



COWAN PROBES INTERSTELLAR IONIZATION, HEATING



JOHN J. COWAN

In studying the ionization and heating of the interstellar medium, it is important to understand the galactic distribution of both the gas and its sources of excitation.

At the October 4 meeting of the National Capital Astronomers, John J. Cowan, researcher at the University of Maryland, will discuss some of his recent results that indicate that galactic γ -rays appear to come from cosmic rays that probably are emitted by supernovae located in the spiral arms of the galaxy. These results provide evidence of a substantial density contrast between the gas in the spiral arms and that in the interarm regions. This density contrast indicates that the central stars of planetary nebulae are the most likely sources of excitation of the interarm regions; and that classical OB stars (which are located in the spiral arms) are

very important in ionizing the gas in the spiral arms.

A native Washingtonian, John J. Cowan received his B. A. in physics from George Washington University in 1970 and his M. S. in physics from Case Institute of Technology in 1971. He is a candidate for the Doctorate at the University of Maryland, where he has taught astronomy. He has spent the past three summers as a research associate at Goddard Space Flight Center.

OCTOBER CALENDAR

- Friday, October 3, 10, 17, 24, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.
- Saturday, October 4, 6:15 PM — Dinner with the speaker at Bassin's Restaurant, 14th Street and Pennsylvania Avenue, NW. Reservations unnecessary.
- Saturday, October 4, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. John J. Cowan speaks.
- Monday, October 6, 13, 20, 27, 7:30 PM — Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Streets, NW. Information: Jerry Schnall, 362-8872.
- Friday, October 10, 8:30 PM — Observing with the NCA 5-inch Clark refractor at the U. S. Naval Observatory. See article on page 7.
- Saturday, October 11, 3:00 PM — Annual NCA picnic and star party, hosted by Dick and Nancy Byrd. See article on page 7.
- Saturday, October 18, 2:00 PM — Meeting of all interested in observing in any of several categories. Costanzo will host. See article on page 7.
- Saturday, October 25, 7:00 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. Planetarium program if cloudy. Information: Bob McCracken, 362-8872.

SEPTEMBER LECTURE

Addressing the September 6 meeting of the National Capital Astronomers, Dr. J. David Bohlin, solar astrophysicist of the U. S. Naval Research Laboratory, reviewed the current status of interpretation of the spectacular extreme-ultraviolet solar complex discovered by Skylab.

While the details could not, of course, be anticipated, the observational preparations were made with great expectations in the design of the Apollo Telescope Mount, a cluster of solar instruments originally intended for the Apollo program. Included were soft-X-ray telescopes, UV and extreme-UV spectroheliographs, UV spectrograph, white-light coronagraph, and two H_{α} telescopes. Of these, two UV and XUV instruments operated by the NRL group headed by Dr. Richard Tousey provided the observations primarily discussed by Dr. Bohlin.

The solar spectrum from 170 to 630 is comprised entirely of emission lines, offering the spectroheliographs monochromatic images of the Sun in several dozen wavelengths. Images in the He II ($\lambda=304\text{\AA}$) line show the polar caps as regions of suppressed radiation. Bohlin observed and reported this effect shown by He II spectroheliograms made on rocket flights in 1970, when he termed the regions "coronal voids." Shown spectacularly in the 3-54 \AA X-ray spectrum, the effect also occurs in other parts of the corona, now known as coronal holes. Invariably associated with regions of single magnetic polarity, these voids apparently result from the inability of the open monopole lines to hold captive the coronal gasses. Hence, there is no corona over the poles. Without exception, coronal holes do not cross magnetic neutral lines; a 10-15° buffer zone always exists.

With the aid of a summer student, Dr. Bohlin has plotted the He II indications of all the coronal holes photographed in X-ray by the Skylab mission, and has found excellent correlation. Occasionally the boundary of the hole is amazingly stable. The center remains stationary over the surface of the Sun and rotates at the Carrington rate, 13.2 day⁻¹, surprisingly regardless of latitude; the surface of the Sun rotates differentially.

Coronal holes have lifetimes of as many as five or six rotations of the Sun.

Associated with the coronal hole phenomenon, macrospicules, not seen in visible light, were discovered in the He II line. Similar to the well-known H_{α} microspicules seen at 6562.8 \AA , but of sizes and dynamics many times larger, these He II macrospicules radiate only in the XUV, and show no positional correlation with the H_{α} microspicules. While both are jets of solar material ejected from the chromosphere, the phenomena seem unrelated. The typical H_{α} microspicule may be 10 seconds in length and 1 or 2 seconds in diameter, and may last 5 minutes. He II macrospicules typically are an arc minute in length, show radial velocities of as great as 150 km sec⁻¹, and evolve over a 10 to 20 minute lifetime. Velocities may vary erratically with time. Velocity distributions indicate the possibility of matter being ejected by some energy input such as a shock wave, followed by a free-fall return. Some rise, fall, and rise again, indicating multiple energy impulses. Unlike the microspicules, the macrospicules only occur within the boundaries of coronal holes, but the relationship is not yet fully understood.

Polar plumes were observed in visible light in 1902, when they were suspected to be related to the solar magnetic field. Their appearance in the XUV spectrum is the same in size, structure, temperature, and density as in white light. Densitometer tracings of long exposures at 260-470 , however, revealed lines of Al VIII and IX, and Na XIII in the plumes, all new identifications, yielding new temperature information: polar plumes are nearly isothermal at 700,000 to 800,000 degrees. Their structure agrees with Newkirk's monopole field model. The evolutionary scale of polar plumes is typically a few days.

The relationship of these newly-discovered phenomena to the solar wind,

ANNUAL NCA PICNIC TO BE HOSTED BY BYRDS

Dick and Nancy Byrd will host the NCA at their lake and cabin in Virginia on Saturday, October 11 from 3:00 PM. Bring food for cooking (Dick has grills) and whatever equipment will help you enjoy the black sky afterward. A-c power for telescope drives is not available. To reach Byrdland:

From Virginia, go south on I-95 34 miles from Beltway to U. S. 17; south on 17 across U. S. 1 at light onto Route 664; right at light onto 218; left at light onto U. S. 3; about 19 miles farther, just after the town of King George, left onto Route 205. Cross U. S. 301 at light, *continue 4.1 miles and turn right onto Route 620 immediately after Ninde Post Office. At 0.85 miles turn left onto unmarked private dirt road. Proceed about 700 feet to fork, bear right through chainposts. About 1200 feet farther is an overgrown gravel parking area on left. A drivable grass road leads from here to the cabin.

From Southern Maryland, go south on U. S. 301 about 10 miles south of the Potomac River bridge to the intersection with Route 205. Turn left onto 205 and continue 4.1 miles as from * above.

Examine your map for the preferred route from your location. For further information, call Dick or Nancy Byrd at 280-2577 before 11:00 AM of the 11th.

NEW DINNER ARRANGEMENTS FOR SPEAKER

Watch for an announcement of new arrangements for dinner with the speaker beginning next month. November *Star Dust* will carry details.

OBSERVERS TO MEET

Observers or others interested in the observational aspects of any of several categories (variable stars, lunar, planetary, or meteors, etc.) are invited to attend a general organizational meeting of those sections of NCA. The meeting will be held by Daniel Costanzo at his home, 900 North Jacksonville Street, Arlington, Virginia, on Saturday, October 18, at 2:00 PM. For further information, call Dan at 841-0051

OBSERVATIONS WITH CLARK REFRACTOR SCHEDULED

On October 10, beginning at 8:30 PM, an informal observing session for NCA members will be conducted by Larry White with the NCA's 5-inch refractor at the U. S. Naval Observatory. Your NCA pass will admit you to the grounds; go *directly* from the gate to the guard desk in the lobby. Any NCA member who wishes to use this NCA-owned instrument at any time, day or night, needs only a qualifying familiarization in order to be added to the admission list. This occasion will provide an excellent opportunity for your check-out. For information call Larry at 978-9681.

LAST MONTH

A group of members met with Bill Winkler on September 14 at the 5-inch Clark refractor for solar observations with the Clark, with Wolfgang Schubert's H_{α} -solar-prominence telescope (*Star Dust*, April and June 1973), and other instruments.

President Benson Simon and wife, Mary Ellen, hosted members at their home on September 27 for discussions of telescopes and optics with Benson and extraterrestrial life with Mary Ellen.

The annual Middle East Regional Award of the Astronomical League was presented to Bob McCracken at the September meeting. The award was made in absentia at the Pittsburgh convention in June; Regional Chairman Bob Young came to Washington to make the presentation.

hence, to our atmosphere and biosphere, discussed briefly by Dr. Bohlin, is a profound incentive to seek a better understanding of the star upon which we are so utterly dependent.

EXCERPTS FROM THE IAU CIRCULARS

1. August 13 – M. Cortes, Agrupacion Astronomica, Sabadell, Spain, discovered a third disturbance in the South Equatorial Belt of Jupiter at longitude 120 , the first time that three such disturbances have been under observation simultaneously.

2. August 10-21 – T. Matilsky, MIT, reported that the transient X-ray source A0621-00 on the Monoceros-Orion boundary had increased in brightness to four times that of Scorpius X-1 in the soft-X-ray spectral range. Boley and Wolfson, Dartmouth College, reported that a 12th-magnitude optical object 1' from the position of the X-ray source was 5 magnitudes brighter than on the Palomar *Sky Atlas*. Spectra obtained with the 400-cm Mayall telescope at Kitt Peak showed no features except interstellar absorption lines. Detection of radio emission was reported by several observers. Lola J. Eachus, Center for Astrophysics, discovered on Harvard plates that the object also had a nova-like eruption in 1917, reaching 12th magnitude.

3. August 29 – M. Honda, Kurashiki, Japan, reported the appearance of a naked-eye nova in Cygnus. Hundreds of independent discoveries followed. Spectra from numerous sources first showed only shallow, broad H absorption lines. Hydrogen emission lines then appeared, followed by Fe II, OI, and CaII. Absorption lines showed blue shifts indicating approach velocities of 1,000 to 2,500 km per second.

This listing courtesy R. N. Bolster.

FOR SALE

Eight-inch homemade Newtonian telescope on rugged equatorial mount. No drive. \$300.00. Carley Hammerle, 573-6627.

FIRST CLASS MAIL

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