★ STAR DUST

Volume XXXV October 1978 Number 2

OCTOBER CALENDAR — *The public is welcome.*

Monday, October 2, 9, 16, 23, 30, 7:30 PM — Telescope-making classes at the Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Friday, October 6, 13, 20, 27, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall.

Saturday, October 7, 6:15 PM — Pre-meeting dinner at Bassin's Restaurant, 14th Street and Pennsylvania Avenue, NW. Reservations unnecessary.

Saturday, October 7, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. Program to be announced.

Saturday, October 21, 8:00 PM — *Exploring the Sky* special: NCA and National Park Service jointly host the Cornell Club of Washington. Not public. Glover Road south of Military Road, NW, near Rock Creek Nature Center. Planetarium if cloudy. See page 7.

Saturday, October 28, 7:30 PM — *Exploring the Sky,* (public) presented jointly by NCA and the National Park Service. Planetarium if cloudy. Location as above. Information: Bob McCracken, 229-8321.

SEPTEMBER LECTURE

James W. Christy, discoverer of Charon, the satellite of Pluto, narrated his discovery of the satellite and its naming at the September 9 meeting of National Capital Astronomers. Christy is an astronomer of the U. S. Naval Observatory, Washington, DC.

Christy emphasized the difficulty of observing even Pluto, and the near impossibility of detecting a satellite such as Charon.

Pluto was discovered in 1930 by Clyde Tombaugh at Lowell Observatory 15 years after the death of Percival Lowell, who established the observatory for planetary research and spent many years seeking the planet. *(Tombaugh also spoke for NCA some time after his discovery. Ed.)* Since its discovery, it has moved through about one-fifth of its 248-year orbit, sufficiently for close determination of its orbital parameters. In about 1950 Gerard Kuiper, using the 200-inch Palomar Hale telescope, searched unsuccessfully for a satellite of Pluto. While no appreciable disk has been observed, his measurements indicated a maximum diameter of about 6,000 km. About 1955, Hardy and Walker noted a ±10-percent magnitude variation having a 6.4-day period, which was attributed to rotation of the planet and a hemispheric difference of albedo.

In 1955, just 5 miles from Lowell Observatory, where Pluto was discovered, the Flagstaff, AZ station of the U. S. Naval Observatory was established. There, in 1964, the 61-inch astrometric reflector, designed for extremely precise positional work, was installed. Christy showed a number of plates taken with this instrument that attest to its optical excellence. In 1965, 70, and 71, plates of Pluto were taken with this telescope for positional measurements. Since none had been taken subsequently, Christy requested that plates be taken for current positional determination.

The 5 x 7-inch astrographic plates are sent to the USNO at Washington, DC, where positions are determined with the Observatory's precision measuring engine to within 1 micron on the plate.

Christy's requested plates were taken, six images on each plate, on April 12, April 20, and May 12, 1978. On June 22, Christy was examining one of these images, a 2-minute exposure, which showed a rather triangular elongation typical of a faulty plate — but the surrounding star images were good, not elongated, as from guiding error. He examined the plates microscopically, found the normal small optical imperfections common to the star-image structures.

and identified each in the images of Pluto. The latter, however, showed one small projection not found in the structure of the star images. Further examination showed that the extra projection was on opposite sides of the April 13 and May 12 images. No such projection was evident on the April 20 plate.

With his colleagues, Christy checked all known possible aberrations. The motion of Pluto relative to the stars during the exposures is far too small; image defects were eliminated by repeats and comparisons with star images; a speck of dust on the filter that might affect only one image was dismissed by examination of all the images taken in different positions on the plates. Perhaps a background star? A close candidate was found for April 13, but reexamination of the plate showed the suspected star separately from the image of Pluto.

By the end of April 22 they were convinced that Pluto has a satellite!

Christy then checked all of the available plates taken of Pluto with the astrometric reflector — about 50 — and found that the normal seeing disks on most were larger than the elongation. Only those taken under the very best seeing conditions were usable. Of these, he found two taken in 1965 which had been marked, "Pluto elongated," thus having been dismissed as unsuitable for use! A series of five plates taken within one week under fortunate conditions in 1970 showed the satellite in various positions about Pluto.

The orbital period, while not precisely determinable from the few available observations, appeared to be very close to the rotational period of the planet. Robert S. Harrington, USNO dynamicist, examined the possibility that Pluto and its satellite are indeed locked in synchronous rotation by tidal friction. Using a rotational period of 6.3867 day, recent data from Anderson and Fix, Harrington calculated position angles of the satellite back to 1965. Christy independently measured position angles on all available images. Comparison showed excellent agreement. Thus, the orbital period of the satellite was shown to be that of the rotation of Pluto; the two are indeed synchronous. This is the first known case of such synchronization in the Solar System.

Dr. Gart Westerhaut, Scientific Director of the Naval Observatory, called a meeting at which it was decided to seek confirmation before announcing the discovery. Plates were requested to be taken at times predicted by Harrington, without the reason being given, from Flagstaff and the Interamerican Observatory at Cerro Tololo, Chile. On July 2 an excellent plate was received from Flagstaff. Position angle: 350°; Harrington's prediction: 352°. July 5, Dr. Graham called from Cerro Tololo, said he had measured the elongation at 175°. He did not know that Harrington's prediction was 175°.

While awaiting confirmation, Christy and his colleagues considered some of the implications of the discovery. Having an accurate orbital period, now known to equal the rotational period, they could calculate the mass of Pluto, about 0.2 percent that of the Earth, and, with other considerations, deduce the size of Pluto, about 3,000 km — half that of Kuiper's estimate, and the satellite's diameter, about half that of Pluto.

In retrospect, Christy pointed out, it appears that Kuiper's 1950 measurement of Pluto's diameter may have included the unresolved satellite. Indeed, calculation of the satellite's orbital position at the time of Kuiper's measurement indicates an image size very consistent with the diameter Kuiper reported. Perhaps the very satellite Kuiper unsuccessfully sought ironically led to his mismeasurement of Pluto's diameter.

Pluto is believed to have a somewhat irregular surface of methane ice at about -350°F. At Pluto's distance, the Sun subtends an angle of only about 45 seconds; the unresolved disk would appear to the unaided eye as an extremely bright star. Christy displayed an artist's rendition by USNO staff astronomer Sally Bensusen of a probable Plutonian landscape based upon what can now be surmised. She depicts the satellite's crescent illuminated by the distant, star-like, but intense, Sun over the rough, icy Plutonian horizon.

On July 6, 1978, when the discovery had been adequately confirmed by other observatories, the International Astronomical Union was notified. On the following morning a press conference was held at the Naval Observatory to announce the Plutonian satellite. In making the announcement, Captain Joseph C. Smith, Superintendent of the Observatory, pointed out that the disco-

GRAZING OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following grazing lunar occultations in October. For further information call Dave at 585-0989.

UT Date	Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
10-11-78	02:25	Emmaville, PA	8.0	69	6S	12 cm
10-12-78	04:29	Pittsburgh, PA	5.4	80	5S	3 cm
10-19-78	02:51	Roseville, VA	7.7	90	12N	20 cm
10-27-78	08:59	Hereford, MD	8.7	19	3N	15 cm

NCA, NCP TO HOST CORNELL CLUB

The Cornell Club of Washington will be hosted jointly by National Capital Astronomers and the National Park Service at a special *Exploring the Sky* program on October 21 at 8:00 PM. The location, adjacent to the Rock Creek Nature Center, is on Glover Road just south of Military Road, NW. In case of clouds, a planetarium program will be given in the Nature Center. Members are encouraged to support the event; telescopic support is particularly solicited.

This event is not public; it is in addition to our regular public series.

WORTH CROWLEY DIES

Long-time NCA member and past trustee Worth Crowley died on September 13 after a long illness. He served as a trustee from 1971 to 1975 and contributed substantially to the reframing of the NCA Constitution.

SPACE SHUTTLE STATUS REVIEWED; "MODERATE CHANCE" FOR SKYLAB

John F. Yardley, NASA's Associate Administrator for Space Transportation Systems, showed "substantial progress" in a detailed Space Shuttle program review before the House Subcommittee on Space Science and Applications.

The review showed that the only significant problems concern the main engine and the vehicle's weight. If testing continues to go well, the engine could be certified for first manned orbital flight in September 1979. The weight problem will not affect the September schedule, but may constrain somewhat certain later missions. Alleviating approaches are under study.

Additional funding required to support the revised schedule is estimated at 8 to 9 percent of the early estimate of $5.2 billion. Lack of additional funding would delay the September 1979 flight by six to nine months, and the delivery of production orbiters by up to one year.

Asked to assess the probability of recovery of Skylab, the sophisticated orbiting observatory-laboratory with large crew quarters, unoccupied since February 8, 1974, William O'Donnell, NASA's Public Affairs Chief, told *Star Dust* NASA sees a "moderate chance." Assuming a good flight in September 1979, a second flight in February 1980 could very reasonably recover Skylab. An effort will be made to launch the recovery flight in December 1979, but O'Donnell feels that the February flight is more realistic.

Skylab's deteriorating orbit is expected to descend to 150 nm by April 1980 and terminate shortly afterward. A propulsion unit to be orbited by the Shuttle and remotely maneuvered to dock with Skylab would place Skylab into a higher orbit, where it could be used in conjunction with the Shuttle in the future.

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very was made just 101 years after the two satellites of Mars were discovered at the Naval Observatory by Asaph Hall.

The satellite of Pluto was discovered within about a block of where the two satellites of Mars were discovered; the discovery photograph of Pluto's satellite was taken at Flagstaff, AZ, within 5 miles of Lowell Observatory, where Pluto was discovered.

The announcement made television that night, and many front pages, but not of the Washington papers. It also made many specialized journals, "including your own *Star Dust*." Christy described his gratification as "very pleasant."

The rigid IAU naming convention precludes Christy's naming the satellite

Charlene for his wife. "If you don't name it what they want you to, you may not get to name it at all." It may be many months before his best effort from the Greek mythology, *Charon*, will be considered. meanwhile, the satellite will be known as 1978 P 1.

EXCERPTS FROM THE IAU CIRCULARS

1. August — M. M. Phillips, Cerro Tololo Interamerican Observatory, reported that observations with the SIT-vidicon spectrometer on the 4-m telescope show the nucleus of NGC 7213 to have an emission spectrum characteristic of a Seyfert galaxy. This is the first such nucleus seen in a class-S0 galaxy.

2. September 1 — T. Haneda, Haranomachi, Fukushima, Japan, and J. da S. Campos, Durban, South Africa, discovered a 10th-magnitude comet in Microscopium. Haneda made his discovery of comet 1978j with an 8.5-cm refractor.

3. September 10 — W. Morrison, Peterborough, Ontario, and P. L. Collins, Mount Hopkins Observatory, discovered a nova of magnitude 6.8 in Cygnus at 21h 40m 38s, +43° 48' 10". The prenova star is visible at m=20 on a Palomar Sky Survey plate. It was fainter than limiting magnitude of 12 on a PROBLICOM survey photo taken by B. Mayer on September 8.

4. September 12 — D. E. Machholz, Los Gatos, CA, discovered a comet of 11th magnitude in Canis Major with a 25-cm reflector.

This listing courtesy R. N. Bolster.

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