



## BRANDT TO DESCRIBE CRAB - SUPERNOVA PETROGLYPHS



DR. BRANDT

Approximately one dozen pictographs and petroglyphs in the southwestern United States and Mexico can be interpreted as records of the 1054 A. D. supernova which produced the Crab Nebula.

At the December 6 meeting of NCA, Dr. John C. Brandt, Chief of NASA's Solar Physics and Astrophysics Laboratory, Goddard Space Flight Center, will discuss his investigations of these interesting carvings. Their identification as records of the event is based upon the close conjunction of the crescent moon and the supernova on the morning of July 5, 1054 A. D., in western North America. The date approximates that of maximum brightness as given by the Chinese dynastic records.

The common elements of these rock-art records are two: the representation of a bright object and a crescent. Although the drawings themselves cannot at present be dated, most of the local areas are known to have been inhabited in the mid-eleventh century A. D.

John C. Brandt was born in St. Louis, Missouri, where he received his A. B. degree from Washington University in 1956. In 1960 he received the Ph. D. from the University of Chicago. Prior to becoming Chief of the Solar Physics Branch at Goddard in 1967, Dr. Brandt was a senior research scientist of the Institute for Space Studies, and astronomer at Kitt Peak National Observatory. He has taught physics and astronomy at the University of Chicago, New York University, and Columbia University. Honors he has received include the National Science Foundation Postdoctoral Fellowship at Mt. Wilson and Palomar Observatories, and the NASA-Goddard Exceptional Performance Award.

Dr. Brandt has published numerous papers and well-known books, and is Associate Editor of the *Astrophysical Journal Letters*. He is a member of the International Astronomical Union, the American Astronomical Society, and Fellow of the American Association for the Advancement of Science.

### DECEMBER CALENDAR - *The public is welcome.*

- Monday, December 1, 7:30 PM — Telescope-making class at the Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Note: no other Monday class in December. Information: Jerry Schnall, 362-8872.
- Friday, December 5, 7:30 PM — Telescope-making class at American University, McKinley Hall basement. Note: no other Friday class in December.
- Saturday, December 6, 6:15 PM — Dinner with the speaker at O'Donnell's Sea Grill, 1221 E Street, NW. Reservations not necessary.
- Saturday, December 6, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. Dr. John Brandt speaks.
- Saturday, December 20, 8:00 PM — Meeting of those interested in observing lunar occultations. Department of Commerce, 14th and E Streets, NW. Information: Walter Nissen, 528-6671.

## NOVEMBER LECTURE

Dr. G. E. Brueckner, head of the Solar Spectroscopy Section of the U. S. Naval Research Laboratory, addressed the November 1 meeting of NCA on the reconnection of magnetic field lines in the solar corona. Interpretations are emerging from his experiments aboard Skylab.

There is some observational evidence that the mechanism is the source of solar flare energy. Brueckner suggests that such reconnections may also account for the energy emitted by explosive galaxies, and possibly for the recently discovered gamma-ray bursts, which may originate in stellar flares.

If in the vicinity of a magnetic dipole on the surface of the Sun the gas pressure within the field is small compared to the magnetic pressure, and if there is no electric current flow along the flux lines, then a force-free, or potential field exists; all of the ionized material within the field lines is captured by the field. In the distant regions the gas pressure may exceed the field pressure and force the field lines out to an apparently open configuration. The approximately radial field lines may then reconnect, leaving a field loop which violently accelerates ionized material to high velocities. This process may power many high-energy astrophysical phenomena in the Sun, the magnetopause of the Earth, stars, perhaps even galaxies.

Electric current flow along the field lines of a magnetic dipole will generate a radial magnetic component; the resulting vector will twist the field into flux tubes, leading to the possibility of reconnections and consequent ejection of the plasma mass within the tubes. This model implies that electric currents are dominant in such a system.

A region of the same magnetic polarity which does not apparently link an opposite pole is called open, although the linkage is simply lost to observation. If in the vicinity of such a region a small magnetic dipole emerges, such as is associated with sunspots or plages, it will, during its growth, form interconnections with the general field that will accelerate particles.

Brueckner's Skylab experiments tend to provide observational validation of his models. He points out that the fields and currents are, of course, not measured directly, but are inferred from other measurements.

Because the ultraviolet spectrum of the Sun consists entirely of emission lines, spectroheliograms in lines of the high-temperature coronal components show no disc background. UV and XUV observations from Skylab, unobtainable from the Earth, thus trace the coronal structure in temperatures corresponding to many ionization levels of the elements. Various plasma configurations are evident in Brueckner's spectroheliograms, from those in  $20,000^\circ\text{K}$  He II to Fe XXIV (only two electrons left!) at  $2 \times 10^7^\circ\text{K}$ . An emergent bipolar region is observed to interconnect with the residual flux of a previous system. The connection was retained as the new region grew and diffused. A twisted field configuration of lines or flux tubes was observed to develop over a period of hours, emitted X-rays in an apparent transition to a lower energy state, indicating acceleration of electrons, after which the field appeared untwisted. In other observations, twisted loops in eruptive prominences were unwound, as the confined material within them was accelerated into interplanetary space. The unwinding process was not entirely clear, but apparently involved some disconnections and reconnections. Spectroheliograms were not made continuously, so many interesting parts of these processes escaped observation. When the field kinks in an eruptive prominence unwind, extreme force is exerted on the magnetic foot points on the surface, resulting in disconnection from the surface and reconnection elsewhere, the inhibiting effect of high coronal conductivity

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## OCCULTATION OBSERVATION TO BE DISCUSSED

Members (and guests) interested in observing lunar occultations will meet with Walter Nissen at the Department of Commerce on Saturday, December 20, at 8:00 PM. Observing and timing techniques and an observation program will be discussed. For further information call Walter Nissen at 528-6671.

Some December occultations:

Date	Time (ES)	Star (ZC Nr)	Magnitude	Disappearance (D) Reappearance (R)
7	7:34P	3093	4.5	D
9	5:54P	3326	6.4	D
9	10:39P	3340	7.5	D
10	7:45P	3455	6.4	D
20	11:44P	1234	6.1	R
22	00:38A	1359	5.1	R
23	3:49A	1482	6.3	R
29	5:32A	2241	5.1	R

## WELCOME TO NCA

Stephen C. Buczinski  
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Alexandria, Virginia 22301

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## OBSERVERS ORGANIZED

Three observing groups of NCA met with Daniel Costanzo on October 18 to organize observing programs. Participants agreed to continue the monitoring of Nova Cyg 1975 (V-1500 Cyg), and to study Jupiter jointly with the Richmond and Norfolk groups.

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notwithstanding. Large surges were observed in prominences as fields were straightened, with mass ejected at velocities of several hundred km per second.

No clear correlation has been seen between large-scale coronal structure and a single flare; flares always seem to manifest themselves in small structures near the surface. They last only about five minutes and have risetimes of about 30 seconds. If reconnections provide the energy source, only the small, local structures could be involved in the short time scale.

While the present interpretations are mainly qualitative, they seem to indicate that reconnection of magnetic field lines is the dominant physical process governing most of the dynamic structures in the solar corona and the transient events associated with them.

Most of this structure was unknown before the Skylab mission.

Magnetic reconnections have been proposed as the source of solar flare energy in previous theories, mostly discarded; diffusion time constants are too long. The new observations seem to explain and resurrect the general idea.

Dr. Brueckner estimates that another five to seven years will probably be required for complete quantitative reduction. In response to questioning, he said that funding from NASA seems adequate to support the present level of NRL effort, but that even with the enormous data backlog, more observations would help; photographs and spectroheliograms are needed every 30 seconds for a period of a week or so to fill in details. The Space Shuttle may make it possible.

EXCERPTS FROM THE IAU CIRCULARS

1. October 27 — A. Epstein, Harvard and Smithsonian Observatories, reported that the SAS-3 group observed X-ray emission from the position of Beta Perseii (Algol).

2. October 27 — T. Gehrels, Lunar and Planetary Laboratory, University of Arizona, discovered an 18th-magnitude comet (19750) in Aries on photographs taken with the 122-cm Palomar Schmidt telescope.

3. November — R. M. West, European Southern Observatory, Geneva, discovered a comet on photographs taken in August and September by O. and G. Pizarro with the 100-cm Schmidt telescope at La Silla. Now in Microscopium, Comet West (1975n) is predicted to be of 12th magnitude. It may become visible at magnitude 5 in the morning sky in mid-march.

4. November 1 — Kaluziensi, Holt, Boldt, and Serlemitsos, Goddard Space Flight Center, detected an X-ray flare in Norma with the Ariel 5 all-sky monitor.

5. November 11 — W. A. Bradfield, Dernancourt, Australia, discovered a 10th-magnitude comet (1975p) in Centaurus.

UPDATE, item 3, November 28 — Comet 1975n may reach magnitude 0.5 on February 22, 1976, two days before perihelion, and m 1.6 near perigee on March 3. (Marsden, SAO)

This listing courtesy R. N. Bolster.

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