★ STAR DUST

Volume XXXIV June 1978 Number 10

JUNE CALENDAR — *The public is welcome.*

Friday, June 2, 9, 16, 23, 30, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Saturday, June 3, 6:15 PM — Dinner with the speaker at Bassin's Restaurant, 14th Street and Pennsylvania Avenue, NW. Reservations unnecessary.

Saturday, June 3, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW.

Monday, June 5, 12, 19, 26, 7:30 PM — Telescope-making classes at the Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Saturday, June 10, 9:00 PM — *Exploring the Sky*, presented jointly by NCA and the National Park Service. Glover Road south of Military Road, NW, near Rock Creek Nature Center. Information: Bob McCracken. 229-8321.

MAY LECTURE

Dr. Thomas C. Van Flandern, Chief of the Celestial Mechanics Branch of the Nautical Almanac Office, U. S. Naval Observatory, spoke at the May 6 meeting of National Capital Astronomers, on "The New Solar System."

Dr. Van Flandern depicted a newly emerging view of solar-system history—a history of many changes since its formation several billion years ago.

From the profusion of both ground-based and space-program discoveries during the last two decades, Van Flandern briefly cited numerous apparent anomalies in the solar system difficult to reconcile with a static history. He recounted three examples in further detail and offered possible explanations.

How did Mercury, so unlike the other planets, become so heavily cratered on one side, like the Moon? What caused its rotation in 3:2 resonance with its revolution instead of the expected 1:1? What caused Venus' dense atmosphere and hot surface, and its slight retrograde rotation? There are innumerable questions about the unique water planet, the Earth, and its Moon. The recently acquired great knowledge of Mars has generated many new questions about the planet and its satellites. Deimos and Phobos closely resemble asteroids, but how could they possibly have been captured? Do the asteroids represent matter from which a planet failed to form, or perhaps fragments of a disintegrated former planet? Jupiter poses many problems, and its satellites seem to be of two families — direct and retrograde. Could some of them have been captured? Many questions remain about Saturn's ring system and its divisions. Saturn's outer satellite, Iapetus, is black on one side, white on the other. The rotational axis of Uranus lies within about 9 degrees of the orbital plane, and its rotation is retrograde. Its newly discovered ring system, very different from that of Saturn, seems to consist of material much darker than any known, and the ring orbits seem impossibly unstable. Neptune's satellite system is quite disturbed. Pluto crosses the orbit of Neptune, has a higher excentricity than any other planet. The Oort cloud of comets is 1,000 times as far from the Sun as the farthest planet.

As a dynamicist, Van Flandern sees in the foregoing circumstances abundant evidence of change, some violent, some recent, during the five-billion-year history of the solar system. He elaborated on three examples:

Origin of the satellites of Mars — Phobos is crater-saturated with a dust regolith on top. It was nearly shattered by the impact causing its largest crater. Its 2-gram-per-centimeter density and other physical and chemical properties

classify Phobos as a carbonaceous asteroid. Deimos is also crater-saturated and has an even thicker dust layer. Their gravitational fields are too weak to hold their dust layers against meteor impacts, and no craters appear in the dust. What is the origin of these satellites and their dust layers?

Van Flandern suggested a possible answer in terms of his disintegrated-planet hypothesis. Following the event, the smallest, fastest particles would reach Mars first, after a few months. Some of these would encounter a range of atmospheric retardation leading to capture into temporary orbits. Rapid orbital decay would follow repeated atmospheric entry on successive orbits. These temporary orbits may extend far beyond the atmosphere, however, and greatly enlarge the retardation-capture cross-section through collision with the larger, later arrivals.

Capture by collision outside the atmosphere does not require entry into the atmosphere on successive orbits; permanent orbits can result. Moreover, as noted by Slabinski, solar radiation pressure would increase the pericenter distances of the very finest dust particles, thus lifting them into higher orbits, to be subsequently swept up by the larger fragments thus captured. The temporary resistance would serve to circularize the orbits and reduce their inclinations through well-known principles. This is consistent with the observations.

The enigmatic rings of Uranus — Discovered last year by stellar occultation, the ring system of Uranus has now been photoelectrically observed by occultation of three stars. Approximately ten rings are apparent. Very unlike the rings of Saturn, they are quite narrow with wide spaces between. The individual orbital inclinations or excentricities or both are such that differential precession among the constituent particles or fragments should dissipate the rings within 20 years. No such precession that would indicate an age of more than 3 years has yet been observed.

All photographic efforts to date, high-altitude and ground-based, have failed, including methane-band filtration. Absorption in Uranian methane reduces the glare of the planet to provide a 5-magnitude contrast advantage in photographing faint nearby objects in the methane band. An upper limit has been set on the albedo of the rings at 1 percent of that of the rings of Saturn — substantially darker than any known material.

Van Flandern's suggested model can account for the observations and is not without precident in the solar system: The orbit of each ring may be occupied by a single satellite which, like the satellite of Jupiter, Io, is evolving a gas trail around the orbit. Refractive defocussing could dim transiting starlight to produce an apparent occultation as observed, and could cast a shadow on the disk of the planet. A faint, apparent shadow has been photographed on the disk. The phenomenon is well known; indeed, it is the same mechanism whereby turbulent atmospheric inhomogeniety — poor seeing — plagues the astronomer, even though the atmosphere is transparent. Transparency of the rings could account for their invisibility.

Neptune's disturbed satellites — The present behavior of Neptune's satellite system suggests some major disruptive event. Triton, perhaps the most massive satellite in the solar system, is in retrograde orbit with a 20-degree inclination. Subject to tidal decay, its orbit may be terminated in another 10^8 years. Nereid, having an orbital excentricity of 0.76, twice that of any other solar-system satellite, approaches escape velocity at lower apsis.

Pluto has often been suspected of being an escaped satellite of Neptune; their orbits interlock. Pluto's mass is in the satellite range. Recently reduced

NCA OFFICERS ELECTED

The following fiscal 1979 officers were elected at the May 1978 meeting:

President	James H. Trexler
Vice President	Daniel G. Lewis
Secretary	William R. Winkler
Treasurer	Robert M. Lynn
Trustee	Richard J. Byrd
Sergeant at Arms	Walter I. Nissen

TREASURER'S ANNUAL REPORT

INCOME

Dues	2172.54
Obsv. Hdbks	123.75
Tele. Mkg. class	118.00
TOTAL	2414.29

BALANCE ON HAND

May 31, 1978	2616.85
May 31, 1977	2252.11
GAIN	$364.74

NOT INCLUDED ABOVE

Telescope donations $124.50.

EXPENSES

Sky & Tel subscr	1059.00
Star Dust production	165.40
Distribution	373.50
From prev. years	236.97
Obsv. Hdbks	126.00
Directories	63.70
Secretary's expenses	16.80
Treasurer's expenses	59.78
Speakers' dinners	71.90
DC Corp. Commission	1.00
TOTAL	$2414.29

Robert M. Lynn, Treasurer

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mass estimates indicate that Pluto's tidal escape from Neptune could not result in a sufficient perturbation to account for the present circumstances.

Van Flandern and Harrington, using computer simulation of the system dynamics, examined the possibility of perturbation by an intruding body. They soon delimited the mass, velocity, and encounter geometry, and, after ten thousand Monte Carlo experiments, determined that the present circumstances could be approximated, if: Neptune originally had four satellites similar to the Galilean satellites of Jupiter, before a low-velocity close approach by a body of a few earth masses, probably a planet formerly in an orbit just outside but crossing that of Neptune. The perturbation resulted in one satellite orbit's inversion into a retrograde high inclination, similar to the orbit of Triton. another was almost ejected, its new orbit resembling that of Nereid. A third was ejected into an outside orbit very much like that of Pluto. The fourth satellite could be made to escape to an inside orbit crossing that of Uranus. (Chiron?) The intruding planet was almost ejected from the solar system, and may now be in a very highly eliptical, comet-like orbit, far from the Sun, where it has thus far escaped discovery.

Whether or not these possibilities describe the real history, they serve to illustrate the kinds of individually unique events, many of which may have altered the solar system substantially since its formation. Since it is at present not possible to integrate back through these events to determine the previous conditions, we may only be observing the results of the latest overlay of changes in a continuing series that has made the solar system very different from that which was formed about 4.5 billion years ago. rm, ww

EXCERPTS FROM THE IAU CIRCULARS

1. April 10 — Persson, Hale Observatories, and Nicholson, Matthews, Goldreich, and Neugebauer, California Institute of Technology, observed an occultation by the Uranian ring system using the 250-cm reflector at Las Campanas Observatory. All five previously detected rings were seen *(sic)*, and three or possibly four new ones were found. All of these lie within the outermost previously known ring, the epsilon ring.

2. April 21 — Astronomers at the University of Wyoming and Warner and Swasey Observatory determined that "Nova Sagittarii 1978" was instead the long-period variable V3876 Sag, also known as infrared object IRC -20494.

3. April 27 — Rolf Meier, Ottawa, Canada, discovered a 10th-magnitude comet in Lynx with a 40-cm reflector. Marsden's parabolic elements for Comet Meier (1978f) indicate that it will reach perihelion in November, when it will reach naked-eye brightness, but the elongation from the Sun will be small.

FOR SALE

Six-inch Newtonian telescope: Criterion RV-6 Dynascope with 7- and 18-mm oculars, 2- to 3-X Barlow, Edmund camera mount, sunscreen, 35-mm SLR adaptor. Edwin Kennedy, 4806 Harvard Road, College Park, MD 20740. Phone: (301) 277-9259.

WANTED

Erfle eyepiece, Edmund No. 5160, 1.25-in focal length, 1.71-in aperture. Will pay $50.00. James H. Trexler, 5609 Ottawa Street, Oxon Hill, MD 20021.

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