ 258°	Both Yellow
100 Her	18h07m+26°	5.9 & 6.0	14.2" @ 183°	2 Equal white stars
NGC 6205	16h42m+36°	5.8v	Dia 16.6'	M13 Class 5 Globular, Magnificent!
NGC 6229	16h47m+48°	9.4v	Dia 4.5'	Class 4 Globular
NGC 6341	17h17m+43°	11.2v	Dia 11.2'	M92 Class 4globular
IC 4593	16h12m+12°	10.9p	Dia 12"	Plan.Nebula Type 2+2
NGC 6210	16h44m+24°	9.3p	Dia 14"	Plan.Nebula Type 2+3b

## Tips on observing the twilight sky:

- > Find a place to observe where you have an unobstructed view of both your western and eastern horizons.
- > Before trying to identify individual details, such as slight differences in color in a portion of the sky, study the overall sunset phenomenon several times first to get a feel for what happens.
- > When observing, relax and let your eyes seek regions of equal illumination or hue; you'll be surprised how quickly you can detect the shapes and bands of color this way.
- > During twilight, there is a tremendous range of light intensity between the eastern and western skies. After looking at a bright part of the sky, close your eyes for a few moments to allow them to recover from the glare. The color-sensitive aspect of your vision is easily saturated by intense light and, without short rest periods, your eyes will be unable to perceive the subtle shadings.
- > An interesting way to study individual areas of sky is by use of a small mirror held at arm's length. Face away from the part of sky you wish to observe and use the mirror to inspect the region of interest. In this way, you can also compare the colors of different parts of the sky by holding your mirrored image against the background of your choice.
- > The Earth's shadow (the dark grey-blue band across the eastern horizon just after sunset) is only visible until it rises to about  $6^\circ$  high; after that, its upper boundary quickly fades. Why you can see Earth's shadow is because our eastward view immediately after sunset is directly along the boundary between the illuminated and non-illuminated parts of the atmosphere. As time passes, we view this boundary with an ever-steepening angle and it soon disappears.  
When observing the Earth's shadow, note the red-to-orange-to-yellow development of color just above its upper edge. These are the sun's rays passing well overhead and reflecting directly back. This phenomenon, disappearing at approximately the same time as the Earth's shadow, is called the "counter-twilight."

Compliments of David Rosenthal, Radio Netherlands  
Contributed by Eppler Nowell

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## WANT ADS

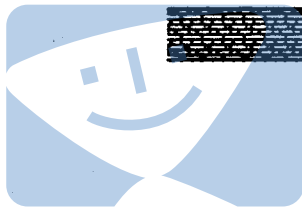
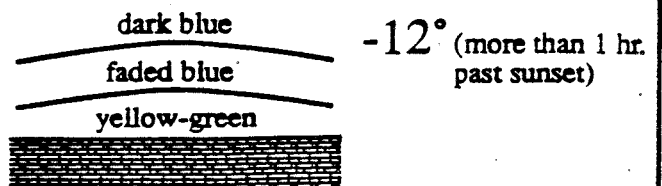
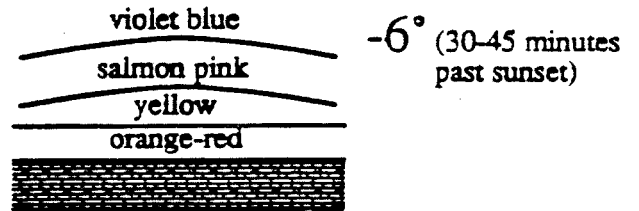
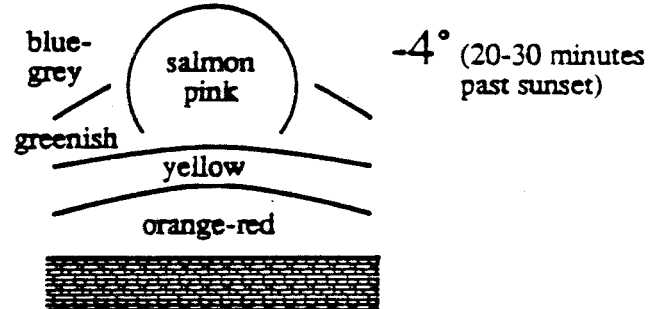
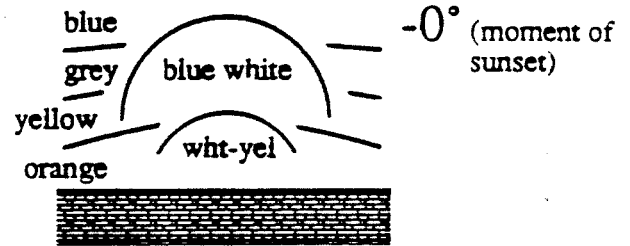
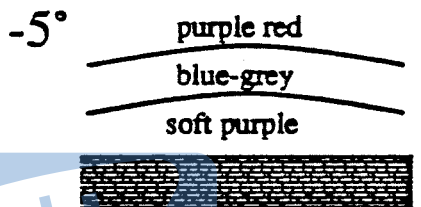
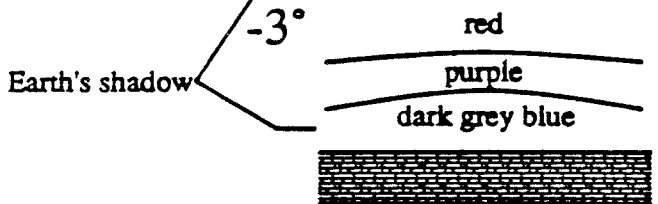
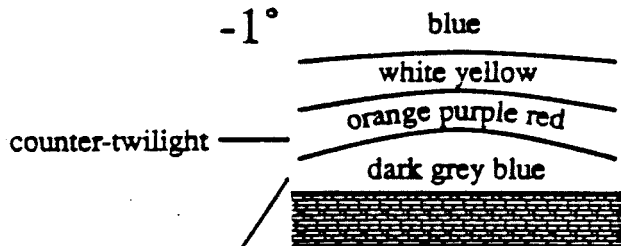
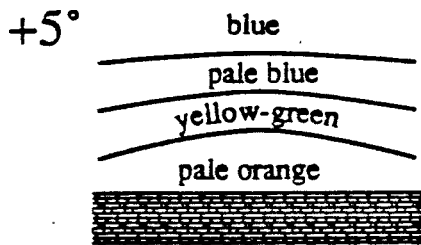
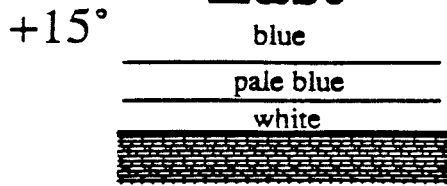
Members' advertisements for astronomy gear are free and will run three times. Just send your ad to SFAA Bulletin Editor, 190 Chilton Avenue, San Francisco 94131. Please notify the bulletin editor if an item is sold so that it may be deleted. This service is provided to club members only on a space-available basis.

- ◆ **For Sale: Unitron Model 142 three-inch equatorial refractor with accessories. Excellent first scope, especially for city viewing. \$575 or best offer. Call Tom at 474-8992.**
- ◆ **For Sale: Restored 1970 V.W. Camper. \$2,800. Call James at 221-6004.**

# Sunset sky colors

## East

## West



Smile

Note: Positive and negative numbers indicate sun's distance above or below horizon in degrees

Make checks payable to San Francisco Amateur Astronomers and mail to:  
Treasurer, San Francisco Amateur Astronomers, 32 Penhurst Avenue, Daly City 94015.  
Founded in September, 1952, the San Francisco Amateur Astronomers (SFAA) is an association of people who share a common interest in astronomy and other related sciences. Our membership consists of people from all walks of life, educational backgrounds and ages. Many SFAA members own their own telescopes; some have been made by hand in local telescope-making classes and vary in size from six to 25 inches diameter.

- Select one category:
- \$20 enclosed, individual membership
  - \$20 enclosed, foreign membership
  - \$25 enclosed, family membership
  - \$25 enclosed, institutional membership
  - \$5 enclosed, youth membership (under 18)

Telephone: \_\_\_\_\_

Address: \_\_\_\_\_

Name: \_\_\_\_\_

## SAN FRANCISCO AMATEUR ASTRONOMERS MEMBERSHIP APPLICATION

### San Francisco Amateur Astronomers

c/o Morrison Planetarium  
California Academy of Sciences  
Golden Gate Park, San Francisco, CA 94118

#### Features

- ★ Russian Space Science
- ★ Astronomy Software for PCs
- ★ Compact Galaxy Groups
- ★ The Labors of Hercules
- ★ Sunset Sky Colors