

YR	MO	DA	HR	JD(JE)	RAJ2000.0	DEC	ORA	VAR	DOEC	DELTA	POBAND	THETA	BETA	GLONG	GLAT	AZ	AL	AZD	ALD	TMAQ
1996	0	20	0	2450162.5	14 52.36	-00 22.4	-5.97	85.8	30	1.15	270.4	136.4	36.6	221.0	18.1	228.8	40.7	72.6	20.6	1.7
1996	0	21	0	2450163.5	14 52.25	-00 24.1	-5.83	100.7	18	1.33	258.4	137.3	36.7	218.9	20.1	227.7	47.4	68.1	18.0	1.2
1996	0	22	0	2450164.5	14 52.14	-00 25.8	-5.69	115.6	15	1.51	245.4	138.2	36.8	216.8	21.1	226.6	54.1	57.0	15.0	0.8
1996	0	23	0	2450165.5	14 52.03	-00 27.5	-5.54	130.5	12	1.69	232.4	139.1	36.9	214.7	22.1	225.5	61.2	45.9	12.0	0.4
1996	0	24	0	2450166.5	14 51.52	-00 29.2	-5.40	145.4	9	1.87	219.4	140.0	37.0	212.6	23.1	224.4	68.3	34.8	9.0	0.0
1996	0	25	0	2450167.5	14 51.41	-00 30.9	-5.26	160.3	6	2.05	206.4	140.9	37.1	210.5	24.1	223.3	75.4	23.7	6.0	-0.4
1996	0	26	0	2450168.5	14 51.30	-00 32.6	-5.11	175.2	3	2.23	193.4	141.8	37.2	208.4	25.1	222.2	82.5	12.6	3.0	-0.8
1996	0	27	0	2450169.5	14 51.19	-00 34.3	-4.97	190.1	0	2.41	180.4	142.7	37.3	206.3	26.1	221.1	89.6	1.5	0.0	-1.2
1996	0	28	0	2450170.5	14 51.08	-00 36.0	-4.83	205.0	-3	2.59	167.4	143.6	37.4	204.2	27.1	220.0	96.7	0.4	-0.4	-1.6
1996	0	29	0	2450171.5	14 50.97	-00 37.7	-4.69	220.0	-6	2.77	154.4	144.5	37.5	202.1	28.1	218.9	103.8	-0.7	-0.8	-2.0
1996	0	30	0	2450172.5	14 50.86	-00 39.4	-4.55	234.9	-9	2.95	141.4	145.4	37.6	200.0	29.1	217.8	110.9	-1.6	-1.2	-2.4
1996	0	31	0	2450173.5	14 50.75	-00 41.1	-4.41	250.0	-12	3.13	128.4	146.3	37.7	197.9	30.1	216.7	118.0	-2.5	-1.6	-2.8
1996	0	1	0	2450174.5	14 50.64	-00 42.8	-4.27	265.0	-15	3.31	115.4	147.2	37.8	195.8	31.1	215.6	125.1	-3.4	-2.0	-3.2
1996	0	2	0	2450175.5	14 50.53	-00 44.5	-4.13	280.0	-18	3.49	102.4	148.1	37.9	193.7	32.1	214.5	132.2	-4.3	-2.4	-3.6
1996	0	3	0	2450176.5	14 50.42	-00 46.2	-3.99	295.0	-21	3.67	89.4	149.0	38.0	191.6	33.1	213.4	139.3	-5.2	-2.8	-4.0
1996	0	4	0	2450177.5	14 50.31	-00 47.9	-3.85	310.0	-24	3.85	76.4	149.9	38.1	189.5	34.1	212.3	146.4	-6.1	-3.2	-4.4
1996	0	5	0	2450178.5	14 50.20	-00 49.6	-3.71	325.0	-27	4.03	63.4	150.8	38.2	187.4	35.1	211.2	153.5	-7.0	-3.6	-4.8
1996	0	6	0	2450179.5	14 50.09	-00 51.3	-3.57	340.0	-30	4.21	50.4	151.7	38.3	185.3	36.1	210.1	160.6	-7.9	-4.0	-5.2
1996	0	7	0	2450180.5	14 50.00	-00 53.0	-3.43	355.0	-33	4.39	37.4	152.6	38.4	183.2	37.1	209.0	167.7	-8.8	-4.4	-5.6
1996	0	8	0	2450181.5	14 49.50	-00 54.7	-3.29	370.0	-36	4.57	24.4	153.5	38.5	181.1	38.1	207.9	174.8	-9.7	-4.8	-6.0
1996	0	9	0	2450182.5	14 49.40	-00 56.4	-3.15	385.0	-39	4.75	11.4	154.4	38.6	179.0	39.1	206.8	181.9	-10.6	-5.2	-6.4
1996	0	10	0	2450183.5	14 49.30	-00 58.1	-3.01	400.0	-42	4.93	-2.4	155.3	38.7	176.9	40.1	205.7	189.0	-11.5	-5.6	-6.8
1996	0	11	0	2450184.5	14 49.20	-00 59.8	-2.87	415.0	-45	5.11	-13.4	156.2	38.8	174.8	41.1	204.6	196.1	-12.4	-6.0	-7.2
1996	0	12	0	2450185.5	14 49.10	-01 01.5	-2.73	430.0	-48	5.29	-26.4	157.1	38.9	172.7	42.1	203.5	203.2	-13.3	-6.4	-7.6
1996	0	13	0	2450186.5	14 49.00	-01 03.2	-2.59	445.0	-51	5.47	-39.4	158.0	39.0	170.6	43.1	202.4	210.3	-14.2	-6.8	-8.0
1996	0	14	0	2450187.5	14 48.90	-01 04.9	-2.45	460.0	-54	5.65	-52.4	158.9	39.1	168.5	44.1	201.3	217.4	-15.1	-7.2	-8.4
1996	0	15	0	2450188.5	14 48.80	-01 06.6	-2.31	475.0	-57	5.83	-65.4	159.8	39.2	166.4	45.1	200.2	224.5	-16.0	-7.6	-8.8
1996	0	16	0	2450189.5	14 48.70	-01 08.3	-2.17	490.0	-60	6.01	-78.4	160.7	39.3	164.3	46.1	199.1	231.6	-16.9	-8.0	-9.2
1996	0	17	0	2450190.5	14 48.60	-01 10.0	-2.03	505.0	-63	6.19	-91.4	161.6	39.4	162.2	47.1	198.0	238.7	-17.8	-8.4	-9.6
1996	0	18	0	2450191.5	14 48.50	-01 11.7	-1.89	520.0	-66	6.37	-104.4	162.5	39.5	160.1	48.1	196.9	245.8	-18.7	-8.8	-10.0
1996	0	19	0	2450192.5	14 48.40	-01 13.4	-1.75	535.0	-69	6.55	-117.4	163.4	39.6	158.0	49.1	195.8	252.9	-19.6	-9.2	-10.4
1996	0	20	0	2450193.5	14 48.30	-01 15.1	-1.61	550.0	-72	6.73	-130.4	164.3	39.7	155.9	50.1	194.7	260.0	-20.5	-9.6	-10.8
1996	0	21	0	2450194.5	14 48.20	-01 16.8	-1.47	565.0	-75	6.91	-143.4	165.2	39.8	153.8	51.1	193.6	267.1	-21.4	-10.0	-11.2
1996	0	22	0	2450195.5	14 48.10	-01 18.5	-1.33	580.0	-78	7.09	-156.4	166.1	39.9	151.7	52.1	192.5	274.2	-22.3	-10.4	-11.6
1996	0	23	0	2450196.5	14 48.00	-01 20.2	-1.19	595.0	-81	7.27	-169.4	167.0	40.0	149.6	53.1	191.4	281.3	-23.2	-10.8	-12.0
1996	0	24	0	2450197.5	14 47.90	-01 21.9	-1.05	610.0	-84	7.45	-182.4	167.9	40.1	147.5	54.1	190.3	288.4	-24.1	-11.2	-12.4
1996	0	25	0	2450198.5	14 47.80	-01 23.6	-0.91	625.0	-87	7.63	-195.4	168.8	40.2	145.4	55.1	189.2	295.5	-25.0	-11.6	-12.8
1996	0	26	0	2450199.5	14 47.70	-01 25.3	-0.77	640.0	-90	7.81	-208.4	169.7	40.3	143.3	56.1	188.1	302.6	-25.9	-12.0	-13.2
1996	0	27	0	2450200.5	14 47.60	-01 27.0	-0.63	655.0	-93	8.00	-221.4	170.6	40.4	141.2	57.1	187.0	309.7	-26.8	-12.4	-13.6
1996	0	28	0	2450201.5	14 47.50	-01 28.7	-0.49	670.0	-96	8.18	-234.4	171.5	40.5	139.1	58.1	185.9	316.8	-27.7	-12.8	-14.0
1996	0	29	0	2450202.5	14 47.40	-01 30.4	-0.35	685.0	-99	8.36	-247.4	172.4	40.6	137.0	59.1	184.8	323.9	-28.6	-13.2	-14.4
1996	0	30	0	2450203.5	14 47.30	-01 32.1	-0.21	700.0	-102	8.54	-260.4	173.3	40.7	134.9	60.1	183.7	331.0	-29.5	-13.6	-14.8
1996	0	31	0	2450204.5	14 47.20	-01 33.8	-0.07	715.0	-105	8.72	-273.4	174.2	40.8	132.8	61.1	182.6	338.1	-30.4	-14.0	-15.2
1996	0	1	0	2450205.5	14 47.10	-01 35.5	0.07	730.0	-108	8.90	-286.4	175.1	40.9	130.7	62.1	181.5	345.2	-31.3	-14.4	-15.6
1996	0	2	0	2450206.5	14 47.00	-01 37.2	0.21	745.0	-111	9.08	-299.4	176.0	41.0	128.6	63.1	180.4	352.3	-32.2	-14.8	-16.0
1996	0	3	0	2450207.5	14 46.90	-01 38.9	0.35	760.0	-114	9.26	-312.4	176.9	41.1	126.5	64.1	179.3	359.4	-33.1	-15.2	-16.4
1996	0	4	0	2450208.5	14 46.80	-01 40.6	0.49	775.0	-117	9.44	-325.4	177.8	41.2	124.4	65.1	178.2	366.5	-34.0	-15.6	-16.8
1996	0	5	0	2450209.5	14 46.70	-01 42.3	0.63	790.0	-120	9.62	-338.4	178.7	41.3	122.3	66.1	177.1	373.6	-34.9	-16.0	-17.2
1996	0	6	0	2450210.5	14 46.60	-01 44.0	0.77	805.0	-123	9.80	-351.4	179.6	41.4	120.2	67.1	176.0	380.7	-35.8	-16.4	-17.6
1996	0	7	0	2450211.5	14 46.50	-01 45.7	0.91	820.0	-126	9.98	-364.4	180.5	41.5	118.1	68.1	174.9	387.8	-36.7	-16.8	-18.0
1996	0	8	0	2450212.5	14 46.40	-01 47.4	1.05	835.0	-129	10.16	-377.4	181.4	41.6	116.0	69.1	173.8	394.9	-37.6	-17.2	-18.4
1996	0	9	0	2450213.5	14 46.30	-01 49.1	1.19	850.0	-132	10.34	-390.4	182.3	41.7	113.9	70.1	172.7	402.0	-38.5	-17.6	-18.8
1996	0	10	0	2450214.5	14 46.20	-01 50.8	1.33	865.0	-135	10.52	-403.4	183.2	41.8	111.8	71.1	171.6	409.1	-39.4	-18.0	-19.2
1996	0	11	0	2450215.5	14 46.10	-01 52.5	1.47	880.0	-138	10.70	-416.4	184.1	41.9	109.7	72.1	170.5	416.2	-40.3	-18.4	-19.6
1996	0	12	0	2450216.5	14 46.00	-01 54.2	1.61	895.0	-141	10.88	-429.4	185.0	42.0	107.6	73.1	169.4	423.3	-41.2	-18.8	-20.0
1996	0	13	0	2450217.5	14 45.90	-01 55.9	1.75	910.0	-144	11.06	-442.4	185.9	42.1	105.5	74.1	168.3	430.4	-42.1	-19.2	-20.4
1996	0	14	0	2450218.5	14 45.80	-01 57.6	1.89	925.0	-147	11.24	-455.4	186.8	42.2	103.4	75.1	167.2	437.5	-43.0	-19.6	-20.8
1996	0	15	0	2450219.5	14 45.70	-01 59.3	2.03	940.0	-150	11.42	-468.4	187.7	42.3	101.3	76.1	166.1	444.6	-43.9	-20.0	-21.2
1996	0	16	0	2450220.5	14 45.60	-02 01.0	2.17	955.0	-153	11.60	-481.4	188.6	42.4	99.2	77.1	165.0	451.7	-44.8	-20.4	-21.6
1996	0	17	0	2450221.5	14 45.50	-02 02.7	2.31	970.0	-156	11.78	-494.4	189.5	42.5	97.1	78.1	163.9	458.8	-45.7	-20.8	-22.0
1996	0	18	0	2450222.5	14 45.40	-02 04.4	2.45	985.0	-159	11.96	-507.4	190.4	42.6	95.0	79.1	162.8	465.9	-46.		

from down under. There was some discussion on the Internet about it and after some gentle prodding, Ed Erbeck started carrying it late last year so I was able to get a copy.

The first thing you notice about the AstroAtlas is its mass--it's an inch thick and printed on heavy paper. Unlike the Sky Atlas, the pages are double sided, so you know there's a lot of information inside. The cover is laminated and the more than 240 11.75" x 16.5" pages are spiral bound so that the charts lie flat when open. Print quality is very good, but due to certain plotting order effects, some information is occasionally obscured (usually text is lost in these cases). All chart edges have overlap with neighboring charts to aid in locating objects near chart boundaries and the adjoining charts are indicated at the edges to help navigate through the atlas. The charts are all black on white.

The second thing that stands out when looking at the charts is the detailed symbology used. Unlike most atlases which only indicate object types and IDs (or in some cases, position angle), the AstroAtlas uses a very intricate (but non-intrusive) set of symbols to indicate all manner of visual appearances of various types of objects. Symbols typically have tick marks or gaps, the location of which varies to indicate some discernable feature such as degree of central concentration of globular clusters, morphological classes of galaxies, obliquity and PA of galaxies, magnitude of central stars in planetary nebulae, and size of objects.

In crowded fields these help in correctly identifying the various objects visible in the eyepiece. Even stars have their spectral class identified by the vertical position of a small white square within the star's black circle. Of course this mark is only visible on stars which are plotted large enough on the charts (this varies with the series). Double stars are plotted with separation, PA, and companion magnitude indicated by symbols (where it is known, the orbit is even plotted with epoch 2000.0 marked). The symbols for diffuse and dark nebulae are not very attractive (especially when

compared to the nice colored and outlined rendition of the Sky Atlas 2000.0), but they do suffice.

The first 20 pages contain an overview of the charts and their contents as well as the symbol legend. There are 6 separate series of charts in the AstroAtlas. Every chart has a culmination table (a nice touch). The A series (12 charts) are mercator projection full sky charts which plot the location of the various other chart series, deep sky objects by type (e.g. globular clusters, planetary nebulae, Messiers, etc.), brightest stars (magnitude 4.0 and brighter), constellation boundaries, etc. These charts form an interesting and useful visual index to the AstroAtlas.

The B series charts are actually 3 sets of 16 charts with each set covering the entire celestial sphere at a scale of 3/16" per degree. The layout is similar to Norton's 2000.0 with two polar charts and 7 north-south pairs covering the space between. Plotted stars are from the Yale Bright Star Catalog (complete to magnitude 6.5 with some 461 between 6.6 and 6.9) and only the brighter deep sky objects are included.

The second B chart set (BS) plots the same information as the "normal" B set, but with South at the top and labels oriented to match (for those lucky Southern hemisphere observers). The third set (BM) has AAVSO style magnitude labels for every star (e.g. 45 means magnitude 4.5) and no deep sky objects are plotted. These are useful for estimating sky transparency among other things.

The C series charts are the heart of the AstroAtlas. The whole sky is covered on 94 charts with a scale of 3/8" per degree with stars to magnitude 9.0 and deep sky to magnitude 14.0 (integrated brightness from varied source catalogs). There are two polar charts (+/- 72 to +/- 90) plus 92 other charts covering a 1h20m by 30 degree section of sky (plus generous overlap). These charts would be wonderful by themselves except in the denser regions of the sky (Virgo, Ursa Major, Cygnus, Sagittarius, the Magellanic Clouds, etc.).

The D series charts solve this problem, covering most of these denser

regions on 42 more pages. The scale varies in this series (most are at 5/8" or 3/4" per degree with some at even larger scales) as does the stellar magnitude limit (from 10.0 to 11.5). Deep sky objects down to magnitude 15.0 are plotted. Of interest in this group are the polar regions (with precession plotted from 1700-2300 AD), Cassiopeia, Cygnus, Sagittarius, Scorpius, Canis Major, Auriga, Leo, Virgo, Ursa Major, Eridanus, the Pleiades, Orion, and many others (including lots of southern sky regions).

The E series contains only 14 charts most of which cover southerly reaches not visible from Northern California. However, there are four charts in the heart of the Virgo galaxy cluster (Virgo and Coma Berenices) at over 1.5" per degree. I'm looking forward to using these detailed charts the next clear night at Fremont Peak. The stellar magnitude limit on them varies from 11.0 to 14.0 with most charts at 13.0 or 14.0. Deep sky objects to magnitude 15.0 are shown.

The final F series covers only the central region of the Large Magellanic Cloud on four charts. The scale is over 1.5" per degree with a stellar limiting magnitude of 14.0 (!) and a deep sky limit of 15.0. These few pages will make anyone want to haul their biggest telescope to the Australian outback for a few weeks of fun.

Overall Impressions

On my first night out with the AstroAtlas I was determined to become familiar with, if not accustomed to, its features. I found that I used the C and D series charts the most often. In some sections of the sky (which are not necessarily covered in the D series charts) I had some difficulty reading object symbols and labels, but for the most part I found the additional information conveyed by the symbols quite useful. For instance, while observing a fairly faint galaxy I thought I might be seeing a second nucleus nearby. Comparing views in a larger (14.5") telescope confirmed my observation. Upon looking at the AstroAtlas again I noted that the

continued on page 3, see Atlas



symbol indicated "multiple/interacting" galaxies. Quite useful information to have without resorting to reference tables or other sources.

I did end up using my old trusty Sky Atlas to locate many objects that night, partially because I still find it most familiar and easy to use for "bright" objects. For more challenging targets (or for folks with bigger instruments) I think the AstroAtlas would be a worthwhile investment allowing for more time observing and less time referencing other sources or object description tables in the dark.

In comparing the AstroAtlas C series to Uranometria (which has a single chart scale of just under 3/4" per degree) I notice that in many cases one atlas plots objects not shown in the other. This must be partially due the inconsistencies in determining and reporting magnitudes of deep sky objects, but also due to the whims of the atlas editors. Uranometria is consistent in its labeling (all objects have labels) while the AstroAtlas often leaves galaxies unlabeled. These objects are apparently not in the NGC or IC catalogs (some are UGC). Beginning with the D series charts the AstroAtlas wins hands down for sheer magnitude depth. In one D chart covering part of Virgo, the AstroAtlas plots almost 50% more objects. The lack of labels for many objects can be something of an annoyance.

Overall I have found this atlas to be a great new field resource as well as observational planning guide. As I work my way through the Herschel 400 list I will be checking out some of the nearby objects plotted in the AstroAtlas. I also have additional motivation to build a larger telescope. I may still buy the full set of Uranometria knowing that I can leave it at home as a desk reference.

The Herald-Bobroff AstroAtlas is available directly from the publisher: HB2000 Publications
P.O. Box 254
Woden
A.C.T. 2606
Australia
or locally from Crazy Ed Optical. The cost is around \$90.

Comet Blasts Through Tree by Bill O'Shaughnessy

The SJAA hosted it's monthly deep sky observing sessions at Henry Coe State Park and Fremont Peak State Park Saturday night, 3/16/1996. I was at the Henry Coe Site.

The skys were mediocre to good at the start of the night. We were threatened by some fog from the north, but by 10:00 pm the skys turned to very good. I was working my way through Don Macholz's Messier Marathon Book and having good success with most of the objects.

We had 7 scopes at the viewing area, ranging from 4.5 inch Tasco to a 10 inch schmidt-cass. During the night we had about 15 to 20 guests come look through our scopes.

At 10:30 Jim Van Nuland found Comet Hyakutake about 5 degrees above the horizon and through a tree. This was much earlier than I had expected it. I have been viewing it from SJ at midnight during the week. The Comet was quite a site even low in the sky and we continued to track it between other object during the night. As it got higher in the sky I could detect a tail to the WSW across the entire field of view of my 20x50 binocs.

With the Comet, the very good skys and the mild weather it was one of my best nights ever at Henry Coe. Can't wait 'til next new moon.

Eye, continued from page 1

ing is behind ranger's house, only us astronomers at this campsite. Contact Jim Van Nuland for more details and to sign up.

Bylaws. Bob Brauer, Bob Maden, and I have revised the club's bylaws to reflect the way SJAA currently conducts business. Copies of the bylaws will be available at the June general meeting and on SJAA's home page. Or send me a note (number and address are on page 7) and I'll send a copy to you. We will hold a vote at the July general meeting (held on June 29 - yes June) on whether or not to accept the new bylaws.

GALILEO MISSION STATUS April 1, 1996

Jet Propulsion Laboratory

The Galileo spacecraft has resumed tape-recorder playback of atmospheric probe data, scheduled to conclude April 15. After the final main-engine maneuver on March 14, the spacecraft performed a series of engineering activities including checkout of the camera and the scan platform, followed by a final repetition of the of the "hammering" procedure, an attempt to free the stuck high-gain antenna. The camera and scan platform are operating nominally, but, as expected, the antenna remains stuck.

The project team has analyzed an unexpected tank pressure situation in Galileo's propulsion system that was observed after the March 14 maneuver. The problem of possible internal leakage is in the helium pressurization system and is somewhat similar to a problem observed last July. Tank pressures can be controlled by maintaining appropriate temperatures with electric heaters in the system, which requires careful management of all spacecraft electric power loads. This strategy has been applied since July. Telemetry now suggests that at least one check valve is closed. All tank pressures are within acceptable limits.

The Galileo engineers are continuing to develop and check out the new spacecraft operating system, which includes new programming for many of the science instruments as well as the attitude control and command and data computers. This mass of computer code is scheduled to be sent up to the spacecraft in May and June.

The spacecraft is performing normally, spinning at about 3 rpm, collecting interplanetary dust and magnetic-field measurements and transmitting them to Earth, together with the tape playbacks and engineering telemetry, at 16 bits per second. Galileo is now just 19 million kilometers (11.9 million miles) from Jupiter, falling back toward the planet at about 892 meters per second (2,000 mph). It is 792 million kilometers (492 million miles) from Earth.

They Make the Best of Company

by Jay Freeman

A Great Horned Owl floated dream-like and silent above my headlight beams, as I led our little convoy of eager comet-seekers down twisty back-country roads toward the California coast. The owl was surely more awake than I, or at least more used to being awake at one AM on a Tuesday morning, but I could begin to appreciate its view of the world. Almost every night for the past week and a half, I had been out late, watching the approach of Comet Hyakutake. On this morning of March 26, 1996, I had coaxed a group of hesitant friends to come along with me. Their reluctance vanished as we viewed the apparition first from the busy downtown streets of San Francisco's suburban bedroom communities, then from side roads near the freeways that skirt the edge of the light-polluted cities and towns. But now we were headed out where the sky was dark; now it was time for the real thing.

State highway 84 terminates at the ocean, a bit more than half way from San Francisco to Santa Cruz. We pulled over to the side of the road a few miles before its end. City glow loomed up over the spine of the peninsula hills to the north and east, but the sky straight up, and south and west over the broad Pacific, was nearly black.

The comet was magnificent, a display that seemed to dazzle our dark-adapted eyes, even though we knew that in absolute terms it did not truly qualify as bright. I recalled a legend about comets from bygone days, that they are great dragons, bringers of wisdom and of knowledge, speeding among the stars, breathing fire and flame, strewing smoke and sparks far across the trembling heavens.

What the ancients saw in the sky usually seems like proof positive that they possessed some of the hallucinogenic substances we regard as modern. Yet this time I could see what they meant -- a dragon indeed. To stare at the coma was to gaze into the maw of the beast; the central concentration provided a view down its very gullet. The straight, narrow beam of the inner

tail blazed with the lambent, incandescent blue of a bunsen flame, as the dragon expelled its mighty breath at full force. Further away, the streaming gout of fire lost intensity and coherence, and widened and dissipated in fading swirls of translucent smoke and pale luminosity, through the equatorial counterglow and beyond, out to ninety degrees, half way across the sky.

The image of the comet and the memory of the owl put me in mind of a modern fantasy I had recently read. The book was Jane Lindskold's Brother to Dragons, Companion to Owls. Of course, it had nothing to do with comets or astronomy, but the title provided a pretty conceit for the night's experience.

Looking again at the streaming tail, standing wide-eyed in awe of its power and beauty, I grew sad at the rarity of such a sight, the more so because the press had done a reasonable job on this one. Most Americans surely knew there was a great comet out there, and heard lots of astronomers tell them to go out and see it.

And most Americans stood up in their well-lit living rooms, turned on the porch lights so as not to trip on the steps, walked outside, and looked up past the street lights, up into the sky of cities and suburbs. Then they wondered what the fuss was about. If they saw anything at all, they saw a bit of fluff, a mere lightning bug. For them, there was no awe and no wisdom, no power and beauty. For them, the Star Dragon refused to appear.

Back home, I took up my book of familiar quotations, on the chance of finding a literary origin for Lindskold's fantasy title. The source was the King James Bible, the words of Job [30:29]. I am not Biblically inclined, but I once studied Job as literature, and remembered a powerful story of the triumph of faith, persistence, determination, and patience over suffering and disbelief. Of course, that doesn't have anything to do with comet-watching, either.

Or does it?

You can't see a great comet easily. You surely can't do so by stepping out of a brightly-lit house into the street lights. It takes determination, to

plan and execute an expedition out away from cities, out where the sky is dark, out to the wild lands where the owls live. It takes patience, to wait for the right combination of time, of viewing geometry, of weather, and of the changing appearance of the comet itself. It takes persistence, for you must go back and do it all over again, night after night, if the precise circumstances were not just so the first time. It takes patience and persistence in a larger sense, as well, to wait for the rare and unpredictable arrival of a bright comet in the skies of Earth, and meanwhile, to learn and practice the methods and techniques of visual observation of faint objects: Even with plenty of advice about dark adaptation, averted vision, and all the other tricks, my companions -- all new to astronomy -- could only see a tail two thirds as long as the one I saw.

Some times you have to suffer a little, too. You're cold. You're tired. You are grubby and unkempt. You are late for work the next day. Things go bump in the night and growl unnervingly, half out of earshot on the side of your car away from the road. Pickup trucks and nondescript old cars cruise by slowly, lights on high beam and radios blaring, as their mysterious occupants, visible only as silhouettes, eye you with who knows what malevolent thought or intent.

There are also matters of faith and disbelief. You must have faith that the comet is really there, even if circumstances conspire to hide it from you the first few times out. You must contend with the disbelief of your friends and colleagues, the ones who have already seen it from their front porches, who tell you time and again that it's no big deal, that there is nothing out there worth the time and trouble to see, that there never was, and never could be, a Star Dragon. You must know in your heart, and remember always, that they are wrong.

If you successfully overcome all these obstacles, then you, too, may one day find yourself brother to dragons, and companion to owls.

They make the best of company.

Turned Down Edge

by Kevin Ferguson

As an aspiring glass pusher I read everything I could find on the techniques before beginning. The subject of "turned down edge (TDE)" seemed like an ATM code phrase for "pure voodoo" ... everyone had something to say, but little was concrete. Much of it was contradictory, and some advice even seemed to go against reason: "Too much pressure at the edge can cause TDE"... "to cure TDE, you need to grind AT THE EDGE"... "Overly long strokes will lead to TDE", but "longer strokes increase the wear in the center of the mirror", or how about "TOT grinding may result in TDE" and, elsewhere "The best way to fix TDE is TOT polishing" Just go to the atm archives and do a search for "TDE" you'll see for yourself!

I gave up trying to understand, and just started grinding...hoping I would somehow avoid this mysterious evil...or figure it out when I needed to.

End fanfare! The crucial point I was missing is this:

Depending on your frame of reference, the exact same curve can be viewed as TDE, or as having a "hole" in the center. If you view the edge as being of correct radius, then you have a central hole. If you say the center is correct, then you have a turned edge...take your pick.

I was confused because this type of surface is ALWAYS called TDE by atms, and the books...which leads to the obvious conclusion that it was caused by too much wear at the edge...which may not always be the case. (It may be easier to understand this point if you picture a perfectly flat surface with a small spherical depression in the middle...is this a defective flat, or a horrible case of TDE?...yes!)

So, TDE can be a result of too much wear at the edge, OR, too much wear at the center. If this makes no sense to you, read the previous two paragraphs again and again until it's clear. "TDE" is one name for two different problems.

This is the result of the tradition of always using the central zone

of the mirror as the reference sphere....Of course things would be even more confusing if we didn't do that, so I am not suggesting a change!

If the mirror is not grinding correctly, the result will be TDE regardless of whether the excess wear is at the center OR the edge. I have read "A TDE is the most common fault in a first mirror"...Of course it is...it is the only indication of two completely opposite "root" problems!

Some of the literature is aimed at one cause/cure and some at the other. Once you know this, then the seeming contradictions disappear. I suspect that some of the TDE horror stories ("Subject: (ATM) Help! TDE won't go away!") I have read may be a result of assuming the wrong cause, and applying "cures" which only worsen the problem, or, at best, stabilize at some lesser degree of TDE. Even a cure of the correct "sign" may "overshoot", resulting in the "other" kind of TDE!

As evidence, here is how I figured this out: I started grinding on a tool I made myself from fired clay. After a short time, it absorbed enough water to get rather soft. The soft tool caused a VERY obvious TDE during coarse grinding with #60 SC. Most atms have TDE problems later on, when things happen slower, and it may be less obvious what is happening.

The tool would wear to too small a radius, resulting in NO wear at edge of mirror, and digging a deep hole in the mirror's center. This was an unstable situation...the hole kept getting worse with "normal", and even very short, strokes...and that hole kept wearing the tool to an even smaller radius...and so on.

So, this "TDE" was caused by ZERO wear at the edge of mirror! Quite counter-intuitive to this beginner!

The only way I found to correct the wear was to offset mirror 1/3 diameter, and apply heavy pressure over center of tool...using the rather flat zone, just inside from the edge of mirror to "mow down" the central "hump" on the tool. The tool could then wear the edge (just inside actually) of the mirror and reduce the central hole, and

hence correct the TDE. A too-soft lapp would do just what my soft tool did, which explains why soft pitch can result in TDE. (BTW, I made a new tool, of very hard tiles...and it is a joy to use...also, what I did would be far too drastic for anyone with a "normal" tool...don't try it as a cure for your case of TDE!)

Which brings up a second thing I was slow to absorb: Some of the figuring strokes in the literature are better understood by considering the effect they produce on the tool (or lapp) rather than only looking at what happens to the mirror.

What happens at one surface eventually causes something at the other, of course. But the cause/effect may sometimes be easier to see by first considering what is happening to the tool. The above is a good example...the real cause of the problem was that the tool was wearing too fast...To fix the mirror, I first had to correct the tool (Yes, I know, they were really both happening at once) The next time you read of a figuring stroke that seems mysterious, or contrary to common sense, try asking yourself "Now what would that do to the lapp?", and maybe it will become clear. (but maybe not...I am finding that there is still a lot of "art" to this science!)

Hopefully this will take some of the "black-magic" out of the TDE lore...I know it had that effect for me. If it's still lost in fog...just start pushing glass like I did...A complete understanding is not required, and you'll have a lot of time to think about it while barrel walking!

I can almost hear it now "Solving the mysteries of the universe while grinding is sure to result in a bad case of TDE" :-)

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COMET COMMENTS, April 9, 1996
by Don Machholz

Comet Hyakutake (C/1996 B2) performed well as it passed by Earth in late March. Not only did it shine brightly, but bits of material were blown off the nucleus while the tail stretched for over 70 degrees. It has been a most memorable comet! It will reach its closest point to the sun on May 1, then becoming an exclusively Southern Hemisphere object, with two possible exceptions. First, it may be visible in

daylight through a telescope to experienced observers who take the proper precautions to avoid pointing their instrument at the sun. Secondly, the comet's tail may be seen rising at morning twilight between roughly April 28 and May 7. A long tail will point toward the northern part of the constellation Triangulum on April 28, swinging southward during the next week until it points toward Saturn (due east) by May 7.

Comet Hale-Bopp passes behind the moon on the morning of May 8. This rare lunar occultation will be

visible at roughly 09hr UT from the western United States, Mexico and Central America. Meanwhile, several other comets are visible, including the faint **Comet Chiron** which has just reached perihelion in its 50-year orbit. It will appear quite small since it is 7 AU away

Comet E1 (NEAT): This comet was discovered at magnitude 16 on March 15 by the Near Earth Asteroid Tracking team. It reaches perihelion in July at 1.35 AU. It may brighten to magnitude 14 by then.

EPHEMERIDES

C/1995 Y1 (Hyakutake)					C/1995 O1 (Hale-Bopp)					C/1996 B2 (Hyakutake)				
DATE	R.A.	Dec	EL	SkyMag	DATE	R.A.	Dec	EL	SkyMag	DATE	R.A.	Dec	EL	SkyMag
00 UT 2000					00 UT 2000					00 UT 2000				
04-27	22h51.1m	+32°47'	51°	M 10.5	04-27	19h44.7m	-17°40'	102°	M 7.8	04-27	02h37.0m	+27°59'	15°	E 0.1
05-02	23h02.5m	+33°35'	52°	M 10.7	05-02	19h43.8m	-17°16'	107°	M 7.7	05-02	02h25.9m	+20°52'	6°	E -0.3
05-07	23h13.1m	+34°18'	53°	M 10.9	05-07	19h42.6m	-16°52'	112°	M 7.5	05-07	02h21.7m	+12°19'	10°	M 0.8
05-12	23h22.8m	+34°57'	54°	M 11.1	05-12	19h40.8m	-16°28'	117°	M 7.4	05-12	02h24.8m	+04°33'	19°	M 2.2
05-17	23h31.6m	+35°33'	56°	M 11.3	05-17	19h38.6m	-16°03'	123°	M 7.3	05-17	02h31.9m	-02°29'	27°	M 3.3
05-22	23h39.7m	+36°05'	58°	M 11.5	05-22	19h35.8m	-15°37'	128°	M 7.2	05-22	02h41.5m	-09°12'	35°	M 4.1
05-27	23h47.0m	+36°34'	60°	M 11.7	05-27	19h32.5m	-15°11'	133°	M 7.1	05-27	02h53.2m	-15°47'	42°	M 4.8
06-01	23h53.6m	+37°00'	62°	M 11.8	06-01	19h28.6m	-14°44'	139°	M 6.9	06-01	03h06.7m	-22°21'	50°	M 5.3
06-06	23h59.4m	+37°20'	65°	M 12.0	06-06	19h24.2m	-14°17'	144°	M 6.8	06-06	03h22.2m	-28°55'	57°	M 5.8

C/1996 B1 (Szczepanski)					22P/Kopff					95P/Chiron				
DATE	R.A.	Dec	EL	SkyMag	DATE	R.A.	Dec	EL	SkyMag	DATE	R.A.	Dec	EL	SkyMag
00 UT 2000					00 UT 2000					00 UT 2000				
04-27	09h22.3m	-16°31'	109°	E 10.6	04-27	18h21.5m	-16°19'	122°	M 9.0	04-27	12h30.5m	-05°46'	152°	E15.5
05-02	09h24.5m	-17°59'	106°	E 10.8	05-02	18h29.5m	-16°10'	125°	M 8.7	05-02	12h29.5m	-05°36'	147°	E15.5
05-07	09h27.5m	-19°19'	102°	E 11.1	05-07	18h37.2m	-16°02'	127°	M 8.5	05-07	12h28.5m	-05°27'	142°	E15.5
05-12	09h31.0m	-20°43'	100°	E 11.3	05-12	18h44.3m	-15°55'	131°	M 8.3	05-12	12h27.8m	-05°20'	137°	E15.5
05-17	09h35.1m	-21°56'	97°	E 11.5	05-17	18h51.0m	-15°49'	134°	M 8.1	05-17	12h27.1m	-05°13'	132°	E15.5
05-22	09h39.7m	-22°51'	94°	E 11.8	05-22	18h57.2m	-15°46'	137°	M 7.9	05-22	12h26.6m	-05°06'	127°	E15.5
05-27	09h44.6m	-23°10'	92°	E 12.0	05-27	19h02.4m	-15°46'	140°	M 7.7	05-27	12h26.3m	-05°01'	122°	E15.6
06-01	09h49.9m	-24°58'	89°	E 12.2	06-01	19h07.2m	-15°51'	144°	M 7.5	06-01	12h26.2m	-04°57'	117°	E15.6
06-06	09h55.6m	-25°07'	87°	E 12.4	06-06	19h11.2m	-16°00'	148°	M 7.2	06-06	12h26.2m	-04°55'	112°	E15.6

Orbital Elements

Object	Hyakutake (95Y1)	Szczepanski	Haykutake (96B2)	Hale-Bopp	Kopff	Chiron
Peri. Date	1996 02 24.28973	1996 02 06.89903	1996 05 01.40305	1997 04 01.12081	1996 07 02.1998	1996 02 14.95655
Peri. Dist (AU)	1.054576	1.4486192	0.23014060	0.9141160	1.5795617	8.4539538
Arg/Peri (2000)	046.35126°	151.44413°	130.18992°	130.58985°	162.83487°	339.56390°
Asc. Node (2000)	195.75924°	345.41073°	188.05114°	282.47097°	120.91329°	209.38406°
Incl (2000)	054.46584°	051.90616°	124.90012°	089.42765°	004.72143°	006.93041°
Eccentricity	1.0	0.9899357	0.9998449	0.9951019	0.5440739	0.3828750
Orbital Period (yrs)	Long Period	1727	57,000	3000	6.45	50.70
Source	MPC 26543	MPEC1996-C02	MPC 26724	MPC 26723	MPC 22032	MPC 22797

Telescope Loaner Status by Paul Barton

No.	Scope Description	Borrower	Due Date
1	4.5" Newt/P Mount		available
3	4" Quantum S/C	(in storage) call	available
6	8" Celestron S/C	Allen Cogdell	5/19/96
7	12.5" Dobson	Tim Sanstrom	5/9/96
8	14" Dobson		available
9	C-11 Compustar	Ed Voss	indefinite
15	8" Dobson	Bob Elsberry	5/9/96
18	8" Newt/P Mount	Jerry Lovelace	5/6/96
19	6" Newt/P Mount	Stephen Shoup	6/8/96
21	10" Dobson	Rich Navarrete	5/3/96
23	6" Newt/P mount	Shelly McAleese	5/11/96
24	60mm refractor	Sridhar Lakshmikanthan	5/25/96
26	11" Dobson	Paul Barton	indefinite
27	13" Dobson	(just overhauled, good)	available
28	13" Dobson	(new, good, in storage)	available

There are several small refractors available as well. Due to lack of space, several scopes are in storage -- can be retrieved in a few days. Call. #27, Odyssey I, 13.1" Dob is freshly overhauled and is a fine scope if you can transport a "big one". The finder was donated by Jack Zeiders. The 2" focuser was also donated (lost record of who).

Celestial Calendar - May 1996 by Richard Stanton

Lunar Phase	time (pdt)	date	rise	trans	set
FM	04:50	03	20:32	00:59	06:27
LQ	22:04	09	01:16	06:45	12:18
NM	04:48	17	06:17	13:24	20:36
FQ	07:14	25	13:07	19:37	01:29

Mercury		Dist: 0.55AU.		Mag: -0.8	
date	rise	trans	set	RA	Dec
07	06:32	13:46	20:58	03:42.5	+21:12
17	05:49	12:48	19:46	03:24.7	+17:21
27	05:09	11:58	18:47	03:12.9	+14:21

Venus	Dist: 0.36AU			Mag: -4.7	
07	08:02	15:44	23:15	05:39.1	+27:46
17	07:37	15:16	22:54	05:51.8	+27:17
27	07:00	14:32	22:04	05:48.2	+25:59

Mars	Dist: 2.37AU			Mag: +1.2	
07	05:28	12:11	18:54	02:05.6	+12:13
17	05:09	12:00	18:52	02:34.4	+14:44
27	04:51	11:50	18:50	03:03.5	+17:00

Jupiter	Dist: 4.52AU			Mag: -2.6	
07	00:32	05:22	10:11	19:16.7	-22:12
17	23:48	04:41	09:30	19:15.6	-22:15
27	23:07	04:00	08:48	19:13.3	-22:21

Saturn		Dist: 10.1AU		Mag: +1.0	
07	04:19	10:20	16:22	00:15.9	-00:35
17	03:42	09:44	15:47	00:19.5	-00:13
27	03:05	09:08	15:12	00:22.7	+00:05

SOL Star Type G2V Intelligent Life in System ?					
07	06:03	13:04	20:06	02:58.3	+16:56
17	05:54	13:04	20:15	03:37.6	+19:25
27	05:48	13:05	20:23	04:17.8	+21:22

Astronomical Twilight	Begin	End
JD 2,450,210	07	04:23 21:47
JD 2,450,220	17	04:09 22:00
JD 2,450,230	27	03:58 22:12

Sidereal Time				
Transit Right	07	00:00	=	13:53
Ascension at	17	00:00	=	14:33
Local Midnight	27	00:00	=	15:12

Darkest Saturday Night:	May 18
Sunset	20:15
Twilight End	22:01
Moon Rise	07:00
Dawn Begin	04:08

Astro Ads

Meade 12.5" Starfinder Dobsonian with Meade MA 25mm eyepiece, Telrad, 50mm finder, counterweight. Asking \$500 or will trade for Meade 10" Starfinder Dob.
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