AD ASTRA

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CLUB CALENDAR

Next Meeting: Friday, April 15, 8:00 p.m., at the Bradley Building.
Monthly Program: Hal McAlister, Professor of Astronomy at Georgia State University, will present a talk on advances in high angular resolution astronomy, and his proposal to build a state-of-the-art interferometer (high resolution telescope)

AD ASTRA is published monthly during the academic year by the Atlanta Astronomy Club, Inc. The AAC, a non-profit organization, is dedicated to the advancement of amateur astronomy, and fostering the social, literary, and educational needs of its members. Meetings are held on the third Friday of each month (second Friday of December) unless otherwise announced in this publication. Membership dues are $25 annually and include a subscription to *Sky & Telescope* magazine and use of club observatory facilities.

Editor in Chief: ..... John Marsh
Managing Editor: ..... Don Barry
Technical Editors: ..... Sharone Franklin, David Roberts
Observing Editor: ..... Rick Clark

Submissions: Article submissions are strongly requested, and may be delivered to the editor for consideration.

CLUB MINUTES

The March 18, 1988 meeting of the Atlanta Astronomy Club was held at the Fernbank Science Center with president Lee Wilson presiding.

I. Lee Wilson announced that Sharone Franklin and David Roberts would be the nominating committee for the election of 1988-89 club officers.

II. David Dundee, an astronomer at the Fernbank Science Center, presented the program in the Center's planetarium. Mr. Dundee used the Zeiss projector to show the audience various star clusters, nebulae, and constellations in the southern as well as the northern hemisphere. Included in his "sky show" was the Large Magellanic Cloud where Supernova 1987A was discovered.

"KEEP OUT, EARTHQUAKE DAMAGED BUILDING"

by Brian R. Page

As the airliner descended through the clouds on approach to San Francisco International Airport, I put my Sky & Telescope down and glanced out the window. Much to my surprise, I found myself looking directly at Lick Observatory. I decided at that moment to visit the observatory should my schedule permit while working in Santa Clara.

Winter is the rainy season in Silicon Valley and the hills upon which Lick is situated seemed uncharacteristically green. The dry season lasts from March to November and the hills then assume a brown shade that has come to be familiar to me. Mt. Hamilton, at 4200 feet above sea level, is home to the observatory. This is one of the taller peaks in a range of mountains bordering the eastern edge of Silicon Valley. From the parking lot at the main building, you can look down upon San Jose, Santa Clara, Cupertino, Sunnyvale, Palo Alto, and many other communities which host scores of high-tech firms.

My first encounter with Lick Observatory was on Sunday afternoon. THe following Friday I scooted out of work at 3:30 p.m. and began the long drive up Mt. Hamilton Road. This road snakes up one small range, descends to a tiny valley, and then ascends the higher range of which Mt. Hamilton is a member. The road is incredibly twisted. It was built in 1876 and is only a seven percent grade at its steepest. This is a reminder that the materials to construct Lick were transported by horse.

One hundred years ago, Lick Observatory opened as the first mountain top observatory. James Lick, a wealthy San Francisco businessman, funded the observatory as a monument to himself. He placed the facility under the operational control of the University of California. His remains are interred at the base of the 36 inch refractor.

I had visited Lick once before, in 1983, and the contrast of that visit with the present was striking. An earthquake along the Santa Cruz fault in 1985 damaged the foundation under the 90 ton dome covering the famous 36 inch refractor. No one is now allowed to venture beneath the dome. Visitors may simply stand in the doorway and peer at the long refractor, positioned horizontally and imprisoned by struts and braces which keep the building from collapsing. Nevertheless, research at the observatory goes on. The 36 inch instrument is only one of six major telescopes on the mountain.

When completed in 1888, the 36 inch refractor was not only the first mountaintop telescope, it was also the world's largest refractor. Today it remains the second largest, surpassed only by the 40 inch at Yerkes. The crown and flint blanks were cast in Europe and figured by Alvan Clark & Sons. The mounting was made by Warner & Swasey.

Although the 36 inch telescope supported active research until the 1985 earthquake, a visit (even to the door) is to step back into the 19th century. Everything about the observatory seems Victorian, from the well-worn woodwork to the hand-crafted

wrought iron railing. The modern improvements such as electric controls hardly disturb the aura.

A second telescope is open for public viewing on Mt. Hamilton. This is the 120 inch reflector, named in honor of C. Donald Shane, director of Lick from 1945 to 1958. The Shane reflector is now the premier research instrument. The telescope may e viewed through a large glass window that extends along the floor through an arc opposite the fork mounting. When I was there in late afternoon I was pleasantly surprised to find the dome open. A telescope comes alive only when it is pointing at the sky.

The mirror of the Shane reflector has an interesting story. The five ton blank was cast in 1933 by Corning as a test for the Palomar 200 inch telescope. It lingered in storage until 1951 when Dr. Shane obtained it. Then, the blank was transported to the top of Mt. Hamilton where it was figured. The reflector entered service in 1959.

I was impressed by the great quantity of instruments mounted on the rear end of the telescope. Seeing hundreds of pounds of equipment attached to a telescope drove home the capabilities of the incredibly massive mount.

The 36 inch refractor and the Shane reflector are the only telescopes at Lick Observatory open to public viewing. Some of the others not open include the Anna L. Nickel 40 inch reflector which is housed in the main building along with the 36 inch instrument. Another is the Crossley 36 inch reflector. This telescope was built in Britain in the 19th century. In 1884, Andrew Common won a gold medal from the Royal Astronomical Society for a photograph of the Orion Nebula taken with this telescope. The instrument was subsequently sold to Edward Crossley and, in 1895, acquired by Lick Observatory. The observatory attributes the Crossley telescope with "more scientific results than any other telescope of its size." The success of this instrument helped swing astronomers back to reflectors after the heyday of refractors.

The final telescope worth noting is the 20 inch Carnegie astrograph. This is actually a pair of telescopes. One is optimized for yellow light, the other for blue. Each telescope makes simultaneous exposures on 17 inch square glass plates which are used to determine stellar positions. Sunset from Mt. Hamilton is beautiful. The Santa Cruz mountains on the opposite side of the valley are silhouetted against the setting sun. The valley below is completely enshrouded by clouds. For a time, Lick seems as if it is truly a high mountain top observatory, not a mere 4200 feet above sea level.

As it turned out, the timing of my visit was fortuitous. Even as I write, the main building, visitor's center, and access road have been closed in order to make repairs to the 36 inch refractor facility. The work is expected to take as long as a year. On my future trips west I will certainly be glued to the window as the airplane approaches San Francisco. I hope to catch some glimpse of the restoration. Of course, when the observatory reopens to the public I intend to slip out of work some afternoon and make the trek up Mt. Hamilton Road once again.

ETERNAL ENCHANTMENT

by Anna Belle Close

(From the February, 1950 Atlanta Astronomers Report)

When I was a child, a cloud, to me
Was a thing of beauty and mystery--
A cottony island, a blue lagoon,
Or a flock of sheep wand'ring past the moon.
Oh many an hour in dreams I spent,
As I left this earth in swift ascent
Imagined myself supported there
On a misty platform with none to share
The treasures I found in solitude,
While I sought escape from inquietude.

But now I've been told how clouds are formed--
That they're only water that's been transformed
From rivers and lakes and marshy lands
In a swift reply to the sun's commands.
In droplets more tiny than the dew
Have these clouds collected in Heaven's blue.
Substantial they aren't. Ethereal, yes--
But let Science explain, the wonder's no less.
And now that I'm grown, a cloud, to me,
Still retains its beauty and mystery.

ANNOUNCEMENT

President Lee Wilson has appointed David Roberts and Sharone Franklin to a nominating committee for next year's club officers. To date, the following have expressed interest in serving the club next year in the specified capacity: Lee Wilson, President (club tenure 28 years). Bill Bagnuolo, First Vice President and Program Chairman (2 years). Rick Clark, Second Vice President and Observatory Chairman (8 years). Richard Jakiel, Second Vice President and Observatory Chairman (6 months). Chris Lee, Recording Secretary (3 years). Don Barry, Corresponding Secretary and Newsletter Editor (3 years). Bud Rosser, Treasurer (5 years). As requested by Lee Wilson at the March meeting, input to the committee may be provided to David Roberts at 996-0345, or Sharone Franklin at 934-8796. A slate of floor-nominated candidates and those provided by the nominating committee will be presented and voted on at the May meeting.

Moonset and Moonrise 1988

for Atlanta and vicinity

prepared by Don Barry

	Jan			Mar			May			Jul			Sep			Nov		
Day	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase
01	15:28	05:48	92%	16:54	06:14	94%	19:25	05:19	99%	21:52	07:17	97%	22:15	12:09	70%	—	13:53	51%
02	16:18	06:47	96%	17:52	06:42	98%	20:30	05:52	99%	22:29	08:32	92%	23:01	13:18	60%	00:31	14:22	42%
03	17:14	07:40	99%	18:48	07:07	99%	21:37	06:32	98%	23:01	09:44	84%	23:53	14:21	49%	01:28	14:47	33%
04	18:13	08:26	99%	19:44	07:32	99%	22:42	07:19	94%	23:30	10:53	75%	—	15:17	39%	02:24	15:11	27%
05	19:12	09:06	98%	20:40	07:54	97%	23:42	08:16	88%	23:59	12:01	64%	00:50	16:05	29%	03:19	15:34	17%
06	20:11	09:39	95%	21:38	08:18	94%	—	09:21	80%	—	13:08	53%	01:49	16:46	20%	04:14	15:58	10%
07	21:08	10:08	91%	22:39	08:44	88%	00:33	10:31	70%	00:28	14:14	41%	02:49	17:20	13%	05:11	16:24	5%
08	22:04	10:34	85%	23:42	09:15	81%	01:17	11:43	59%	01:01	15:21	31%	03:48	17:50	7%	06:10	16:53	1%
09	22:59	10:58	78%	—	09:50	73%	01:54	12:53	48%	01:37	16:27	21%	04:46	18:16	3%	07:11	17:27	0%
10	23:55	11:22	68%	00:48	10:34	63%	02:26	14:02	36%	02:19	17:31	13%	05:42	18:40	0%	08:14	18:08	0%
11	—	11:46	60%	01:53	11:28	52%	02:53	15:10	26%	03:07	18:30	7%	06:37	19:03	0%	09:18	18:57	2%
12	00:53	12:12	50%	02:56	12:31	41%	03:25	16:17	16%	04:02	19:22	3%	07:32	19:26	0%	10:19	19:54	7%
13	01:54	12:42	40%	03:52	13:42	30%	03:54	17:25	9%	05:01	20:06	0%	08:28	19:51	3%	11:14	20:58	13%
14	03:00	13:18	30%	04:41	14:57	20%	04:26	18:34	3%	06:02	20:43	0%	09:26	20:18	8%	12:02	22:06	21%
15	04:09	14:03	21%	05:21	16:12	11%	05:02	19:43	0%	07:03	21:15	1%	10:25	20:49	14%	12:43	23:16	31%
16	05:19	14:58	12%	05:57	17:26	5%	05:43	20:50	0%	08:02	21:42	4%	11:27	21:26	21%	13:18	—	42%
17	06:26	16:04	6%	06:28	18:38	1%	06:31	21:53	2%	08:58	22:07	9%	12:30	22:11	30%	13:50	00:25	53%
18	07:27	17:19	1%	06:58	19:48	0%	07:26	22:48	6%	09:53	22:30	16%	13:32	23:05	40%	14:20	01:33	64%
19	08:17	18:36	0%	07:29	20:58	1%	08:24	23:34	11%	10:48	22:53	23%	14:30	—	50%	14:49	02:41	75%
20	08:59	19:52	1%	08:01	22:08	6%	09:25	—	18%	11:43	23:17	32%	15:22	00:07	61%	15:20	03:50	84%
21	09:35	21:05	5%	08:36	23:17	13%	10:25	00:13	27%	12:40	23:44	41%	16:08	01:17	72%	15:54	05:00	92%
22	10:06	22:15	12%	09:16	—	21%	11:24	00:46	36%	13:40	----	50%	16:47	02:31	81%	16:33	06:11	97%
23	10:35	23:23	21%	10:02	00:23	30%	12:21	01:14	45%	14:44	00:15	60%	17:21	03:45	90%	17:18	07:23	99%
24	11:04	—	31%	10:54	01:24	40%	13:16	01:39	54%	15:50	00:51	70%	17:53	04:58	96%	18:11	08:32	99%
25	11:34	00:29	42%	11:50	02:18	50%	14:12	02:03	62%	16:56	01:37	79%	18:24	06:10	99%	19:11	09:35	96%
26	12:06	01:34	53%	12:49	03:04	59%	15:08	02:26	72%	17:59	02:33	88%	18:55	07:22	99%	20:14	10:29	92%
27	12:43	02:39	63%	13:48	03:43	68%	16:07	02:51	81%	18:56	03:38	94%	19:30	08:35	97%	21:17	11:13	85%
28	13:25	03:42	72%	14:47	04:16	77%	17:09	03:18	88%	19:44	04:52	98%	20:09	09:48	91%	22:19	11:50	77%
29	14:14	04:42	81%	15:44	04:45	84%	18:14	03:49	94%	20:24	06:08	99%	20:53	11:00	84%	23:18	12:21	69%
30	15:07	05:36	88%	16:40	05:11	90%	19:22	04:27	98%	20:59	07:24	98%	21:45	12:08	75%	—	12:48	60%
31	16:05	06:24	93%	17:37	05:35	95%	20:30	05:12	99%	21:30	08:37	93%						
01	17:04	07:06	97%	18:33	05:58	98%	21:33	06:07	99%	22:00	09:47	86%	22:41	13:09	65%	00:14	13:13	50%
02	18:03	07:41	99%	19:32	06:22	99%	22:28	07:11	95%	22:30	10:57	77%	23:41	14:02	54%	01:09	13:36	41%
03	19:01	08:11	99%	20:32	06:48	99%	23:15	08:21	90%	23:02	12:05	67%	—	14:45	44%	02:04	14:00	32%
04	19:58	08:38	98%	21:35	07:18	96%	23:55	09:34	82%	23:37	13:14	56%	00:42	15:22	35%	02:59	14:24	23%
05	20:53	09:02	95%	22:40	07:52	91%	—	10:45	72%	—	14:21	45%	01:42	15:53	26%	03:57	14:52	16%
06	21:49	09:25	90%	23:46	08:33	85%	00:29	11:55	62%	00:18	15:26	34%	02:40	16:20	18%	04:57	15:24	9%
07	22:45	09:49	84%	—	09:23	77%	00:59	13:02	50%	01:05	16:26	25%	03:36	16:44	11%	06:00	16:03	4%
08	23:44	10:14	76%	00:49	10:22	67%	01:27	14:08	39%	01:57	17:20	16%	04:32	17:08	6%	07:05	16:49	1%
09	—	10:41	67%	01:46	11:29	56%	01:56	15:14	28%	02:55	18:05	10%	05:27	17:31	2%	08:08	17:45	0%
10	00:46	11:14	57%	02:36	12:40	45%	02:26	16:21	19%	03:55	18:44	5%	06:22	17:55	0%	09:06	18:48	1%
11	01:51	11:53	47%	03:18	13:53	34%	02:59	17:29	11%	04:55	19:17	1%	07:20	18:22	0%	09:58	19:56	4%
12	02:59	12:41	36%	03:54	15:05	23%	03:38	18:35	5%	05:54	19:45	0%	08:19	18:52	1%	10:42	21:07	10%
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14	05:09	14:50	16%	04:56	17:25	7%	05:14	20:37	0%	07:48	20:34	2%	10:23	20:10	10%	11:52	23:25	27%
15	06:04	16:06	8%	05:25	18:35	2%	06:11	21:27	0%	08:42	20:57	6%	11:25	21:00	17%	12:22	----	38%
16	06:50	17:24	3%	05:56	19:44	0%	07:12	22:09	3%	09:37	21:21	11%	12:24	21:59	25%	12:51	00:32	49%
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23	10:41	00:28	36%	11:38	01:40	43%	13:53	00:51	57%	16:41	01:17	75%	16:51	04:58	94%	17:57	08:17	99%
24	11:22	01:33	46%	12:37	02:16	52%	14:53	01:17	66%	17:32	02:26	85%	17:23	06:09	98%	19:00	09:05	98%
25	12:09	02:36	57%	13:35	02:46	61%	15:56	01:45	75%	18:16	03:40	92%	18:00	07:22	99%	20:04	09:46	95%
26	13:02	03:33	66%	14:31	03:13	70%	17:02	02:19	84%	18:53	04:56	97%	18:42	08:35	98%	21:04	10:19	90%
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29	15:56	05:43	89%	17:21	04:25	92%	20:17	04:53	99%	20:28	08:36	95%	21:28	11:51	80%	23:53	11:37	68%
30				18:21	04:51	96%	21:09	06:03	99%	21:00	09:48	89%	22:30	12:40	71%	—	12:00	59%
31										21:35	10:59	80%	23:32	13:20	61%	00:48	12:24	50%
Day	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase	Rise	Set	Phase
		Feb			Apr			Jun			Aug			Oct			Dec	

-------- Phenomenon does not occur on given day

▨ Day does not exist

All times are EST

Phase is at 0h EST of day given

SMALL, ROUND, AND DIM

by Richard Jakiel

Springtime marks a period of change, not only does the climate starts to ameliorate, but the general composition of deep sky objects shifts as well. The brilliant star strewn sky of clusters and nebulae are now setting in the western sky, now being replaced by the more subtle spring constellations. Of the few remaining star clusters, M44 (NGC 2632) or the Praesepe is by far the largest and most easily visible. Spanning over one degree, the Praesepe or Beehive cluster is easily visible to the naked eye as a hazy patch. In a small telescope numerous double and multiple stars are visible among its component stars.

Much farther south (-36 degrees) lies a relatively unobserved star cluster NGC 2818. Burnham's Celestial Handbook describes the cluster as relatively sparse, consisting of 30 stars of magnitude 12 and fainter. Embedded in the cluster is a fairly large, faint plentary NGC 2818A. In the 20", it appeared as a faint oval nebulosity of 13 magnitude and measuring 40"x25". Its surface brightness is quite irregular with several bright patches evident. Much brighter and more typical of the springtime skys is the large galaxy NGC 2903 in Camelopardalis. NGC 2403 is a large Sc galaxy similar to M33 in structure. It is considered to be a distant member of the M81-82 group with an estimated distance of 8 million light years. In the 10" f/6 telescope, it is quite bright, extensive, but rather diffuse, with a bright central hub. Using the club's 20" scope at 95, 175, and 233x the extensive and subtle spiral structure was visible, with dark lanes helping to delineate the spiral arms. Numerous HII regions are visible as knots in the arms; the largest of these is NGC 2404 an impressive H II region comparable in scale to NGC 604 in M33. This object is visible in a 8 or 10" scope as a nebulous knot of 12.5 magnitude.

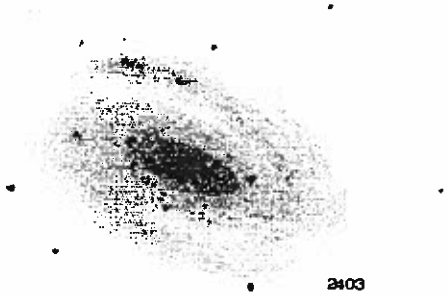
M51
175x

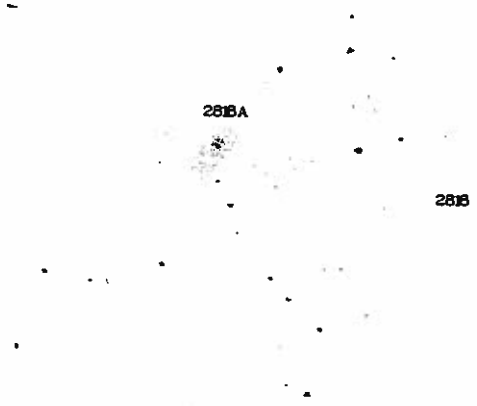
Nearby is the NGC 2832 group in Lynx. This group is composed of 11 "bright" galaxies (as listed in the Uranometria 2000) and a number of fainter ones. The brightest of these is NGC 2832, a 13.0 magnitude cD (central dominant) galaxy. Visible in a 8 or 10" scope, this galaxy is compraable to M87 in the Virgo cluster, but is much fainter due to its much greater distance of 300 million light years. Just south and possibly interacting with the giant elliptical is NGC 2831, a 13.8 magnitude elliptical galaxy. Continuing on the same line is NGC 2830, a SBa (barred spiral with dominant nuclear hub) galaxy of 15.4 magnitude. This is definitel a "small, round, and dim" type of fuzzy visible only in moderatel large amateur scopes. NGC 2834 is a small edge-on spiral galaxy o 15.5 magnitude lying to the east of the main group, while NGC 2825 (top right) and 2829 (bottom right) are your typical fain fuzzies of magnitudes 15.4 and 14.6 respectively.

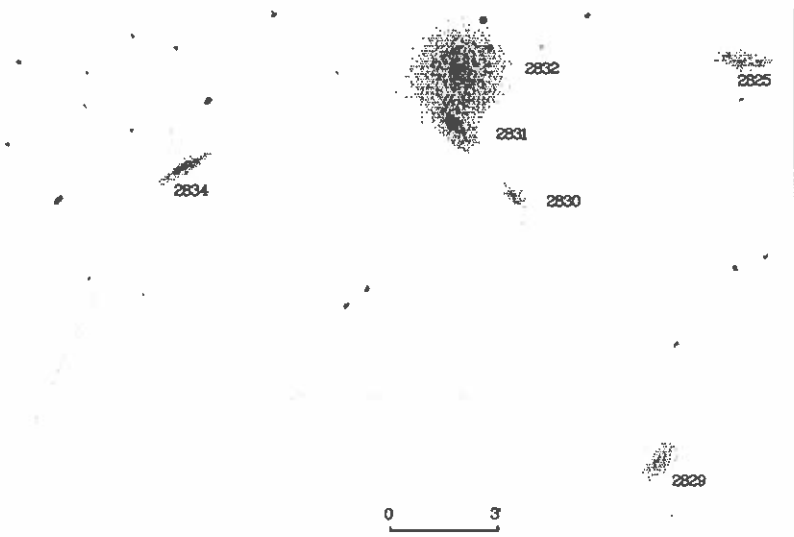
Sometimes it is rather tiresome to dig around groups of fain fuzzies. A small and rather bright group t examine is NGC 3190, located 2 degrees nort of Gamma Leonis. All members of this grou are visible in a 10", with two galaxies (3190 an 3193) are easy 11 magnitude objects. NG 3190 is a large, bright edge-on galaxy with a dark lane that is discernable in a 10" scope NGC 3187 is much fainter (13.5 mag.) and i difficult to see in a 8 or 10" scope. NGC 319 is a medium sized elliptical galaxy with a brigh central core. NGC 3185 is the most distantl located member, a tilted Sa spiral galaxy o about 12.2 magnitude. This small grouping o galaxies is part of a small cluster of galaxies 7 million light distant and are considered a par of the much larger Virgo supercluster.

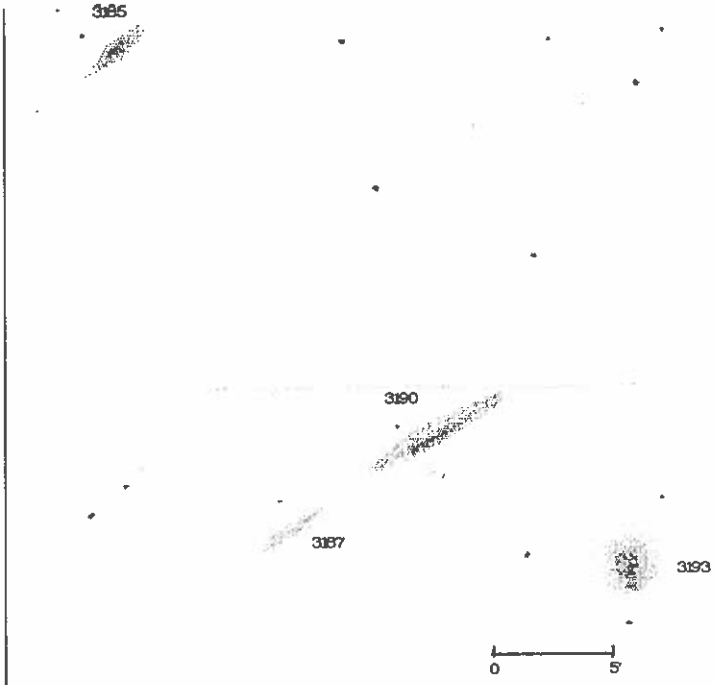
Perhaps the most spectacular galaxy tha I have viewed through the club's 20" telescope is M51 (NGC 5194/5195) in Canes Venatici. I have seen M51 a number of times in scopes ranging from 8 to 12.5" in aperture. On good nights, the spiral structure was readily visible, with some bright condensations visible in a 12.5" f/6.5. However, I was hardly prepared for what I saw in the 20" scope (at 175x) on March 16, 1988. The spiral structure was beautifully delineated by a pale silvery luminescence, with numerous bright knots and H II regions peppering the spiral arms. Small dark rifts could be seen near the bright nuclear hub. The companion galaxy (NGC 5195) displayed a prominent dust lane neatly bisecting the galaxy into two uneven parts. The spiral structure on a whole looked very much like a "cream frosted jelly roll".

(Editor's note: We are always interested in hearing about observations made by club members. We invite your submissions and reports of your observing activities to the AD ASTRA*)*









QUESTIONNAIRE

As another year approaches for the Atlanta Astronomy Club and its newsletter, the AD ASTRA, the time has come to make plans and set goals for the future. I would very much appreciate commentary concerning what each of you, as members, would like to see in the club, and in the newsletter, in 1988-89. It doesn't require much time to voice your opinions and needs. Together, we can continue to make our club thrive and improve. Please take the time to answer the following few questions, and mail your comments to:

2867 Ashford Road
Atlanta, GA 30319

Thank you,

Don Barry

1. What do you most enjoy about the Atlanta Astronomy Club? What do you least enjoy?

2. What would you like to see changed in the Astronomy Club?

3. Do you find the content of the AD ASTRA informative? useful?

4. What would you like to see more of in the AD ASTRA? Less of?

5. What topics would you like to see presented in 1988-89 programs of the Atlanta Astronomy Club?

6. Do you have any additional comments or concerns?

Thanks again for your patience. Your input will be summarized in a future newsletter, and will help us in 1988-89.

OBSERVER'S ALMANAC

by Don Barry

Moon Rise, Set, and Phase

(All times are EDT)

Date	Rise	Set	Phase	Date	Rise	Set	Phase
04/15	06:28	19:37	2%	05/07	01:36	11:34	70%
04/16	06:59	20:47	0%	05/08	02:20	12:45	60%
04/17	07:32	21:57	0%	05/09	02:57	13:56	48%
04/18	08:11	23:06	3%	05/10	03:29	15:05	37%
04/19	08:55	----	9%	05/11	03:55	16:12	26%
04/20	09:46	00:12	15%	05/12	04:27	17:20	17%
04/21	10:41	01:10	24%	05/13	04:57	18:28	9%
04/22	11:40	02:01	33%	05/14	05:28	19:37	3%
04/23	12:40	02:43	42%	05/15	06:04	20:46	0%
04/24	13:39	03:18	52%	05/16	06:46	21:53	0%
04/25	14:37	03:49	61%	05/17	07:34	22:55	2%
04/26	15:34	04:16	70%	05/18	08:28	23:50	5%
04/27	16:30	04:40	78%	05/19	09:27	----	11%
04/28	17:26	05:04	85%	05/20	10:28	00:37	18%
04/29	18:24	05:28	92%	05/21	11:28	01:16	26%
04/30	19:24	05:53	96%	05/22	12:26	01:48	35%
05/01	20:27	06:22	99%	05/23	13:23	02:16	44%
05/02	21:33	06:55	99%	05/24	14:19	02:42	54%
05/03	22:40	07:34	98%	05/25	15:14	03:05	62%
05/04	23:45	08:22	94%	05/26	16:11	03:29	72%
05/05	----	09:19	88%	05/27	17:10	03:54	80%
05/06	00:44	10:24	80%	05/28	18:12	04:21	88%

(----) indicates phenomenon does not occur on given day.

SATELLITES TONIGHT

An orchid raised aboard the Russian Salyut 6 space station several years ago was abducted from its habitat in a Moscow greenhouse, and died before it could be recovered. It is not expected that this unfortunate demise will hinder the Soviet Space Program. Later this year two additional modules will be affixed to Mir, prior to visits by several european teams. With the last Progress shuttle to Mir, the total supply tonnage has now exceeded the initial station weight.

In our own space program, it was recently announced the space shuttle would recover the aging LDEF satellite (see predictions) if flights resume this year. The LDEF satellite contains several experiments designed for measuring effects of long duration in space (for which it has exceeded its design specification)

```
Wednesday evening, 20 April 1988   after 07:48 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
09:35:10PM 315.8 28.6 R 00647 05:34.6 04:21.6 +51d58 +0.2
09:36:26PM 044.3 87.2 R 00343 23:51.0 10:06.2 +35d34 -1.1
Shadow entry.
 MIR                 USSR

Saturday evening, 23 April 1988    after 07:50 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
08:56:37PM 271.9 20.6 L 00839 04:54.3 04:34.8 +12d47 +0.4
08:57:53PM 226.2 28.9 L 00654 02:42.1 06:48.2 -13d35 -0.1
08:59:09PM 182.9 19.5 L 00868 00:13.4 09:18.1 -36d41 +0.8
 MIR                 USSR

Wednesday evening, 04 May 1988     after 09:00 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
10:27:20PM 250.9 16.9 U 01260 04:21.1 07:22.3 -05d40 +2.5
10:28:38PM 268.2 31.7 R 00833 04:08.0 07:36.8 +15d38 +1.7
10:29:56PM 322.1 46.4 R 00637 03:38.9 08:07.5 +58d42 +1.5
10:31:15PM 013.6 30.9 R 00852 17:19.0 18:27.1 +78d10 +3.0
Shadow entry.
 SALYUT 7            USSR

Thursday evening, 05 May 1988      after 09:01 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
09:55:42PM 243.2 17.7 U 01226 04:00.0 07:15.6 -10d50 +2.4
09:58:19PM 320.7 57.2 R 00558 02:25.6 08:52.9 +54d37 +1.2
10:00:56PM 034.7 17.5 D 01245 16:44.3 18:36.3 +54d59 +4.8
 SALYUT 7            USSR

Friday evening, 06 May 1988        after 09:01 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
09:24:06PM 235.1 18.2 U 01207 03:37.0 07:10.8 -16d12 +2.4
09:26:42PM 319.3 71.2 R 00500 01:11.6 09:39.1 +46d46 +1.0
09:29:19PM 040.0 18.2 D 01217 17:06.3 17:46.5 +51d06 +5.0
 SALYUT 7            USSR

Sunday evening, 08 May 1988        after 09:03 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
09:39:02PM 205.6 22.1 L 01045 01:49.1 09:21.6 -29d02 +2.7
09:40:20PM 170.2 28.1 L 00889 23:21.0 11:51.1 -27d33 +2.6
Shadow entry.
 LDEF                USA

Wednesday evening, 11 May 1988     after 09:06 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
09:29:43PM 241.9 15.1 L 01318 04:04.6 07:08.6 -13d27 +3.1
09:32:19PM 180.3 35.7 L 00748 00:01.2 11:14.6 -20d37 +2.1
09:33:38PM 137.6 26.5 L 00925 21:23.1 13:54.1 -17d33 +3.1
Shadow entry.
 LDEF                USA

Friday evening, 13 May 1988        after 09:07 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
09:58:40PM 225.3 21.3 L 01072 02:59.1 08:51.0 -20d05 +2.7
09:59:58PM 191.0 26.3 L 00929 00:45.2 11:06.2 -29d04 +2.5
Shadow entry.
 LDEF                USA

Saturday evening, 14 May 1988      after 09:08 PM EDT
 Time(EDT)   Az    El  H Range    LHA    RA/2000 D/2000  Mag
09:22:55PM 225.5 21.8 L 01055 02:58.3 08:19.9 -19d34 +2.6
09:24:13PM 190.5 27.1 L 00909 00:42.3 10:37.2 -28d21 +2.5
09:25:31PM 155.8 21.6 L 01063 22:15.6 13:05.3 -30d08 +3.2
Shadow entry.
 LDEF                USA
```

AD ASTRA

Please direct all address changes or corrections to:
Rick Clark, ALCOR
584 South Mt. Carmel Rd.
McDonough, Georgia 30253

Membership renewals to:
Bud Rosser, Treasurer
5198 Avanti Court
Stone Mountain, Georgia 30088

FIRST CLASS

W. Tom Buchanan
105 Carriage Station Circle
Roswell, GA 30075
8901

If marked with "*" above, your subscription has expired. Please contact the Treasurer promptly to ensure continuous membership.