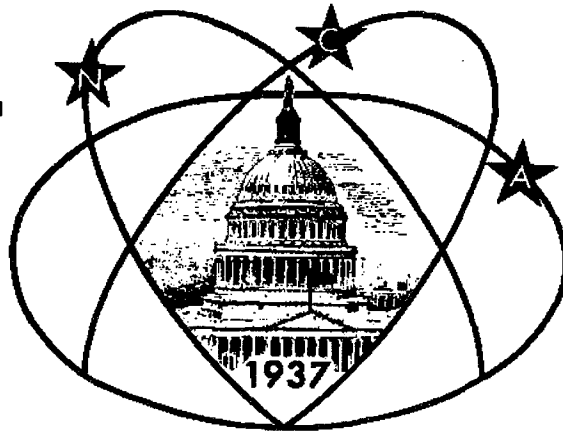


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Searching for the Cosmic Infrared Background

by *Harold Williams*

The next meeting of the National Capital Astronomers will be held Saturday, March 2, at 7:30 P.M. in the Lipsett Auditorium of the Clinical Center (Building 10) at the National Institutes of Health (NIH). Eli Dwek is an astrophysicist in the Infrared Astrophysics Branch of the Laboratory for Astronomy and Solar Physics (LASP) at the NASA/GSFC (National Aeronautics and Space Administration/Goddard Space Flight Center). He is a member of the COBE (Cosmic Background Explorer) Science Working Group, working primarily on the interpretation of the data obtained by the Diffuse Infrared Background Experiment (DIRBE) on board the COBE satellite. His research areas of interest include the origin of the cosmic infrared background, the large scale distribution of stars and dust in the Milky Way Galaxy, and studies of interstellar dust. Eli Dwek received his graduate degree in physics and mathematics at the Hebrew University in Jerusalem, Israel (1973), and his Ph.D. in astronomy from Rice University in Houston, Texas (1977). He was a

postdoctoral fellow at Caltech, and joined NASA in 1983. The speaker Eli Dwek wrote the following abstract for a talk of similar title, "In Pursuit of the Cosmic Infrared Background," given at the University of Maryland. "The cosmic infrared background (CIB) consists of the cumulative emissions from pregalactic objects, protogalaxies, and evolving galaxies throughout the history of the universe. The light from these objects is partially redshifted and partially absorbed and reradiated by dust into the infrared (IR) wavelength region. The Diffuse Infrared Background Experiment (DIRBE) on board the COBE satellite is the first space experiment designed to conduct a systematic search for the CIB in the 1.25 to 240 micron region. The detection of the CIB is the most challenging of the three experiments on the COBE satellite. Its signal is hidden behind a veil of infrared emission from interplanetary dust, and from galactic stellar and dust emission. Peeling off these layers of foreground emissions, while leaving the cosmic signal unscathed is a formidable task. In

this talk I will describe the efforts of the DIRBE team to unveil the CIB. Additional clues to the energy density of the CIB are provided from the observations of TeV gamma rays from Markarian 421; I will describe our analysis of its spectrum and the resulting limits we derived on the CIB intensity. Finally, I will describe the theoretical efforts underway for modeling the IR emission from evolving galaxies, in order to estimate their contribution to the CIB." The NCA home page <http://myhouse.com/NCA/home.htm> now has links to the COBE home page, which has links to DIRBE explanations and data; please go there to find out more.

Comet Hale-Bopp Countdown

by *Daniel Cosntanzo*

With all the publicity over Comet Hyakutake, not to be forgotten is last year's big comet discovery: Comet Hale-Bopp. It is slated to begin putting on (hopefully) a wonderful show roughly a year from now. This article begins a series of updates in *Star Dust*, counting down to Hale-Bopp's predicted bright appearance in early 1997. Following astronomical custom, all distances below are given in astronomical units (AUs), where 1 AU is Earth's mean orbital distance from the Sun, or

Robotic Telescopes on the Moon

No Review by *Harold Williams*



Due to the inclement weather, on Saturday, February 3, 1996, NCA did not meet to hear Peter Chen speak on "Robotic Telescopes on the Moon," but we will hear him speak on April 6, 1996 in the Lipsett auditorium of the Clinical Center (Building 10) at the National Institutes of Health. We apologize for any inconvenience

See *HALE-BOPP*, page 4

Calendar of Monthly Events

The Public is Welcome!

Saturday, March 2, 5:30 PM—Dinner with our speaker will take place at the Bombay Dining Indian Restaurant, 4931 Cordell Ave., Bethesda, MD., before the monthly meeting. We will start ordering at 5:30 PM. See the map on the back for directions.

Saturday, March 2, 1996, 7:30 PM—The March NCA meeting will feature Eli Dwek speaking on "Searching for the Cosmic Infrared Background." Meeting will also provide information on observing the bright new Comet Hyakutake.

Mondays, March 4, 11, 18, and 25, 8:30 PM—Public nights at the U.S. Naval Observatory (USNO), in Northwest Washington, D.C. (off Massachusetts Avenue). Includes orientation on USNO's mission, viewing of operating atomic clocks, and glimpses through the finest optical telescopes in the National Capital region. Information: USNO Public Affairs Office, 202/653-1541.

Wednesday, March 6, 1996—March "Sky Watch" column appears in *The Washington Post* "Style" section. It lists many events for that month.

Tuesdays, March 5, 12, 19, and 26, 7:00-9:30 PM—Mirror-making classes with Jerry Schnall at the Chevy Chase Community Center at Connecticut Avenue and McKinley Street, NW in Washington. Information: 202/362-8872.

Fridays, March 8, 15, 22, 29, 1996, 8:30 PM—NCA's Celestron-14 telescope open nights with Bob Bolster, 6007 Ridgeview Drive, south of Alexandria off Franconia Road between Telegraph Road and Rose Hill Drive. Call Bob at 703/960-9126.

Saturday, March 9, 1996, Night—Waning gibbous Moon provides this month's *third longest* night "deep night" period with Moonless skies from dusk until around 11 p.m. See explanation below.

Saturday, March 16, 1996, Night—Waning crescent Moon provides this month's *longest* Saturday night "deep night" period, with Moonless skies all night long. See explanation below.

Tuesday, March 19, 1996, 6:30 PM—Carnegie Institution of Washington Capital Science Lectures will feature Anneila I. Sargent speaking on "Other Solar Systems: Searches for Planetary System in Formation. *Will swirling clouds of gas and dust surrounding suns*

like our own form solar systems and perhaps another Earth?

Saturday, March 23, 1996, beginning 6:00 PM—Observation of Comet Hyakutake at Hopewell Observatory. See article on page 3 for directions.

Saturday, March 23, 1996, Night—Waxing crescent Moon provides this month's *second longest* Saturday night "deep night" period, although Moonless skies don't begin until around 11 p.m. See explanation below.

Wednesday, April 3, 1996—March "Sky Watch" column appears in *The Washington Post* "Style" section. It lists many events for that month.

Saturday, April 6, 1996, 7:30 PM—The April NCA meeting will feature Peter Chen speaking on "Robotic Telescopes on the Moon." More information will follow on the new Comet Hyakutake.

The Calendar's Saturday "Deep Night" Periods—Astronomy is quite unique among the sciences in that the original specimen of study, the Universe itself, is accessible to each of us possessing the gift of sight. We need only look up at the sky with wonder. And there is no better place to experience that original specimen than at a dark-sky site during "deep night" periods. For many, Saturday nights represent the most convenient times to do that. The Saturday deep night periods listed in this issue's "Calendar of Monthly Events" occur on two to three Saturday nights each month. They are continuous time intervals, of two or more hours duration, starting either Saturday night or Sunday morning, when neither daylight, twilight, nor Moonlight interfere with experiencing the dark sky. However, artificial light, in the form of light pollution, can interfere. To avoid this problem, several relatively dark-sky sites are available for NCA members' use in Maryland, Virginia, and West Virginia. Information: Daniel Costanzo, 703/841-4765.

This deep night listing was prepared by Daniel Costanzo from data generated by Jay Miller using MICA, the Multi-year Interactive Computer Almanac software package, created by the U.S. Naval Observatory. MICA is publicly available in both PC and Macintosh versions. Several NCA members can assist those interested in learning to use MICA.

Comet Hyakutake: NCA's Up-To-Date Viewing Primer

Part 1

by Daniel Costanzo

The comet is coming. The comet is coming at last. The Solar System's two decade long "drought" of very bright comets may be coming to an end — that is comets reaching first magnitude or brighter (Comet Halley never got above 2nd magnitude) — when the newly discovered Comet Hyakutake graces Northern Hemisphere, mid-latitude skies this March and April.

By now, you will probably already have been alerted to this new comet's discovery as it charges in from the depths of space. As of *Star Dust* press time (February 23), the comet was nearing 7th magnitude, sporting two stubby tails, and was easily visible in binoculars from dark-sky sights. More detailed studies showed it was a large object, as comets go. It was ejecting prodigious amounts of material comparable to Comet Halley's output a decade ago. All these facts point to this comet's shaping up to become a fine sight in March. Following is an up-to-date viewing primer for March, customized for the National Capital area. It is designed to put you in the dark *watching* this comet, not in the dark *about* this comet. It is based on over a quarter century of personal experience finding and observing comets from both suburban and dark-sky locations. It is kept as nontechnical as possible, yet free of all the schlock, deficiencies, and inaccuracies present in other guides.

This primer emphasizes visual viewing prospects for observers using binoculars or the unaided eye, since that is what most observers will be doing. Those interested in photography and electronic imaging should contact NCA member Bob Bolster for practical advice (703/960-9126). He is quite knowledgeable in those fields. Bob can also provide customized listings and charts of comet positions, viewing times, etc.

This viewing guide and chart assumes you have at least a basic knowledge of the sky. In other words, you will need to be familiar with finding rough cardinal directions (with a compass or by the Sun), celestial and horizon coordinates, the stellar magnitude system, the brightest stars (e.g., Arcturus), the Moon's movement and how its phases work, the sky's brightest asterisms (e.g., the Big Dipper), how to find the North Star (i.e., Polaris), the negative effects of light pollution, and how to use a planisphere. If you don't know these things, then please don't fret. NCA members are ready, willing, and able to help you. For that's what we're here.

Viewing Basics

Comets are like people: they each have their own unique personalities. Like people, comets can be fickle, moody, and unpredictable. But so far, comet experts believe Comet Hyakutake will

put on a very nice visual show to the unaided eye or binocular viewers from mid-March through late April.

First, and foremost is how to pronounce the name of Yuji Hyakutake, this comet's Japanese discoverer: "**You-gee Hi-ahh-koo-tah-key.**" But to make things easier, the comet can simply be referred to as "Comet H," or as "the comet." While it is going by the name Comet Hyakutake, its full official designation is Comet C/1996 B2 (Hyakutake).

Now for the truth about magnitudes; all magnitudes given here are what I call "total fuzzy magnitudes." Technically, they are called "total integrated magnitudes." But a first magnitude comet, though bright, is something far different from a first magnitude star, such as Regulus in the constellation Leo. Regulus can be easily seen poking through the pall of light pollution hanging over a city, while in that same sky, a first magnitude comet would appear as a not that obvious fuzzy puff. That is, because with a star, the light is all concentrated in a single point source, while with a comet, the light is diffused across an extended source several arcminutes, or more, in size.

Many (but not all) comets show a small starlike point embedded in the brightest part of their fuzziness. This is the comet's nucleus. Its brightness is

See *COMET C/1996*, page 4

Comet Observing at Hopewell Observatory

NCA members, families, and guests are invited to view Comet Hyakutake at Hopewell Observatory on Saturday evening / Sunday morning March 23/24 as it approaches maximum brightness. Sunset will be at 6:26 pm and astronomical twilight ends at 7:56. The Moon sets at 10:55. The comet will be above the horizon at the end of twilight, but quite low until 9:00. It will be best after 11:00. If you wish, come any time after 6:00 pm and bring your prepared picnic dinner. Coffee, tea, and cocoa will be provided by the Hopewell Corporation.

Directions:

(1) From the Beltway (I-495) go west on I-66 25 miles to Exit 40 at Haymarket onto U.S. 15. (2) Turn left on U.S. 15 at the end of the exit ramp. (3) Go 0.3 mile to traffic light, turn right onto Va. 55. (4) Go 0.8 mile to Antioch Road (Rt. 681) and turn right. (5) Go 3.2 miles to the end of Antioch Rd. and turn left onto Waterfall Road (601). (6) Go one mile and bear right onto Bull Run Mountain Rd. (Rt. 629). (7) Go 0.9 mile on 629 to narrow paved road at right with an orange pipe gate. (Directly across from an entrance gate with stone facing.) (8) Turn right through pipe gates, go 0.3 mile to top of ridge, and around the microwave station. (9) Continue on dirt road through the white gate and woods a few hundred feet to the observatory. Park along the road short of the buildings.

If it is cloudy the event will be postponed until Sunday, the 24th. For further information call (703) 960-9126.

COMET C/1996, from page 3

defined by the comet's nuclear magnitude. But for simplicity, all magnitudes given here are total integrated magnitudes, i.e., "total fuzzy magnitudes." Given comets' fickleness, all comet magnitude predictions can be wildly off. So always bracket any such magnitude prediction, nuclear and total, with plus or minus three magnitudes. So a comet predicted to be first magnitude could range anywhere between -2nd magnitude and 4th magnitude.

Now for the truth about tails. Not all comets produce those magnificent tails that are their hallmark, particularly tails easily visible to the unaided eye. But comets producing tails can create two basic types: dust tails and gas tails. Dust tails are generally slightly or greatly fan-shaped. Gas tails are generally very narrow and jet-like. Comet tails always more or less point away from the Sun; the gas tails more than the dust tails. But the vagaries of viewing geometry from Spaceship Earth sometimes gives the illusion that part of the tails are pointing towards the Sun, producing the so-called "anti-tail,"

Now a whole lot of things can be calculated about comets, like expected brightness, when an anti-tail might appear, etc. But none of these obviates your going out and observing it. That is the important thing. If possible, go out to a dark-sky site for best viewing when no Moon is in the sky. But don't hesitate to try and see it from light polluted sites or in Moonlight. During the comet's brightest periods, at least something could be visible.

March Viewing

Neglecting everything else, including the comet's changing brightness, the best time each night to view any comet in the sky depends on juggling three motions:

- The comet is moving;
- The Moon is moving (and changing phases); and
- Earth is moving (both orbiting the Sun & rotating).

With this in mind in early March, the comet should be a 6th magnitude puff of light, rising about Midnight and best seen in binoculars in the early morning as it reaches its highest point in the sky

HALE-BOPP, from page 1

149,597,870 kilometers (about 92,955,600 miles).

In February, visual observers recovered the comet in the predawn sky, after it spent a couple of months in conjunction behind the Sun. As of February 20, Hale-Bopp was still hanging in there at around 9th magnitude, right on the mark with magnitude predictions. It was visible in 25 centimeter (10 inch) aperture instruments as a small puff of light, sporting a small, fan-shaped tail. More detailed studies show it to be ejecting huge amounts of material. Given its still considerable distance from the Sun, that's a sure sign Hale-Bopp is cooking under increasing Solar warming, and encourages optimistic predictions of a bright 1997 appearance.

March 15 will find Hale-Bopp inexorably chugging Sunward at 5.0 AU from the Sun (0.2 AU inside Jupiter's mean orbital distance from the Sun), and 5.4 AU from Earth. From dark-sky sites, it will be easily visible in the above mentioned aperture telescopes as an 8th

(culmination) around 4 a.m. The Full Moon will interfere during this period, but less so as the Moon wanes after Last Quarter on March 12. By mid-March, still an early morning object, the now 5th magnitude comet rises about 11 p.m. and culminates about 3 a.m.

Around March 15 to 20, the comet should become visible (reaching 3rd magnitude) to the unaided eye for the first time from dark-sky sites (but not from light polluted sites). It should be a nice object in binoculars and be high enough to see low in the southeast about Midnight. Rapidly brightening to first magnitude, and rapidly moving northward from night to night, the comet appears higher in the sky and is easier to see earlier in the night. On March 24, it becomes circumpolar and is thus visible all night (and can be seen all night until early April). On March 24, it also is nearest to Earth and now moving rapidly at about 18 degrees per day (3/4 degrees per hour).

Listed on page 5 are the best calendar dates for viewing the comet in terms of both brightness and altitude above the horizon. They cover the period extending from when the comet's predicted magnitude is 1.4 and brightening (to peak at 0.7) to when it is magnitude 1.4

to 9th magnitude puff low in the morning sky, just before dawn. Based on the latest orbital elements available on February 15, perigee (closest approach to Earth) is slated for about a year from now — March 22, 1997, at 1.31 AU — as the comet closes in on the Sun, with perihelion (closest approach to the Sun) slated for April 1, 1997 at 0.91 AU.

Those wishing further information on Comet Hale-Bopp via the World Wide Web can access NCA's home page (<http://myhouse.com/NCA/home.html>). Those wishing further information via telephone recordings can call *Sky & Telescope* magazine's "Skyline" (617/497-4168). *Sky & Telescope* magazine also provides information and high quality finder charts. (*Sky & Telescope* magazine is available to NCA members at a discount.)

Information and data for this article was obtained and generated by NCA members Walter Nissen and Bob Bolster, with other information coming from the 1996 February 9 "Skyline."

and fading. So on these nights, the comet should be visible from light polluted suburban skies, e.g., Silver Spring, Maryland. But if possible, go to a dark-sky site during this period, and stay up late enough to try and avoid the Moon.

See *COMET C/1996*, page 5

Newsletter Deadline for April Star Dust MARCH 15, 1996

*** DO NOT BE LATE!!! ***

We need everyone to work together. Please send your submissions in on time so that all NCA members will receive newsletters on time. Send your submissions to Gary & Alisa Joaquin, at 7821 Winona Ct., Annandale, VA, 22003. Leave a message on voice mail 703/750-1636 or send an ASCII file via e-mail at 71561.1747@compuserve.com or AGJOAQ@ix.netcom.com or fax to 703/658-2233. Submissions must be on time or they may not get in. Have a Happy St. Patrick's Day.



Comet Primer and Ephemeris Table

COMET C/1996, from page 4

The dates below denote observing times starting in the evening and continuing through the early morning of the next day, e.g., "Fri. Night, March 22" means "Friday night/Saturday morning, March 22/23." All times are Eastern Standard Time (EST), with viewing directions given for the convenient hours of 8 p.m. to 10 p.m. EST. Nights giving times when the comet reaches its highest point in the sky (culmination) are nights when the later you stay up, the better to both avoid the Moon and allow the comet to rise high in the sky. On nights without culmination times, the comet is too close to the North Celestial Pole to make any difference:

Fri. Night, March 22—Look for the comet low in the east-northeast sky and near the bright star Arcturus. At 9 p.m., the waxing crescent Moon will be 11 degrees around 3:00 a.m., high overhead.

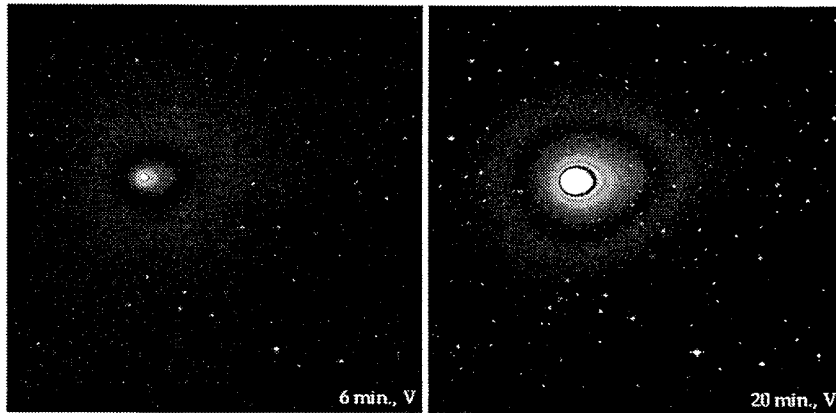
Sat. Night, March 23—Comet low in the east-northeast sky. It will be a little higher than the night before. At 9 p.m., waxing crescent Moon 21 degrees up; Moonset around 11 p.m. Culmination around 2:30 a.m., high overhead. NCA dark-sky observing session at Hopewell Observatory (see announcement on page 3).

Sun. Night, March 24—Comet nearest Earth (perigee); in the northeast sky below and to the right of the end of the Big Dipper's handle. At 9 p.m., waxing crescent Moon 31 degrees up; Moonset around Midnight. Culmination around 2:30 a.m. high overhead.

Mon. Night, March 25—Comet brightest it will be in March; look for it in the north-northeast sky between the Big Dipper and the North Star (Polaris). At 9 p.m., waxing, nearly First Quarter Moon 41 degrees up; Moonset around 1 a.m. Culmination around 1:30 a.m.

Tue. Night, March 26—Comet closest to North Celestial Pole; in the north sky, close to and above Polaris. At 9 p.m., First Quarter Moon 49 degrees up; Moonset around 1:30 a.m.

Comet Hyakutake



1.54-m Danish Telescope/DFOSC

ESO La Silla Observatory

These false-color photos (seen here in black and white) show the first images of comet C/1996 B2 (Hyakutake), obtained with the DFOSC instrument at the Danish 1.54 meter telescope at the ESO La Silla Observatory. This comet is expected to become quite bright when it passes near Earth in late March 1996. The observations were made by Jean-Marie Will, visiting astronomer from Sternwarte de Universitaet Bonn, Germany.

The images have been reproduced from two CCD frames with a 6 and 20 minute exposure times, respectively. They were obtained through a standard V-filter just after 08:00 UT on 9 February 1996. The instrument was DFOSC with the Danish Lora/Lesser CCD (2052 x 2052 pix; 0.39 arcsec/pix; field of view 13.3 x 13.3 arcmin). For this presentation, the original CCD frames were bias-subtracted, flat fielded, cleaned and the field was trimmed to 10.4 x 10.4 arcmin. North is up and East is to the left. The cometary coma which consists of dust and gas emitted by the nucleus is elongated in the anti-solar direction (p.a. = 289 deg; counted from North over East); the tear-shape form is indicative of the beginning development of a dust tail. Otherwise, the coma is very symmetrical and there is no evidence of any jets or outflows. The largest diameter on the 20-min exposure is about 7 arcmin.

At the time of this observation, the comet was at a distance of 1.52 AU (227 million kilometers) from the Earth and 1.88 AU (281 million kilometers) from the Sun.

Credit: European Southern Observatory

Wed. Night, March 27—Comet is the north-northwest sky, to the west (left) of Polaris. At 9 p.m., waxing Moon just past First Quarter 56 degrees up; Moonset around 2:00 a.m.

Thu. Night, March 28—Comet in the north-northwest sky, a little further west (left) of Polaris than last night. At 9 p.m., waxing gibbous Moon 61 degrees up; Moonset occurs after comet getting lower in the sky. Moon, nearing full, interferes for rest of month.

In addition, an ephemeris table for the comet Hyakutake has been generated by NCA's Bob Bolster on page 6, (the back side of this pullout) providing more detailed information on where to look during the most favorable observation times. Please feel free to copy it and distribute it to anyone who is interested.

For those wanting to see a spectacular tail, comet tails are notoriously difficult to see with the unaided eye from light polluted areas. Under light polluted conditions, if a comet is visible at

See COMET C/1996, page 7

Comet C/1996 B2 (Hyakutake) Ephemeris

Calculated by Robert N. Bolster, February 11, 1996

Terms:

R.A., Dec.: Right ascension and declination, J2000.0.
 DELTA, r: Distance of comet from Earth and Sun, in A.U.
 SUN ELONG: Angular distance from the Sun.

h, AZ: Altitude above the horizon, azimuth from north toward east.

m1: Predicted brightness — can be considerably in error.

Times and dates are EST.

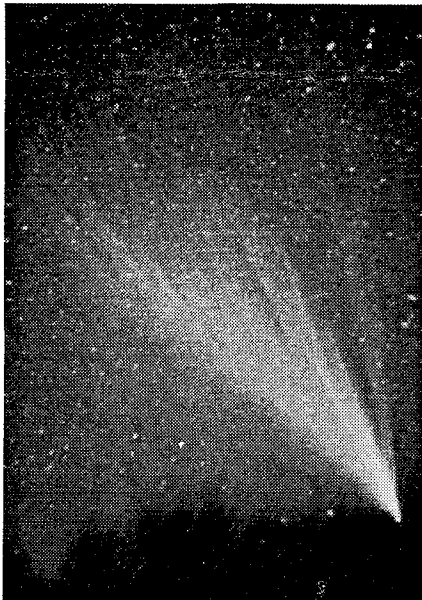
1996 DATE	EST Time	R.A.	Dec.	DELTA	r	Sun ELONG	Comet			Moon	
							h	AZ	m1	h	Az
3 20	21 0	14 52.0	+4 52	0.177	1.133	137	2	85	2.3		
3 20	22 0	14 51.9	+5 7	0.176	1.132	137	14	95	2.3		
3 20	23 0	14 51.8	+5 23	0.175	1.131	138	26	105	2.2		
3 21	00 0	14 51.8	+5 39	0.174	1.130	138	37	116	2.2		
3 21	01 0	14 51.7	+5 55	0.173	1.130	138	47	132	2.2		
3 21	02 0	14 51.7	+6 12	0.171	1.129	138	54	152	2.2		
3 21	03 0	14 51.6	+6 28	0.170	1.128	138	58	178	2.2		
3 21	04 0	14 51.5	+6 45	0.169	1.127	138	55	205	2.2		
3 21	21 0	14 50.2	+12 8	0.151	1.113	137	8	81	1.9	-0	285
3 21	22 0	14 50.2	+12 29	0.150	1.112	137	20	90	1.8		
3 21	23 0	14 50.1	+12 51	0.149	1.111	137	32	99	1.8		
3 22	00 0	14 50.0	+13 13	0.148	1.110	137	43	111	1.8		
3 22	01 0	14 49.9	+13 35	0.147	1.109	137	54	126	1.8		
3 22	02 0	14 49.8	+13 57	0.146	1.108	137	62	149	1.8		
3 22	03 0	14 49.7	+14 20	0.145	1.107	137	66	181	1.8		
3 22	20 0	14 47.7	+21 39	0.130	1.093	135	4	65	1.5	22	271
3 22	21 0	14 47.6	+22 8	0.129	1.092	135	15	73	1.4	11	280
3 22	22 0	14 47.4	+22 37	0.128	1.091	135	27	82	1.4	0	289
3 22	23 0	14 47.3	+23 7	0.127	1.090	135	39	90	1.4		
3 23	00 0	14 47.2	+23 37	0.126	1.089	135	51	100	1.4		
3 23	01 0	14 47.0	+24 8	0.126	1.088	134	62	114	1.4		
3 23	02 0	14 46.9	+24 39	0.125	1.088	134	72	139	1.3		
3 23	03 0	14 46.7	+25 10	0.124	1.087	134	76	189	1.3		
3 23	20 0	14 43.4	+35 3	0.113	1.072	129	14	56	1.1	33	266
3 23	21 0	14 43.2	+35 41	0.112	1.071	129	24	63	1.0	21	275
3 23	22 0	14 42.9	+36 20	0.111	1.070	129	35	69	1.0	10	283
3 23	23 0	14 42.7	+36 59	0.111	1.069	128	47	74	1.0	-0	292
3 24	00 0	14 42.4	+37 39	0.110	1.069	128	58	79	1.0		
3 24	01 0	14 42.1	+38 19	0.110	1.068	128	70	83	1.0		
3 24	02 0	14 41.8	+38 59	0.109	1.067	127	82	85	1.0		
3 24	03 0	14 41.6	+39 40	0.109	1.066	127	86	285	1.0		
3 24	19 0	14 35.6	+51 10	0.104	1.052	119	17	37	0.8	53	245
3 24	20 0	14 35.1	+51 55	0.103	1.051	119	25	42	0.8	43	258
3 24	21 0	14 34.6	+52 40	0.103	1.050	118	34	46	0.8	31	269
3 24	22 0	14 34.0	+53 25	0.103	1.049	118	43	49	0.8	20	277
3 24	23 0	14 33.5	+54 11	0.103	1.049	117	52	49	0.8	9	286
3 25	00 0	14 32.9	+54 57	0.103	1.048	117	60	45	0.8	-1	295
3 25	01 0	14 32.3	+55 42	0.103	1.047	116	68	34	0.8		
3 25	02 0	14 31.7	+56 28	0.103	1.046	116	72	12	0.8		
3 25	19 0	14 15.0	+69 18	0.104	1.031	106	30	23	0.7	62	231
3 25	20 0	14 13.4	+70 2	0.104	1.030	105	36	25	0.7	52	249
3 25	21 0	14 11.7	+70 46	0.105	1.029	105	41	25	0.7	41	261
3 25	22 0	14 10.0	+71 29	0.105	1.028	104	46	23	0.7	30	271
3 25	23 0	14 8.0	+72 12	0.105	1.027	104	50	20	0.7	18	279
3 26	00 0	14 6.0	+72 54	0.106	1.027	103	53	14	0.7	7	288
3 26	01 0	14 3.8	+73 37	0.106	1.026	102	55	7	0.7	-3	297
3 26	02 0	14 1.4	+74 19	0.106	1.025	102	54	359	0.7		
3 26	19 0	12 2.2	+84 39	0.115	1.010	93	40	7	0.8	67	209
3 26	20 0	11 42.7	+85 5	0.115	1.009	92	42	5	0.8	59	235
3 26	21 0	11 20.0	+85 28	0.116	1.008	92	43	3	0.9	49	251
3 26	22 0	10 53.6	+85 48	0.116	1.007	91	43	1	0.9	38	263
3 26	23 0	10 23.7	+86 3	0.117	1.006	91	43	359	0.9	27	272
3 27	00 0	9 50.6	+86 15	0.118	1.005	90	42	357	0.9	16	281
3 27	01 0	9 15.3	+86 20	0.118	1.004	90	41	356	0.9	5	289
3 27	19 0	4 21.8	+80 21	0.133	0.988	82	45	351	1.1	68	180
3 27	20 0	4 17.8	+79 55	0.133	0.987	82	43	348	1.1	65	214
3 27	21 0	4 14.2	+79 30	0.134	0.987	81	41	347	1.1	56	237
3 27	22 0	4 11.0	+79 5	0.135	0.986	81	38	346	1.1	46	253
3 27	23 0	4 8.0	+78 40	0.136	0.985	80	35	347	1.1	35	264
3 28	00 0	4 5.2	+78 16	0.137	0.984	80	32	348	1.1	24	273
3 28	19 0	3 37.1	+71 16	0.156	0.967	74	47	337	1.3	64	155
3 28	20 0	3 36.3	+70 57	0.157	0.966	74	43	335	1.3	66	188
3 28	21 0	3 35.5	+70 38	0.158	0.965	73	38	335	1.3	61	219
3 28	22 0	3 34.8	+70 19	0.159	0.964	73	33	337	1.3	53	239
3 28	23 0	3 34.1	+69 60	0.160	0.963	73	28	340	1.4	42	253

Note: 1900:00 (7 pm) is twilight. The sky is fully dark at 20:00 (8 pm).

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all, it will most likely appear to the unaided eye (or binoculars) as a fuzzball, or fuzblob. For viewing any tails, it is best to go to dark-sky sites. Either way, the big disadvantage to this particular comet's passage is that it will whisk by Earth at 0.10 astronomical units (AU) away — a scant 15 million kilometers (9.3 million miles) from Earth — before the point of maximum cooking by the Sun (0.23 AU). (1 AU is Earth's mean orbital distance from the Sun, or 149,597,870 kilometers (92,955,621 miles).) Comets' best looking tails tend to be produced after perihelion, after Solar heating has thoroughly cooked the comet's dirty ice-berg, causing it to eject the maximum amount of dust and gas. Prior to perihelion, a comet is still a little too chilled to do that.

A visible tail is not an inevitable certainty with this (or any other) comet. But from our point of view on Spaceship Earth, whatever tail is present will be very foreshortened as the comet ap-



Comet West, photo taken by George W. Kelley, Jr., in March 7, 1976 at 10:10 UT (5:10 a.m. EST), 10 minutes exposure on Plus X pushed to ASA 600. The gas tail is the faint and thin tail at the extreme right pointing almost straight up. The dust tail is the large, fan-shaped tail extending off towards the upper left. For scale, the diamond shaped asterism of bright stars at the extreme upper right is part of the small constellation Delphinus.

proaches us, since it will be coming in almost straight at us. (Don't worry gentle reader. There won't be any collision between comet and Earth.) Then, starting around March 20, as the comet begins whisking by Earth, any tail present will rapidly lengthen as it appears broadside to us. In the process, it could become extremely long (tens of degrees from dark-sky sites), reaching its maximum length around the nights of March 24 through 26. After that, the tail rapidly foreshortens again as the comet recedes from Earth, getting shorter and shorter each night all the way into April.

The comet is expected to dim during the first week of April as it moves away from Earth. But it will then brighten again and should still be easily visible until getting lost in the evening twilight glow toward the end of April. But that guide will have to wait for *Star Dust's* April issue.

Further Advice & Assistance

Despite all the astronomical community's raving about everyone going "on-line," a whopping roughly ninety percent of all Americans currently still are not. So to the vast majority of citizens, giving them a web site number in 1996 is still about as useful as giving them a telephone number was in 1896. Yet, almost all Americans can view at least some aspect of this comet. With just a little bit of good information about when and where to look, many can be introduced to the joy of astronomy and perhaps be well on their way to becoming skilled observers. NCA recognizes its role in helping to fill this information gap. Telephone questions about the comet may be directed to NCA's Harold Williams (301/650-1463) or to our general phone line (301/320-3621).

Those wishing further information via telephone recordings can contact *Sky & Telescope* magazine's "Skyline" (617/497-4168). *Sky & Telescope* magazine itself also provides information and high quality finder charts, and is available at a discount through NCA membership. Nontechnical viewing information is available via telephone recordings on the Smithsonian "Sky Watcher's Report" (202/357-2000).

Those with access to the World Wide Web, and wishing further information on Comet Hyakutake, should



Comet Halley, photo by Bob Bolster NCA member January 8, 1986. Taken with the 30-cm Wright telescope at Hopewell Observatory with Hypersensitized 2415 film, f/4/1, 29 minutes. The gas and dust tails are intertwined and not separated, unlike the Comet West.

first visit NCA's home page provided in the article by Harold Williams on "NCA's Web Page Evolving" (see page 7 in this issue). This home page lists several other Web sites providing more information. However, a word of warning about those other Web sites: They vary in quality, accuracy, and suitability of their information.

To minimize the problem of light pollution's interfering with observing the comet, it is best to go to a dark-sky site. Several relatively dark-sky sites are available for NCA members' use in Maryland, Virginia, and West Virginia. For details and advice regarding dark-sky sites in Virginia, call Daniel Costanzo (703/841-4765) and for dark-sky sites in Maryland, call Harold Williams (301/650-1463). The Hopewell Corporation has also kindly scheduled an observing session (see page 3) for NCA members at one of those sites, the Hopewell Observatory, on an ad hoc basis, possibly on very short notice, to take advantage of clear weather. To participate, contact Dan and Harold at

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the above phone numbers, and simply take advantage of every observing opportunity.

In Washington, D.C., the National Air and Space Museum (NASM) Albert Einstein Planetarium will use its fine planetarium facilities to describe how to find and view the comet during NASM's "The Stars Tonight" program. These free daily presentations on viewing the comet will begin Saturday, March 9 and should run at least through the end of March, with the possibility of extending into April. They will run seven days a week, starting at 3:00 p.m., each day. For further details, call NASM's Planetarium Production Offices during weekday business hours at 202/357-1529, or -1530, or -1531 or call anytime the recordings on the Einstein Planetarium Information Line (202/357-1550), or the Langley Theater & Einstein Planetarium Information Line (202/357-1686).

In suburban Virginia, Steve Smith at the Arlington Planetarium, in Arlington, will conduct public programs on March 4 and April 8 describing how to view the comet. Both start at 7:00 p.m., and are followed by outside observing, weather permitting. Call the planetarium for details (703/358-6070). In suburban Maryland, NCA's Harold Williams will conduct a similar public program on March 20 at 7:00 p.m., at the Montgomery College Planetarium, in Takoma Park. Call Harold for details (301/650-1463).

This is what NCA is all about: serving the entire National Capital area with advice and assistance on subjects astronomical. So please use this primer. Make copies of it and give them to relations, colleagues, and friends. Please come to NCA's March 2 meeting

NCA Web Page Evolving

by Harold Williams

NCA's web page is growing sometimes daily. Not only have links been added to the research topics of our speakers and sometimes their own home pages, like our May speaker on Comets, Casey Lisse, but late-breaking astronomically useful stuff like the new possibly bright comet C/1996 B2 (Hyakutake). If you have access to the Internet and a web browser you might want to check NCA's home page at least weekly. If you don't have access to the Internet, Erol's will sell you access and provide the software for IBM compatibles for \$13 per month with unlimited access guaranteed at 14.4—28.8 kilobaud. I have free access at the University of Maryland with Netscape as a browser, but I went with Erol's because I was tired of not being able to get in on the modem pool at the University of Maryland in the evening before midnight.

to obtain the latest updates, advice, and handouts, including observing ephemeris (table) and finder charts. For April viewing, more information will also be available at NCA's April 6 meeting. Please come to that meeting, too. But most of all, please go outside and observe this rare and hopefully magnificent sky spectacle.

Good Comet Viewing!

Information and data for this primer was obtained and generated by NCA members Bob Bolster, Walter Nissen, and Harold Williams, with other information coming from "Skyline" for February 5, 9, 16, and 23, 1996.

From The Secretary

The number of members in the NCA has decreased from 262 last June to 237 in mid February. The net 25—member loss amounts to a 10% drop in membership. My theory is that we have not had a cosmic disaster lately. The NCA had a big spurt in membership following the comet collisions with Jupiter in July 1994. We should hope that the appearance of Comet Hale-Bopp next summer and Comet Hyakutake will bring us many new members.

In the meantime, I urge all NCA members to tell their friends about the many benefits of belonging to our society. In other words, please do a little proselytizing for the NCA. Bring a friend to our monthly meetings, give him or her a copy of *Star Dust* or ask him to call me for more details about the NCA. I promise to replace any recent issue of *Star Dust* that you may use this way.

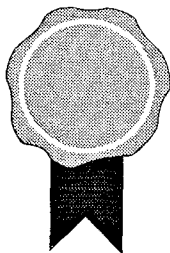
On another subject, please notify me as soon as possible after you move or get a new telephone number. I need this information to keep the NCA directory and your mailing label up to date. You must, however, notify *Sky & Telescope* magazine directly of any changes in your address because only you have your S&T mailing label that they need for making address changes. Finally, please check your NCA mailing label and directory listing and report any errors or omissions to me. Thanks, Leith Holloway, NCA Secretary, 301/564-6061.

1996

Observer's Handbook

Copies of the 1996 *Observer's Handbook*, published by the Royal Astronomical Society of Canada, will be on sale for \$12 apiece at the NCA monthly meetings until they are sold out. This means you can obtain this fine annual publication at a substantial discount through NCA, making it another astronomical shopping benefit of NCA membership. Please bring a check made out to "National Capital Astronomers" rather than cash. If you wish to buy a copy but cannot attend the meeting, please call me evenings or weekends to make other arrangements. Thanks, Jeff Norman, 202/966-0739

Regional Science Fairs



The regional science fairs are coming up in March and April. NCA gives an award to the best astronomy related projects in each fair. Winners receive a year's membership in NCA and a year's subscription to *Sky & Telescope*. However, this requires that we have members judge the projects. Preferably, we will have more than one in each jurisdiction. If you are interested, please contact Jay Miller at 301/530-7942, email address is jhmiller@os2bbs.com.

National Capital Astronomers, Inc.

SERVING SCIENCE & SOCIETY SINCE 1937

NCA is a non-profit, membership supported, volunteer run, public-service corporation dedicated to advancing space technology, astronomy, and related sciences through information, participation, and inspiration, via research, lectures, presentations, publications, expeditions, tours, public interpretation, and education. NCA is the astronomy affiliate of the Washington Academy of Sciences. All are welcome to join NCA. For information: 301/320-3621 or 703/841-4765.

SERVICES & ACTIVITIES:

Monthly Meetings feature presentations of current work by researchers at the horizons of their fields. All are welcome; there is no charge. See monthly *Star Dust* for time and location.

NCA Volunteers serve as skilled observers frequently deploying to many parts of the National Capital region, and beyond, on campaigns and expeditions collecting vital scientific data for astronomy and related sciences. They also serve locally by assisting with scientific conferences, judge science fairs, and interpreting astronomy and related subjects during public programs.

Discussion Groups exchange information, ideas, and questions on preselected topics, moderated by an NCA member or guest expert.

Publications received by members include the monthly newsletter of NCA, *Star Dust*, and an optional discount subscription to *Sky & Telescope* magazine.

NCA Information Service answers a wide variety of inquiries about space technology, astronomy, and related subjects from the public, the media, and other organizations.

Consumer Programs on selection, use, and care of binoculars and telescopes, provide myth-breaking information, guidance, and demonstrations for those contemplating acquiring their first astronomical instrument.

Dark-Sky Protection Efforts educate society at large about the serious environmental threat of light pollution, plus seek ways and means of light pollution avoidance and abatement. NCA is an organizational member of the International Dark-Sky Association (IDA), and the National Capital region's IDA representative.

Classes teach about subjects ranging from basic astronomy to hand-making a fine astronomical telescope. NCA's instructors also train educators in how to better teach about space technology, astronomy, and related sciences.

Tours travel to dark-sky sites, observatories, laboratories, museums, and other points of interest around the National Capital region, the Nation, and the World.

Discounts are available to members on many publications, products, and services, including *Sky & Telescope* magazine.

Public Sky Viewing Programs are offered jointly with the National Park Service, the Smithsonian Institution, the U.S. Naval Observatory, and others.

NCA Juniors Program fosters children's and young adults' interest in space technology, astronomy, and related sciences through discounted memberships, mentorship from dedicated members, and NCA's annual Science Fair Awards.

Fine Quality Telescopes up to 36-cm (14-inch) aperture are available free for member's use. NCA also has access to several relatively dark-sky sites in Maryland, Virginia, and West Virginia.

YES! I'D LIKE TO JOIN THE NATIONAL CAPITAL ASTRONOMERS

Enclosed is my payment for the following membership category:

Regular

Sky & Telescope and *Star Dust*. (\$48 per year)

Star Dust only (\$24 per year)

Junior (Only open to those under age 18) Date of birth: _____

Junior members pay a reduced rate.

Sky & Telescope and *Star Dust*. (\$34 per year)

Star Dust only (\$10 per year)

First name Middle Last name (_____) Telephone

Street or Box Apartment City State Zip

If family membership, list names of additional participating immediate family members in same household, with birthdates of all those under 18 years old: _____

Note: If you already subscribe to *Sky & Telescope*, please attach a recent mailing label. You may renew this subscription through NCA for \$24 when it expires.

Make check payable to: **National Capital Astronomers, Inc.**, and send with this form to:

NCA c/o Jeffrey B. Norman, 5410 Connecticut Avenue, NW, Apt. #717, Washington, D.C. 20015-2837.

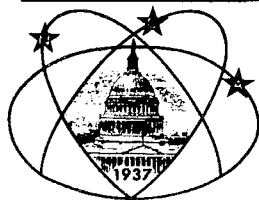
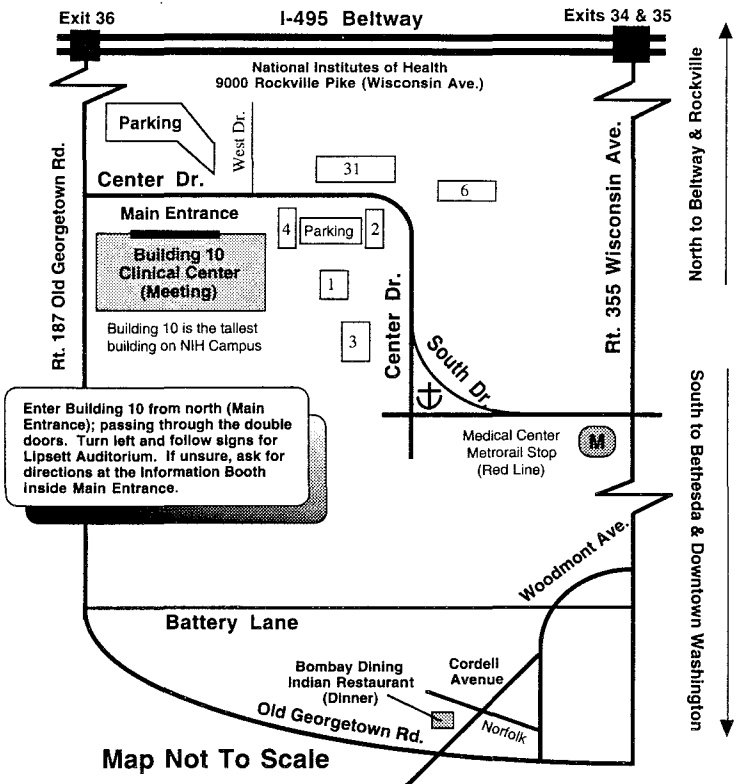
The following information is optional. Please indicate briefly any special interests, skills, education, experience, or other resources which you might contribute to NCA. **Thank you, and welcome to NCA!**

Getting to the NCA Monthly Meeting

Metrorail Riders - From Medical Center Metro Stop: Walk down the hill, pass the bus stops and turn right at the anchor onto Center Drive. Continue uphill to Building 10 (walking time about 10 minutes), the tallest building on campus. Also, the J2 bus line connects the Bethesda (7:16 PM) and NIH (7:23 PM) Metro stops with Building 10 (7:25 PM).

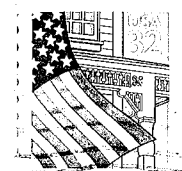
To Bombay Dining Indian Restaurant—Take Wisconsin Avenue toward Bethesda and bear right onto Woodmont (or take the next right onto Battery Lane). Follow Woodmont to Cordell (2 blocks south of Battery) and make a right at the Thai Place Restaurant. Go one block and cross Norfolk, then watch for the restaurant on your right in the next block (between Norfolk and Old Georgetown). It is just about across the street from Nam's, so there is convenient free parking in the nearby garage. Seats not guaranteed after 5:30.

Star Dust is published ten times yearly (September through June) by the National Capital Astronomers, Inc. (NCA), a non-profit, astronomical organization serving the entire National Capital region, and beyond. NCA is the astronomy affiliate of the Washington Academy of Sciences and the National Capital region's representative of the International Dark-Sky Association. Phone Numbers: 301/320-3621 or 703/841-4765. President, Wayne H. Warren, Jr., 301/474-0814. Deadline for *Star Dust* is the 15th of the preceding month. Editors Alisa & Gary Joaquin, 7821 Winona Ct., Annandale, VA 22003, 703/750-1636, E-mail-see deadline box for new address. Daniel J. Costanzo, Editorial Advisor. *Star Dust* © 1995 may be reproduced with credit to National Capital Astronomers, Inc.



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