☆ STAR DUST

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NATIONAL CAPITAL ASTRONOMERS

JANUARY CALENDAR — *The public is welcome.*

Friday, January 6, 13, 20, 27, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Saturday, January 7, 6:15 PM — Dinner with the speaker at Bassin's Restaurant, 14th Street and Pennsylvania Avenue, NW. Reservations unnecessary.

Saturday, January 7, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. Dr. Peter Boyce speaks.

Monday, January 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.

DECEMBER LECTURE

Dr. Werner Neupert, Head of the Solar Plasma Branch of the NASA GSFC Laboratory for Astronomy and Solar Physics, spoke to National Capital Astronomers at the December third meeting. His topic was our current knowledge of the physics of solar flares with emphasis on analysis of results from Orbiting Solar Observatory 7.

Solar flare study began on September 1, 1859 with the observation of a white-light flare by Carrington and Hodgeson in England. Although large geomagnetic storms followed, the association between flares and disturbances of the Earth's magnetic field was not widely recognized until this century.

A global network of flare patrol cameras has revealed the morphology of a typical event. In the light of the Balmer alpha spectral line of hydrogen, two parallel bright ribbons of light develop and fade away over a period of about 90 minutes. The flare is a three-dimensional structure extending into the corona. Invisible emissions from flares were discovered in the 1930's as a result of radio fadeouts of the ionosphere D-layer. Today rockets and satellites measure extreme ultraviolet (EUV) and X-ray emissions from flares while ground-based instruments measure emissions over much of the radio spectrum.

Different parts of the flare radiation spectrum have different time scales. X-rays have a slower rise time than H_α, peak later, but decrease at the same rate as $H\alpha$. EUV radiation reaches a short primary peak early in the flare, followed later by a secondary peak. These time differences indicate that several different processes are occurring simultaneously.

Emissions from flares come from several altitudes. While an H_α flare brightens near the photosphere, a loop of 304Å He II may erupt in the corona. The H_α region of the flare has a temperature of about 10,000 K; the X-ray source is at about 20 million K. The bright H_α ribbons are often connected by coronal X-ray arches extending from one magnetic footpoint to another.

The source of solar flare energy (about 10^{31} ergs) has not been positively identified. Conventional longitudinal magnetographs show little advance indication of the eruption of a flare. Possibly the rapid triggering necessary results from breakdown of a large solar current in a small area producing a high-voltage discharge. It is not clear how these currents move, how charge neutrality is maintained, or what causes the initial discharge.

It is obvious that sunspot magnetic fields play a role, being as strong as 2,000 Gauss and not representative of the potential field. Sweet (1958) proposed that between two oppositely polarized sunspots in a group there exists a neutral current sheet separating magnetic streamers extending into the corona. In one case a streamer is directed outward from the Sun while a nearby one is directed inward. Where these streamers run sufficiently close together they will annihilate each other, releasing energy for particle acceleration. The particles will either travel away from the Sun along open magnetic field lines or be trapped near the Sun in closed fields, releasing their energy at low altitudes. Most theories along these arguments are weak in that they do not allow for quick enough merging of field lines for the energy to be released over an observed period of about one minute.

Priest and Haber offer the promising hypothesis that emerging magnetic flux rising to the surface of the Sun establishes a bipolar field leading to instabilities that release energy from the ambient magnetic field. From laboratory magnetohydrodynamics, it is hard to see how sufficiently large and long-enduring instabilities can be started in view of the strong turbulent dissipation. It is thought that after initial magnetic acceleration of charged particles, turbulence itself accelerates them. Development of better magnetographs capable of taking transverse magnetograms is needed to pursue these studies.

The 1979 NASA Solar Maximum space missions may lead, in the ensuing

KOWALL CALLS OBJECT 1977 UB CHIRON. ORBIT UNSTABLE

Dr. Charles Kowal, discoverer of planetoidal object 1977 UB, has suggested the name, Chiron (kī'rŏn), for the object, after the centaur of Greek mythology. If Chiron is the first of a new band of asteroids to be discovered, the many mythological centaurs will provide names for the class.

Traditionally, the discoverer of such an object has the privilege of naming it; it is expected that the International Astronomical Union will officially adopt the name.

At the U.S. Naval Observatory, Dr. Thomas Van Flandern and Dr. Robert Harrington are examining the orbit in an effort to determine whether the object might be either an escaped satellite of a major planet (Saturn, Jupiter, Uranus, and Neptune all are candidates, according to Van Flandern), or an asteroid which has been re-orbited by a close encounter with a major planet (probably Jupiter) (*Star Dust*, December 1977).

The orbit is quite unstable; dynamically tracing its history, they find the present 5-3 synchronization with Saturn to be a short-term relationship, soon to be destroyed by precession. They have found moderately close encounters with Saturn, with the resulting perturbations, to occur about every ten orbits. Calculations by Bryan Marsden, SAO, Cambridge, have shown two approaches to within about 1 AU of Saturn in the last 1,000 years.

Van Flandern and Harrington have found the orbit to have been so drastically altered not more than 3,000-5,000 years ago that it is impossible to trace its history further.

NASA DECISION: PIONEER 11 TO FLY OUTSIDE SATURN'S RINGS

When Pioneer 11 reaches Saturn in 1979, it will fly approximately the trajectory planned for the two Voyagers now on the way to Saturn (via Jupiter) in 1980 and 81. The craft will pass the ring plane at 30,000 km from the outer ring and subsequently approach to 25,000 km from the planet.

The decision was made recently by Dr. Noel W. Hinners, NASA Associate Administrator for Space Science, and A. Thomas Young, Director of Planetary Programs, and will exercise one of the options mentioned in *Star Dust*, December 1974, where the remarkable mission is described. Pioneer 11 will thus serve as a pathfinder for the Voyagers, the second of which may use the trajectory for a boost encounter to forward it to a rendezvous with Uranus in 1986. Pioneer itself was thus boosted to Saturn by such an encounter with Jupiter.

Also bearing upon the decision was the dubious safety of flight within the rings, one of the options. "It is essential for us to do everything we reasonably can to ensure Voyager's success," according to Young.

A recent eclipse of a Saturnian satellite, Iapetus, by the shadow of the rings indicated that the dark portions are apparently filled with invisible material, not empty (*Star Dust*, December 1977, page 15). Attempted flight through such a region would very likely prove disasterous.

Late Thursday, December 15, Voyager 1 overtook and passed Voyager 2, which was launched first on a slower trajectory. The craft were 124.7 million km from Earth and 17 million km apart. Voyager 1 will have a four-month lead when it arrives at Jupiter in 1979, nine-months lead at Saturn in 1980.

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5 years, to a much better understanding of flares — and of the related problem of control of nuclear fusion.

Among the outstanding problems in flare theory, Dr. Neupert said, are why a flare loop holds its physical shape so well in spite of the strong spectral turbulence and Doppler radial velocities they reveal; why the high-energy solar proton events peak several years after sunspot maximum in the solar cycle; and whether all flares can be explained by the same processes. ww

EXCERPTS FROM THE IAU CIRCULARS

1. The asteroidal object 1977 UB discovered by Kowal has been found on plates taken in 1976, 1969, 1952, 1943, 1941, and 1895. The 1895 image was taken with the 61-cm Bruce astrograph at Cambridge, Massachusetts, the 1941 and 1943 images with the same instrument at Bloemfontein. A precise orbit has been determined, showing a period of 50.68 years, eccentricity of 0.3786, semimajor axis of 13.6952 AU, and inclination of 6°92.

2. November 15 — Shao, Harvard College Observatory, discovered an 18th-magnitude supernova in an anonymous galaxy on a plate taken of 1977 UB with the 155-cm reflector. The object is shown at 16th magnitude on Kowal's discovery plate.

3. December — K. Fox and D. E. Jennings, Goddard Space Flight Center, reported the first detection of interstellar methane in observations of Ori A with the NRAO antenna at Kitt Peak.

4. May 29, 1978 — Wasserman and Franz redetermined the position of the star SAO 85009, and predict that its occultation by (2) Pallas will be visible from Maine, Ontario, and westward along the U.S.-Canadian border.

This listing courtesy R. N. Bolster.

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