EPHEMERIS

Vol. 2 No.8 Official Publication of the San Jose Astronomical Association AUGUST, 1990

FLIGHTS OF FANCY

In place of a speaker this month at the general meeting, the SJAA will present a video tape titled "Digital Landscapes". It features Earth, the movie, Mars, the movie, Miranda, the movie, and finally a Mars rover simulation. In Mars, the movie, actual Viking orbiter images were digitized and animated into a spectacular flight across the Martian surface. Fly through canyons, craters, and around volcanoes in this state of the art computer simulation. I hope Bob Fingerhut can get his 60" television into the Red Cross!

MEMBERSHIP RENEWALS

Members who receive Sky & Telescope as part of their SJAA membership are already receiving magazine renewal notices. Please use the handy membership application on the back of the Ephemeris to renew your membership and mail it to Jack Peterson our Treasurer. The same goes for those of you who are membership only. It is best to get your renewals in early, as you don't want to miss future exciting issues of your favorite monthly newsletter. Where else can you read about bones being found on the moon! (Other than the supermarket check-out that is.)

ANNUAL PICNIC

The Annual Picnic and Installation of Officers went extremely well according to Tom Ahl. About 35 to 40 people attended the afternoon event. Chef Hanisch handled the main courses while Sharon Cisneros wowed everyone again with her German chocolate cake creations.

BRANHAM LANE STAR PARTIES - WE WANT YOU!

Don't forget the SJAA is holding public star parties on the following Fridays. Here are the upcoming dates: August 31, September 28, October 26, December 28. Bring a telescope and tell your friends. For more information please contact Tom Ahl or Jim Van Nuland. Their telephone numbers are listed elsewhere in this issue.

BOOK REVIEWS

Something that has been missing from the Ephemeris for a long time has been a written review of astronomical books. Your editor was tipped-off that I might be able to persuade club member Richard Page to make a frequent contribution to our fine newsletter. With a little arm twisting, actually nothing really, I am please to announce that Richard has agreed to send a few articles to me for publication. Thank you Rich, I'm sure our membership will enjoy your contribution.

AUGUST 4TH
"DIGITAL LANDSCAPES"
8 PM

AUGUST 4: DIGITAL LANDSCAPES - VIDEO TAPE PRESENTATION. 8PM, LOS GATOS RED CROSS BUILDING.

AUGUST 11: BOARD MEETING AT THE RED CROSS, FOLLOWED BY THE INDOOR SESSION OF THE INTRODUCTORY ASTRONOMY CLASS.

AUGUST 18: SJAA STAR PARTS AT GRANT RANCH, INCLUDING OUTDOOR SESSION OF THE ASTRONOMY CLASS.

AUGUST 25: HENRY COE STAR PARTY.

AUGUST 31: BRANHAM LANE PUBLIC STAR PARTY. STARTS AT DUSK.

SEPTEMBER 1: SWAP MEET, SLIDE AND EQUIPMENT NIGHT AT THE RED CROSS. SWAP MEET TENTATIVELY SCHEDULED TO RUN FROM 4PM TO 7:30 PM, WITH SLIDE & EQUIPMENT SHOW STARTING AT 8 PM.

SEPTEMBER 8: BOARD MEETING AT THE RED CROSS, 6:30 PM, FOLLOWED BY THE INDOOR SESSION OF THE ASTRONOMY CLASS AT 8 PM.

SEPTEMBER 14: (FRIDAY) THE OUTDOOR SESSION OF THE INTRODUCTORY OBSERVATION ASTRONOMY CLASS MEETS AT THE OBSERVATORY AT FREMONT PEAK STATE PARK. THE 30-INCH WILL BE AVAILABLE FOR GENERAL OBSERVING.

SEPTEMBER 15: HALLS VALLEY GROUP PUBLIC STAR PARTY AT GRANT RANCH. SJAA INVITED.

HUBBLE DEBACLE!

1.5 BILLION DOLLARS? I guess that Tasco optics aren't that bad after all! It seems we have a "space junk telescope" that's a little near-sighted. Informed sources have indicated that the space telescope images are perfect when focused at an object 300 miles distant. Seems that our expensive satellite is pointing the wrong way! See Bob Fingerhut's Space Program Update for more details. (Makes a great story for a Tom Clancy novel, doesn't it?)

AUGUST STARRY NIGHTS

- RICHARD STANTON

LUNAR OCCULTATION/APPULSE/GRAZE/ ECLIPSE - August 6th brings a partial Lunar Eclipse but this will be a tough one to observe. The Moon will be setting just before sunrise on that date. The moon enters the umbra at 05:44 Pacific Daylight Time when the Moon's altitude is around 6 degrees. Let's hope the day dawns with pristine clarity on that morning.

On August 14th the Moon will again cross the Pleiades, occulting and possibly grazing a few stars. For our location this passage will be in process as the Moon rises and should terminate by the time it's up out of the murky horizon.

A lunar occultation of Jupiter will occur on August 18 at 05:12 hours. This is about one hour after Jupiter rises. You should be able to see it reappear on the lunar dark limb around position angle 276 degrees.

ANOTHER MOONWATCH - Once again the U.S. Naval Observatory will be conducting a Moonwatch on Tuesday, August 21. They are still trying to refine their formulas to try to predict the earliest time after the New Moon that the crescent can be seen each month. The August issue of Sky & Telescope will provide further details on participating.

TRITON - Since all of you have no trouble finding Neptune in your scopes, Triton should be a breeze. On August 1st, Triton and Neptune will be just a little north of the Teapot in Sagittarius. The interesting part is that there is a possibility that Triton shining at magnitude 13.6 may occult the 9.2 magnitude star SAO 187435. While it is predicted that the event may be too low on our horizon for observations, the calculations by Lowell Observatory are so tenuous that it may be worth a shot. A finder chart for Neptune and the subject star is on page 65 of the July S&T. Triton hell, I'm still trying to find my socks!

MARS - This month the God of War rises from his slumber around midnight and will have grown to about 9 arc seconds in diameter with the South Polar Cap having receded to a minimal condition. This is a good month to begin your astrophotography program of this mystical planet. Quiet, I can hear them coming.

PERMANENT LARGE TELESCOPE SITES

- DEL JOHNSON

The SJAA has a possibility of acquiring two large telescope mounts and preliminary plans call for one of them to hold a 27" Cass. at Grant Ranch County Park while the other holds a 32" Cass at a dark sky site known as the "Rocket Site". Both telescopes will be available to members of the SJAA as well as used for public education.

The Grant Ranch site is at the Halley Hill Observatory, operated by the Halls Valley Astronomical Group, on a knoll to the south of the general campground. The site is 200 ft above the valley floor and is sheltered from the campground lights. The site for the 27" has a particularly good view of the southern and eastern skies. Power and water are 300 ft down the hill and will be extended to the observatories. Also at the base of the hill is a campground available only to groups. Close enough to San Jose for mid-week use, the 27" allows for some serious work while still allowing for public viewing on weekends as well as full support for our own Intro to Astronomy course. Additional provisions will exist for the telescopes that you bring from home.

What has to happen? We must acquire a mount, finish the 27" mirror, alter the mount (assuming we get the smaller of the two Lockheed/NASA mounts), excavate/pour a foundation, build a housing, and tie in to the utilities.

The larger of the two Lockheed/NASA mounts would be located atop a 3100 ft peak located between Mt. Hamilton and Patterson. Presently, a 5 mile dirt road winds up to the peak but it is possible that a long term lease to the land could be worked out based upon our putting in a 1/2+ mile road going directly to the peak (rather than the scenic route). Utilities are nearby and can be tapped. While I haven't been at the site yet, survey trips will be taken in the near future - you are welcome to come along.

Our current situation is that Wayne Rosing is willing to donate a 32" Cass. (f4/f12/f20) and put up a $15000 pledge as a challenge grant based on raising adequate funds, and other resources, to complete the project. The owners of the peak have expressed a willingness to allow use of the land. Wayne has made two stipulations concerning the site and we have no disagreement with either of them: The facility is to be named as a memorial to the late Robert Noyce and, secondly, the telescope shall be fully capable of remote operations/viewing via a downlink. Conceivably, a microwave system could get signals to/from the valley. (Rumor has it that there are some horns/towers available back east.)

What has to happen? Negotiate the land, build a road, run utilities, raise funds, modify the mount (if available; otherwise build a new one similar to Fremont Peak), instrument the telescope, provide datalinks/controls, and build a housing/dorm.

We have two great opportunities in our lap. As described above, we have to make somethings happen (and quickly). The first thing that we need is your attention (and we have that because you are reading this). The second thing is our need to know what resources we have available to us. To accomplish part of this, you are asked to fill out the attached Skill Survey from and mail it to the SJAA (address on back of the Ephemeris). As time goes by and progress is made, you'll be contacted when your skill becomes needed. You may be just asked a question or you may be asked to help on site. Whatever your participation, expert, or water carrier, you'll know that you have been involved in something(s) major in Amateur Astronomy.

Our immediate need is going to be conducting surveys of the sites and mounts so that we can properly size the various tasks. We are going to handle two reasonably big tasks at the same time, hopefully with two teams and a lot of cross talk. Please take the time now to fill out the Skill Survey form and return it as soon as possible.

THE EYE AND ITS ABILITY TO VIEW DIM CELESTIAL OBJECTS

- PART THREE

By the end of the 19th century, the curve of possible visual telescopic discoveries had flattened, thanks to the Herschels, Edward Barnard, and the eagle-eyed double star observer S. W. Burnham. It would be up to photography (and later electronic photometry and image-processing) to take over where the retina's performance gave out.

Unlike the photographic film's emulsion, our eyes do not "build up" a sensitivity to the fugitive photons of starlight. Indeed, if we stared incessantly at exactly the same spot, a phenomenon known as the Troxler effect causes the image to fade out completely! Our brain compensates by directing the eye muscles to continuously sweep our field of vision back and forth, a situation which goes out of control when we've had too much to drink (that's why the Highway Patrolman sticks his flashlight into your eyes if he thinks you're drunk. What a lousy way to ruin your dark adaptation!)

Our eye/brain combination takes about 100 milliseconds to register the intensity and shape of an image. Thus, we can get what Percival Lowell called "revelation peeps" of planetary detail during moments of calm telescopic "seeing." Of course, the film's emulsion usually takes much longer than this to record even the bright light of Jupiter or Saturn, and our planetary pictures never seem to look as good as the views through our oculars.

To get back to visual perception of dim images: the eye, despite its limitations, is enormously sensitive. When the pupil completely relaxes in darkness (achieving an opening of about 7mm in young and middle age, and perhaps 5mm in old age), the retina's "scotopic" vision can detect as few as five or six quanta (photons) of blue-green light, according to scientist Selig Hecht. Since perhaps 90% of the photons actually entering the cornea are lost by absorption or reflection in the eyeball, around 50 to 150 photons must be present outside the eye for the brain to register them at all. Yet this is indeed but a very small amount of light!

If our eyes behaved like film emulsion, we could see phenomenal deep-sky views through our eyepieces that would put photos to shame, since most film can record only about 1% of the photons falling on it at any given moment.

That's why, despite costs, complexity, and limitations of resolution, CCD cameras with 30 to 70% efficiency are now replacing photographic plates at professional observatories for all but wide-field search programs and star charting. As one observatory photographer said sadly to me recently, "When I retire they'll close up this department for good."

So, considering your own eye's potential sensitivity, unless you have acquired an off-axis guider, tele-extender tube, film hypering kit, and a cold camera, or have spent thousands of dollars for a CCD and data processing computer for your telescope, don't give up on visual astronomy! Your eyes are able to show you -- and with relative ease -- details that many astronomers have expected to discern only with expensive photography or image-enhancing electronics.

In Part 4: The Focal Ratio "myth" and visual exit pupils.

COMET COMMENTS

- DON MACHHOLZ

Four comets have been recovered recently, while one new comet has been discovered. Meanwhile, Comet Austin, a small comet which quickly expended much of its mass as it was still approaching the sun, had faded in our evening sky. But comet Levy and Periodic Comets Encke and Honda-Mrkos-Pajduskova continue to brighten. Comet Levy passes through opposition and into our evening southern sky, while comets Encke and "H-M-P" move rapidly into our morning twilight sky.
For the past four years our Seeking Comets section has examined positions, magnitudes and the timing of recent amateur comet discoveries. This month we begin a long look at the discoverers: who they are, how long their discoveries took, and what instrument are used.

Periodic Comet Peters-Hartley (1990d): Robert McNaught of Siding Spring Observatory in Australia recovered this comet on May 26 at magnitude 13. Its eight-year orbital period brought it closest to the Sun (1.63 AU) on June 23 and it is not expected to get any brighter.

Periodic Comet Wolf-Harrington (1990e): Jim Scotti used a 36-inch telescope at Kitt Peak to recover this comet on June 14. It was then magnitude 19, and is expected to become no brighter than magnitude 14 later this year.

Periodic Comet Honda-Mrkos-Pajdusakova (1990f) Jim Scotti also recovered this comet, on June 17. It will be closest the Sun on Sept. 12 at 0.54 AU, in late July it passes only 30 million miles from Earth. Positions are listed in the comet ephemeris. This comet may appear fainter than the estimates suggest.

Comet McNaught-Hughes (1990g): Robert McNaught discovered an image of this object on a plate taken by Shaun Hughes, also of Siding Spring. An early orbit shows perihelion to be next March at 2.4 AU. The comet was magnitude 17 at discovery and will not brighten much in the near future.

Periodic Comet Johnson (1990h): Jim Gibson used the 60" reflector at Palomar to recover this comet on June 17. It will not become brighter than magnitude 15.

SEEKING COMETS

Let's take a look at those comet hunters who find comets and do not get their names on them. In some instances these "independent" discoveries occur when many people find a new comet within a few hours of each other. Since only three names can go on a comet, the other discoverers will not get the "credit" of having their name on the comet.

More often is the case where a comet is "discovered" after it has been confirmed and publicized. This occurred frequently in previous centuries when communications were slow, and it still happens today. A new comet is usually confirmed within a day or two. Then the word is put out by the Smithsonian Astrophysical Observatory. Those who receive news by "electronic mail" will know in a few hours, the mailgrams take 1-3 days, and the printed circulars take a week. During that time comet hunters continue to hunt, and sometimes they run across the new comet.

It might not seem fair that their name doesn't end up on a comet, but the line has to be drawn somewhere. Most comet hunters end up with an "independent discovery" or two.

What about those who receive rapid news of the new comet? They have fewer chances of an independent discovery. My "closest call" occurred in early September, 1977. I had arrived home from work and was preparing to observe when I received a phone call from my boss. A telex message had arrived at work, telling of the Comet Kohler, in a portion of the sky I had planned to sweep that night. If my boss had gone home when the reset of us did, I would have known both the joy and frustration of and independent "discovery" of a known comet!

ASTRO ADS

ASTRO ADS are free to all non-commercial advertisers wishing to sell astronomically related products or services. Please send your ad directly to the Editor, John P. Gleason, 5361 Port Sailwood Dr. Newark, CA 94560 **NO LATER THAN THE 15TH OF EACH MONTH.** Your Astro Ad will run approximately 3-months.

TELESCOPE, EYEPIECES, & ACCESSORIES - All the equipment listed below is near New - Mint + condition. A few items including the telescope have been used twice and most of it has never been used: Televue-Genesis, f/5 Fluorite telescope, includes fitted case, 1.25"-2" adapter, 2 extension tubes and lens hood, asking $1285. Orion Universal (telescoping) Camera Adapter, $25. Televue 13mm Plossl, $65. Televue 15mm Wide Field, $110. Televue 19mm Wide Field, $115. Televue 20mm Nagler Type 2, $295. Celestron 22mm Plossl, $55. Celestron 26mm Plossl, $45. Televue 32mm Plossl, $80. Televue 40mm Wide Field (2"), $260. 60mm Plossl eyepiece (2"), $40. Televue 2.5X Barlow lens, $60. Lumicon Deep Sky filter, $45. Orion, 5 filter set + moon filter (1.25"), $40. Brass and Wood, Televue tripod with leg spreaders (made for Genesis), $295. Will sell all for $2550. Contact: Marty Lutzker, Cupertino 408-257-8706 or 446-4134. 8/90

CELESTRON SUPER C8 w/Powerstar mounting, - stepper motor drive with dual-axis drive corrector, MotoFocus, deluxe heavy duty wedge, Meade heavy duty adjustable tripod, dew shield, star diagonal (1.25"), tele-extender tube for planetary photography, prime focus camera adapter, counterweight bar. Superb, recently collimated optics. Sorry, no eyepieces, declination motor, or finderscope. $850 or best offer. Contact: John Gleason (work phone only please) 408-720-2493 8/90

CELESTRON 8 w/starbright coatings, 8X50 finder, dew zapper, Motofocus, piggyback camera holder, multicoated diagonal, optical tube only one year old, Meade Tripod (more stable than Celestron's), Samsonite style case, $1190. Call after 7 pm, 209-463-1817 Edward Hillyer, 2305 De Ovan Ave. Stockton, CA 95204 7/90

MEADE 2120 LX5 10-inch, UNUSED catadioptric scope, wedge, tripod, 9 X 60 finder, and accessories; including hand control, Portapac portable 12V battery, electric declination motor, Motofocus, Televue 1.8X Barlow and swivel stool. Asking $1,750 or best offer. Contact: Ken Pelter 408-667-2586 or 408-426-1705 6/90

CELESTRON SUPER C8 with internal DC inverter, internal batteries, lighted setting circles, bubble level, compass, Meade tripod, dew shield, battery charger, camera tripod adapter, 8X finder, 2X barlow, star diagonal (1.25"), porro prism (1.25"), 7mm Ortho, 10mm, 26mm, 45mm Plossl eyepieces. Asking $1299. Contact: Paul Sterbentz, 408-274-4723. 6/90

CELESTRON SKY SENSOR computer control for Super Polaris Mount - works perfectly. Includes instructions, charts, and is in original box. $175. Celestron single-axis quartz drive for Super Polaris Mount. $100. Wane L. Clark 408-374-5931 or 415-853-6777. 6/90

C-90 with 3 eyepieces and extension tube for $300. Contact: Richard Aldridge 408-294-5578. 6/90

CELESTRON C6 NEWTONIAN reflector with 25mm Kellner and 7.5mm Plossl eyepieces. Equatorial mount and tripod. Excellent condition. $500. Contact: Mervin Grover after 6 pm, 408-983-2517. 6/90

FOUR 2-inch (inside diameter) pillow block bearings, never used, $175. 2-inch stainless steel shaft, about 5 feet long, $60. Two, 6-inch diameter x 2-inch thick aluminum disks, $10 each. Two, 14 x 8 x 2-inch thick aluminum plates, $20 each. Contact: Bill Cooke, 408-492-5640 days. 6/90

MEADE heavy duty field tripod. Ideal for Celestrons and other instruments. $125 Contact: John Gleason 415-792-8248 6/90

BACK ISSUES OF DEEP SKY WANTED Pat Donnelly is looking for back issues of Deep Sky magazine to borrow. Please contact Pat at 408-778-2741 5/90

C-90 $300, Meade 2080 LX3 with dec. motor, Moto-Focus, RFA, dew shield, off-axis guider, hand control, Ultra-block filter, 35mm Ortho, 8mm Ortho, 13.8mm wide angle, 20mm wide angle. $2400 O.B.O. Contact: Richard Aldridge 408-294-5578 5/90

DOUBLE, TRIPLE & MULTIPLE STARS

- PATRICK M. DONNELLY

From time to time I prepare my annual "cuss and swear" list of double stars. These are stars that admittedly are difficult to resolve, but they should resolve in amateur telescopes. This being early August I would like to share the top ten for this time of the year with you. Go ahead and try, but don't be disappointed if you cannot resolve these on the first try. Some of these took years to resolve.

Begin with Theta Aurigae (O-Sigma 545). Theta is fairly close double with a magnitude 3 primary and a mag. 7.5 secondary separated by 3.4". It is a true binary with approximately a 700 year period. There is a third component a mag. 11 star at 52" from the primary, but it is only an optical double. It may be too late in the year for Auriga, but wait a few months or try early in the morning.

The second star on the list is Iota Leonis. Like Theta Aurigae, it is a true double with a 190 year period. It consists of a magnitude 4 and 6.5 components separated by about 1.2". This star is a real challenge, but if you can resolve it, the dimmer companion is almost identical to the Sun. With a magnitude of 6.5 it should be very easy to determine the distance to Iota, using the dim component. Farther east is Bootes. Within Bootes is one star that is often difficult, Epsilon Bootis. Epsilon is a true physical pair about 250 light-years from the Earth and its period may be several thousand years. Epsilon consists of a mag. 2.47 primary and a 5.04 magnitude secondary separated by about 2.7". It truly is a wonderful sight with a yellow-blue contrast.

Below Epsilon Bootis in Libra is Mu Librae. Mu is a dim companion of Alpha Librae, Zubenelgenubi. It is located about 231" from Alpha Librae. Like Epsilon Bootis it too is a pretty yellow-blue pair consisting of magnitude 5.5 and 6.5 components separated by about 1.7". This star should resolve fairly easily. However, it is always difficult for me. This is probably because of its declination. The components of Mu along with Alpha form a true triple system about 65 light years from Earth. Next to Libra is Scorpius. Scorpius has two difficult doubles Alpha (Antares), and Nu Scorpio. Antares is a pretty red-green pair consisting of a mag. 1 primary and a 6.5 mag. companion at 3". The glare from the primary plays havoc with the dimmer companion. Antares is a true system about 500 light-years away with a period of 850 years. Above Antares is Nu Scorpio. Nu is a wonderful double-double system and a true quad-star in space about 400 light years away. The components, A & B are separated by 41.4" with the A1 - A2 components separated by 1.2" and the B1 - B2 components separated by 2.3". The respective magnitudes are 4.6, 5.6, 7.0 and 7.7. Check this star any night the seeing is excellent.

Sagattarius, like Scorpius has two (2) difficult multiple stars. The first is Eta Sagittarii. Eta is a questionable quadruple system consisting of a mag. 3 primary, a magnitude 9 secondary at 3.6", a magnitude 13 companion at 33.3" and a magnitude 10 companion at 93". The main reasons for the difficulty with Eta is its -37 declination, and the magnitude difference of the close components. This star would make an excellent object to explore next year in Baha while there to view the eclipse. The other is the multiple star NH40 at the center of the Trifid Nebula (M20). The stars are separated nicely and are not too bright. However, it is difficult to find all of them embedded in the middle of M20.

The last two stars to check are at the top of my list. Zeta Herculis and Delta Cygni. Delta Cygni is a true double system about 270 light years away and has a period of about 500

years. Delta consists of a magnitude 3 and a mag. 6.5 separated by 2.2". This star was always a source of frustration for me. I probably tried 25 times before I resolved this star. Now I rarely fail to resolve it, but it was a challenge. Zeta Herculis is at the top of the list. I have resolved this star only once although I have tried many time. Zeta is a true system with a period of only 35 years and is only 30 light years away. Zeta consists of a mag. 2.8 primary and a mag. 5.5 secondary separated by about 1". This year the separation is 1.6". So if you want to see it, now is the year. (It was easy in my 5-inch f/8 refractor - Ed.)

To conclude, resolving close doubles is as much a matter of luck as it is a matter of good optics. IN fact, the single biggest factor is seeing. If the atmosphere is steady, you can resolve all of these stars with a 6-inch telescope. On the other hand nights of no better than 3" resolution have been seen. The other factor is object altitude above the horizon. A object of less than 1.5" separation has almost no chance of resolution below 20 degrees. Good luck hunting these doubles. I'm sure you'll end up agreeing that these are a list of "cuss and swear" doubles.

CELESTIAL IMAGES

- JOHN GLEASON

PERIODIC ERROR CORRECTION WHAT'S IT ALL ABOUT?

Now that Meade has joined Celestron in offering periodic error correction (PEC) electronics to their telescopes, it is perhaps time to examine what PEC is and what this means for the astrophotographer.

In the last six months I was privileged to test the production prototype that ultimately ended up in the Celestron telescopes. The ads for these devices are correct when they say that amateurs have long discussed the possibility of increasing guiding accuracy by either reducing periodic gear errors or even better, implementing some type of autoguidance system. Two months ago, I told you all about a new autoguidance device that is sure to revolutionize amateur astronomy. But this device currently costs about $1000. Periodic error correction could simply be called the "poor man's autoguider" until CCD prices come down.

All telescope worm gear systems have a certain amount of periodic error. It's just a fact of life. Some gears exhibit error amplitude measured in arc minutes, while exceptional quality gears have errors below 5 arc seconds (+/- 2.5 arc

COMET EPHEMERIS

Periodic Comet Honda-Mrkos-Pajdusakova (1990f)

07-23	01h30.4m	-01°53'	01h32.9m	-01°37'	99°	M	9.6
07-28	02h32.3m	+02°37'	02h34.9m	+02°50'	88°	M	9.1
08-02	03h43.5m	+07°30'	03h46.2m	+07°40'	74°	M	8.7
08-07	04h54.1m	+11°33'	04h56.9m	+11°38'	61°	M	8.5
08-12	05h54.6m	+14°08'	05h57.5m	+14°09'	51°	M	8.4
08-17	06h42.7m	+15°30'	06h45.6m	+15°27'	44°	M	8.4
08-22	07h20.7m	+16°05'	07h23.6m	+16°00'	39°	M	8.4
08-27	07h51.9m	+16°13'	07h54.7m	+16°05'	36°	M	8.4
09-01	08h18.9m	+16°01'	08h21.7m	+15°51'	35°	M	8.4
09-06	08h43.8m	+15°32'	08h46.6m	+15°21'	34°	M	8.4
09-11	09h07.8m	+14°46'	09h10.5m	+14°34'	33°	M	8.6

Periodic Comet Encke

08-12	04h04.5m	+30°43'	04h07.6m	+30°51'	74°	M	11.1
08-17	04h23.0m	+31°57'	04h26.2m	+32°04'	74°	M	10.9
08-22	04h44.0m	+33°10'	04h47.2m	+33°16'	75°	M	10.7
08-27	05h08.2m	+34°18'	05h11.5m	+34°21'	74°	M	10.4
09-01	05h36.2m	+35°14'	05h39.5m	+35°15'	73°	M	10.2
09-06	06h08.7m	+35°49'	06h12.0m	+35°49'	71°	M	10.0
09-11	06h46.1m	+35°51'	06h49.4m	+35°47'	69°	M	9.7

Comet Levy (1990c)

DATE (UT)	RA (1950)	DEC	RA (2000)	DEC	ELONG	SKY	MAG
07-23	23h47.7m	+29°12'	23h50.3m	+29°29'	107°	M	7.3
07-28	23h37.0m	+28°33'	23h39.5m	+28°50'	114°	M	6.9
08-02	23h21.7m	+27°22'	23h24.2m	+27°39'	121°	M	6.5
08-07	23h00.0m	+25°18'	23h02.4m	+25°34'	130°	M	6.0
08-12	22h29.1m	+21°39'	22h31.5m	+21°55'	140°	M	5.4
08-17	21h45.8m	+15°21'	21h48.2m	+15°35'	151°	M	4.9
08-22	20h48.4m	+05°16'	20h50.9m	+05°27'	155°	M	4.4
08-27	19h41.1m	-07°38'	19h43.7m	-07°31'	141°	E	4.2

THIS MONTH'S METEORS

SHOWER NAME	DATES	DATE OF MAXIMUM	MAXIMUM VISUAL ZENITHAL RATE (per Hr.)	RADIANT POINT (ON MAX DATE) R. A.	DEC	VELOCITY km/sec.	NOTES
Northern Delta Aquarids	July 14-Aug. 25	Aug. 12	20	22h 36m	-5	42.3	visually sep. frm S. Delta Aqu'ids
Southern Delta Aquarids	July 21-Aug. 29	July 29	30	22h 12m	-16.5	41.4	w/ Alpha Cap'ids & S. Iota Aqu'ids
Alpha Capricornids	July 15-Aug. 10	July 30	30	20h 28m	-10	22.8	w/ S. Delta Aqu'ids, slower velocities
Southern Iota Aquarids	July 15-Aug. 25	Aug. 5	15	22h 13m	-14.7	33.8	w/ S. Delta Aqu'ids some long paths
Northern Iota Aquarids	July 15-Sept. 20	Aug. 20	15	21h 48m	-6	31.2	long duration shr some long paths
Perseids	July 23-Aug. 23	Aug. 12	70	3h 5m	+57.4	59.4	swift, w/ trains usu. org or yellow
Kappa Cygnids	Aug. 9 - Oct. 6	Aug. 18	5	19h 20m	+55	24.8	mod. velocity, good contrast w/Perseids
Southern Piscids	Aug. 31 - Nov. 2	Sep. 20	<1	0h 24m	+ 0	26.3	weak visual stream

seconds). My own Parsec-12 mount has a +/- 10 arc second error. A Losmandy mount that I recently tested ran +/- 4 arc seconds, running only a six inch gear. That's pretty exceptional. However, this does not mean that you can just walk away from your telescope during a long exposure. 180mm or shorter focal length lenses would probably yield results that were quite good if used in unattended exposures with these mountings, but longer focal lengths demand precise corrections. That means a watchful eye behind the guiding eyepiece for spurious tracking errors.

The frequency of periodic error or worm revolution is typically an average of four minutes. If you monitor a guide star during this time, you will notice the star slowly drift to the west, stop, then drift back to the east in right ascension. In theory, the operation of a PEC drive corrector allows an astrophotographer to record and store in electronic memory, all right ascension drive corrections made during the worm rotation period. The periodic memory algorithm records the manual guiding corrections and replays the pattern of speed adjustments in a smooth manner. This also means that the telescope drive rate is automatically adjusted to the exact rate for that part of the sky. (Here I refer you to the problem of differential atmospheric refraction and telescope tracking, but that's another story.) The expected result is to reduce the amplitude of periodic tracking errors to a very low level, minimizing the number of manual telescope drive corrections made during a long photographic exposure.

The Celestron unit operates in the following manner. Let's say you have finished a precision polar alignment and you are ready to do some long photographic exposures. The Celestron drive corrector has four basic drive rates but we will just look at the PEC function. Once a guide star is acquired and centered using a high power eyepiece with illuminated reticle, the PEC record mode is activated by the simple press of a button. Now for the next 400 seconds (My Parsec-12 drive has nearly a 7 minute worm rotation), I will guide as accurately as possible. Every correction that I make will be recorded. As long as I stay in the Record mode I will continuously update the memory. The next revolution of the worm will reflect the guiding corrections of the previous revolution. The character of the guiding changes as a result of PEC. Errors, seen in the first worm revolution are now smaller and of shorter duration.

When I am satisfied with my recording, a simple press of a button puts the unit into Continuous Playback mode. This feature allows you to correct for spurious errors like wind and atmospheric seeing, without changing the original recording. There is even a Smoothed Playback mode which helps smooth short term irregularities from the original recording. As a bonus, the drive corrector and motor will run for about 20 hours on a standard 9 Volt alkaline transistor battery!

Without PEC my Parsec-12 has a periodic error of +/- 10 arc seconds. With a precision recording made and smoothed playback in operation, the periodic error was reduced to +/ -3.5 arc seconds. This represents a better than 60% reduction of error amplitude with PEC in operation. (This data was measured from actual star images on Kodak 2415 film.)

In practice, I have visually noticed long periods of time where I make no overriding corrections at all under PEC. The trick here is to remember that your telescope is not tracking on a star, but is now running under a very precise gear control system. You still need to watch for those unpredictable errors that tend to show up as soon as you look away from the guiding eyepiece!
It is true that the Celestron PEC does not hold the recording once the power is turned off. But it will only take 4-minutes to make a new recording when using the C8. New recordings should be made anyway to compensate for changes in telescope declination. (See Sky & Telescope Magazine, November 1989 issue.)

Taking the concept one step further, I have combined PEC with the CCD autoguider. Now, instead of making the PEC recording manually, I let the autoguider make the recording for me. It is interesting to watch the reduction in pixel corrections after the first worm revolution during the record mode. The smoothed playback is then switched in for the remainder of the exposure. Recently I ran a 90 minute exposure on Barnard's "S" dark nebula in a 10 to 15 knot wind at Fremont Peak. The combination of the PEC and the autoguider yielded perfect star images.

PEC drive correctors are still only available for Celestron and soon, Meade telescopes. The test unit I use runs a small but efficient DC motor with the precise worm rotation period pre-programmed into the ROM algorithm. This makes the unit somewhat unique to my Parsec-12. If however the concept of PEC is well received by amateurs, it will simply be a matter of time when PEC drive correctors are available for all types of telescope drive systems, perhaps even under the ***Celestial Images*** product name!

To conclude, PEC is indeed something that many astrophotographers have talked about. It can dramatically reduce the amplitude of periodic error in telescope worm gear systems, turning good drive systems into exceptional ones.

THE ASTRONOMY BOOKSHELF

- RICHARD PAGE

The Moon Observer's Handbook
Fred W. Price
Cambridge University Press, 1988
309 pages

It has been observed many times that the first object the novice amateur astronomer is likely to seek out telescopically is the Moon. Unfortunately, it seems to have become a corollary of this observation that nearly as often the amateur quickly looses interest in our nearest neighbor. Why should this be?
Most of us find little enough time to devote to our avocation, so that we tend to schedule our observing with the explicit intent of avoiding moonlight, especially when in pursuit of deep sky objects. The aversion is partly responsible for the chief cause of lunar neglect: unfamiliarity. How many of us could, off the tops of our heads, locate and identify telescopically more than a handful of features on the lunar surface, let alone correlate them to current theories of lunar formation and morphology? This is not to say that one need become an expert selenologist to appreciate the Moon, any more than one need be a cosmologist to enjoy a view of a distant galaxy. But think how impoverished our pleasure in viewing a galaxy like M82 would be without the knowledge that this apparently small fuzzy spot is in reality a huge assemblage of hundreds of millions of stars undergoing an unimaginably violent disruption in an inconceivably distant corner of the universe. Similarly, if our view of the Moon is nothing more than a seemingly unrelated jumble of craters, plains and mountains, then our interest certainly will quickly wane.

The best antidote to lunar ennui I have yet encountered is The Moon Observer's Handbook, by Fred Price. Though not flawless, Price's handbook provides a thorough guide that caters to all levels of interest, from simply familiarizing oneself with the lunar landscape, to pursuing such exotic subjects as lunar transient phenomena.

The book is organized into seven sections, the first of which deals with the Moon's surface features. Here Price illustrates the various types of formations through a series of small scale maps each covering one specific type of

feature (maria, ring structures, mountain ranges, etc.). The resultant lack of clutter makes it simple to grasp the overall density and distribution of each type of feature. This sort of graphical clarity characterizes the entire book.

The second section deals with lunar motions, while the third discusses telescopes in much more detail than I think necessary for a guide dedicated to so specific a topic. However, the fourth section, which is the real heart of Price's book, is so well executed that we can forgive any previous excesses.

In this section we are led on a day by day excursion of the waxing moon, from third day after new to just past full. Here Price is in his element, and his infatuation with his subject clearly shines through in vivid descriptions - physical, historical and aesthetic - of the surface features. Each day's phase is illustrated by a clear line drawing of the newly visible terminator details labeled for reference both at the telescope and to the textual account. Also scattered through this section are numerous drawing of specific features executed by various observers. If you are able to pursue these charts and descriptions without feeling an urge to get out the old optic tube and have a look, then perhaps it's time to revive your interest in that old bottle cap collection.

The last three sections, dealing respectively with recording observations, transient phenomena, and research projects, are intended primarily for those whose enthusiasm might carry them beyond the purely aesthetic pursuit of lunar observing.

For those of us whose interest in our satellite waned early in our amateur careers, Fred Price's fine guide may be just the thing to renew an unjustly neglected acquaintance and transform it into an abiding affair.

SPACE PROGRAM UPDATE

- BOB FINGERHUT

HUBBLE FOCUS PROBLEMS - As I am sure you all have heard, Hubble is not able to focus as well as planned due to an error in the fabrication of one of its mirrors. The 2-micron error in the figure has resulted in spherical aberration that prevents focusing the telescope any better than the best ground based telescopes. Instruments that are affected by the poor focus are the wide-field planetary camera and the European faint object camera in the visible wavelengths. The instruments that will not be affected are the faint object camera in the ultraviolet wavelengths, the Goddard high-resolution spectrograph, the faint object spectrograph, the high speed photometer, and fine guidance sensor astrometry. A second generation wide-field planetary camera is currently under development. The new camera will contain a correction for the Hubble's spherical aberration and will be ready for launch in late 1992 or early 1993. Until then, the order for performing experiments will be adjusted for maximum use of the unaffected instruments.

HYDROGEN LEAK GROUNDS SHUTTLE FLEET - On June 29, NASA found a hydrogen leak on the Atlantis that is similar to but much smaller than the one that was found on the orbiter Columbia. The shuttle fleet is grounded until the cause of the leak is found and fixed. It is hoped that the leak can be fixed by late July. If it is, one or both delayed missions could be flown before the Ulysses solar probe in October.

INTELSAT SUCCESSFULLY LAUNCHED An Intelsat F6 communication satellite was launched on a commercial Titan booster on June 23. The satellite is identical to one that was stranded in the wrong orbit on March 14. Intelsat has accepted a NASA offer to send space shuttle astronauts to rescue the stranded satellite by attaching a new rocket motor to boost it to its proper orbit in early 1992.

SECOND TITAN 4 LAUNCHED ON JUNE 8 - This expendable launch vehicle, with the payload capacity of the shuttle, launched a classified military payload on this mission.

KRISTALL MODULE DOCKS WITH MIR SPACESTATION - The successful docking means that the cosmonauts will have a ladder with which to attempt to reach and repair the ripped insulation on their Soyuz-9 spacecraft. The ripped insulation is blocking key sensors that are needed for re-entry.

EUROPEAN PARTICIPATION IN CASSINI MISSION APPROVED - The European Space Agency will supply the Huygens probe that will descend to the surface of Saturn's moon Titan. Launch is planned for 1996.

SPACE STATION PRELIMINARY DESIGN REVIEWS (PDR) ARE UNDERWAY - The PDR for the station environmental control and life support system is complete. All reviews should be complete by late summer. The space station design is about 20% complete. station was damaged during launch on Feb. 11. Ripped insulation is blocking key sensors needed to align the spacecraft properly for re-entry. An extendible latter that the crew needs to get near and repair the damage was sent up in the Kristall module on May 31. Unfortunately, as of early June, the cosmonauts were having trouble docking the Kristall module to the Mir space station. Will follow-up with the exciting conclusion next month.

METEOR NOTES

JIM RICHARDSON

August is a busy month for shower activity, and we go into it with no less than six active showers occurring at the same time. Even through it is best known for the Perseid shower, the best display this year will probably be from the Aquarid group of showers, in the very first part of the month. This is because the mid-month activity, including the Perseids, gets clobbered rather effectively by a waning gibbous moon. Later in the month, at new moon, two minor showers are peaking; the Northern Iota Aquarids, which have a very broad peak stretched out over a few weeks, and the Kâppa Cygnids, with a well placed radiant in the northernmost portion of the summer Milky Way.

For those who want to catch a few Perseids anyway (myself included), the trailing edge of the shower will probably be best, to take advantage of the successively later moon rises (about 30- 40 min) each night. The Perseid shower has a 5 day peak, from days of 1/4 strength, so displays will still be good for the 2 or 3 days following the maximum. Below is the radiant altitude/azimuths for the night of the maximum. (Aug. 11-12)

21:55 PDT (4:55 Z) 12 deg ALT/ 23 deg AZ End Even. Twilight. 22:47 PDT (5:47 Z) 17 deg. ALT/29 deg AZ Moon Rise (21 day). 4:00 PDT (11:00 Z) 55 deg ALT/ 39 deg AZ Calculated Maximum. 4:17 PDT (11:17 Z) 57 deg ALT/ 38 deg AZ Begin Morn. Twilight.

Individual Shower Notes:

Southern Delta Aquarids: Paired with the Daytime Arietids (early June).

Alpha Capricornids: Also just called the Capricornids. Cook states that they are not resolvable visually from the S. Delta Aquarids, however, observations show that the S. Delta Aquarids are twice as fast, but fainter, than the average Alpha Capricornid. Norton's (15 ed.) says they are "v.sl.,bright" and associated with Comet 1881 V.

Southern Iota Aquarids: Also called the Piscis Australids, they are not resolvable visually from the S. Delta Aquarids. It is paired with the N. Iota Aquarids, with somewhat slow meteors, having long paths.

Northern Iota Aquarids: Early on, this shower is not resolvable visually from the S. Delta Aquarids. It is long, but quite feeble in its late stages. Paired with the S. Iota Aquarids, with the same characteristic meteors.

Perseids: Associated with Comet 1862 III Swift-Tuttle. Numerically one of the years best displays, with swift meteors, usually trained, and orange or yellow in color.

Kappa Cygnids: Though much weaker, this stream creates a good contrast with the nearby Perseids, which are much swifter and brighter than these moderate, average meteors.

(Data from "A working list of Meteor Streams", A.F. Cook (1973))

June-July Notes: Minor shower observations remained difficult during this period, due to the Moon obscuring the view right during the times of better activity. Sporadic activity is slowly on the rise as we move into summer, so evening observations are getting better, numerically speaking, with peak sporadic activity in August and September. The last two evening sessions have been rewarded by appearances of one of my favorite types of meteors (next to Fireballs, of course), the "slow grazers". These occur around midnight or so, and are from meteoroids which have to catch up with the Earth in it's motion around the Sun, and come up from behind, so to speak, giving them very slow visual velocities. At midnight, these meteoroids are striking the atmosphere nearly parallel to the ground, making very long West to East paths across the sky. These two properties combined make for a very pretty, long, slow meteor, generally orange to red in color. Many variances can occur along the path, with wobbles, flashes, skips, and even pieces being thrown out, and they usually end as a Bolide, breaking apart into several pieces before fading from view. One of these can make an evening of generally mundane sporadic meteors totally worthwhile.

:::CELESTIAL CALENDAR - AUG-1990::::
by Richard Stanton

LUNAR PHASES	Date	Rise	Tran	Set
FM 07:19hr	06-08	1942	0048	0555
LQ 08:54hr	13-08	2337	0649	1407
NM 05:39hr	20-08	0629	1300	1936
FQ 00:34hr	28-08	1431	1940	2339

NEARER PLANETS				
Mercury.....	07-08	0827	1443	2103
0.83 A.U.	17-08	0843	1440	2041
Mag +1.4	27-08	0830	1416	2006
Venus.....	07-08	0415	1124	1837
1.58 A.U.	17-08	0429	1133	1842
Mag -3.9	27-08	0437	1143	1843
Mars.....	07-08	0013	0658	1350
0.92 A.U.	17-08	2351	0641	1338
Mag +0.4	27-08	2327	0622	1324
Jupiter.....	07-08	0438	1145	1856
6.16 A.U.	17-08	0409	1114	1824
Mag -1.8	27-08	0340	1043	1751
Saturn.....	07-08	1828	2318	0409
9.17 A.U.	17-08	1746	2236	0327
Mag +0.2	27-08	1705	2155	0245

SOL				
0906+1633	07-08	0603	1255	1950
0944+1334	17-08	0612	1254	1939
1021+1014	27-08	0622	1258	1928

ASTRONOMICAL TWILIGHT				
JD 2,448,110.5	07-08	0403	-	2142
120.5	17-08	0440	-	2126
130.5	27-08	0452	-	2109

SIDEREAL TIME			
Transit Right	07-08	0000 PDT=	1954
Ascension at	17-08	0000 PDT=	2014
Local Midnight	27-08	0000 PDT=	2034

DARKEST Saturday Night.....August 18

TIMES & DATES ARE PACIFIC DAYLIGHT

SKILLS SURVEY

	Willing	Experienced and Willing
CIVIL WORKS:(*)		
Surveying	_____	_____
Electrical	_____	_____
Water Systems	_____	_____
Concrete	_____	_____
Fire Prevention	_____	_____
Road Construction	_____	_____
Carpentry	_____	_____
SHOP:(*)		
Machining	_____	_____
Welding	_____	_____
Sheet Metal	_____	_____
Assembly	_____	_____
Tooling	_____	_____
DESIGN:(*)		
Hardware	_____	_____
Software	_____	_____
Electronics	_____	_____
Architecture	_____	_____
System	_____	_____
ELECTRONICS:(*)		
Assembly	_____	_____
Test	_____	_____
Calibration	_____	_____
Integration	_____	_____
COMMUNICATIONS:(*)		
Microwave	_____	_____
Land Line	_____	_____
TELESCOPE MAKING:(*)		
Mounts	_____	_____
Instrumentation	_____	_____
Glass Work	_____	_____
MANAGEMENT:(*)		
Project Management	_____	_____
Project Planning	_____	_____
Legal	_____	_____
Insurance	_____	_____
Fund Raising	_____	_____
Publicity	_____	_____
Relations		
Community	_____	_____
Governments	_____	_____
Industry	_____	_____
Institutions	_____	_____
Astro Clubs	_____	_____
Proposal/Spec Writing	_____	_____
(*)Team Leader	_____	_____
Procurement/Foraging	_____	_____
Finance	_____	_____

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