★ STAR DUST

Volume XXXVI March 1980 Number 7

# SHAPIRO TO DESCRIBE EMERGING NEUTRINO TECNIQUES

DR. SHAPIRO

Dr. Maurice M. Shapiro, Laboratory for Cosmic-Ray Physics, Naval Research Laboratory, will bring to the March 1 meeting of National Capital Astronomers an update on the search for cosmic neutrinos.

For cosmic regions where high-energy processes are dominant there are prospects that decisive new information will be provided by the nascent field of high-energy neutrino astronomy.

Neutrinos are probably at least as abundant as nucleons in nature. Yet, no cosmic neutrinos from beyond the solar system have indubitably been detected. DUMAND (Deep Underwater Muon and Neutrino Detector) is both a proposed undersea astronomical observatory and a consortium of interested scientists, engineers, and several universities. The principal aim is to detect high-energy neutrinos and muons by means of the light and sound generated by their interaction.

Maurice M. Shapiro is a member of the steering committee of the DUMAND consortium. He has been Chief Scientist of the Laboratory for Cosmic-Ray Physics since 1949, and for 12 years was simultaneously Superintendent of the Nucleonics Division. His principal research has been in cosmic radiation. He is a former chairman of the Division of Cosmic Physics of the American Physical Society, and a former president of the Philosophical Society of Washington. He was Principal Investigator for cosmic-ray experiments in the *Gemini* and *Skylab* programs. In 1965, NRL established a Chair for Cosmic-Ray Physics for Dr. Shapiro in recognition of his achievements. In 1967 the Secretary of the Navy presented him the Distinguished Civilian Service Award. In 1978 he was awarded a medal of honor by the *Société d'Encouragement au Progrès* in Paris. His many other contributions during an impressive career have been recognized throughout the world. He is listed in *Who's Who in America*, *Who's Who in the World*, and *World Who's Who in Science*. He is a Fellow of the American Physical Society and the American Association for the Advancement of Science, and a member of the International Astronomical Union. He received his Ph.D. in physics from the University of Chicago.

MARCH CALENDAR — *The public is welcome.*

Saturday, March 1, 6:15 PM — Dinner with the speaker at the Thai Room II, 527 13th Street, NW. Reservations unnecessary.

Saturday, March 1, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E streets, NW. Dr. Shapiro will speak.

Monday, March 3, 10, 17, 24, 31, 7:30 PM — Telescope-making classes at the Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Friday, March 7, 14, 21, 28, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Friday, March 7, 14, 21, 28, 8:00 PM — Observing with the NCA 14-inch telescope with Bob Bolster, 6007 Ridgeview Drive, south of Alexandria off Franconia Road between Telegraph Road and Rose Hill Drive. 960-9126.

## FEBRUARY LECTURE

Dr. Jacob I. Trombka of NASA's Goddard Space Flight Center spoke at the February 2 meeting of National Capital Astronomers, on current X-ray and gamma-ray remote-sensing techniques, particularly as applied in the Apollo lunar program.

Dr. Trombka began by highlighting some of the fundamental questions that can be explored through X-ray and gamma-ray remote sensing. These techniques permit determination of a planet's global surface composition, from which information on the object's origin and thermohistory may be deduced. For example, it can be determined whether there has been melting and consequent differentiation of the body, indicated by a concentration of lighter elements such as aluminum in the crust, with denser materials such as iron and magnesium (in dense molecules – *Ed.*) being more prevalent in deeper regions.

The Apollo remote X-ray sensors were detectors of secondary X-ray fluorescense arising from solar irradiation of aluminum, silicon, and magnesium. Three proportional counters with selective filters discriminated among the spectra of these three elements.

Gamma radiation was detected by sodium iodide-photomultiplier scintillation counters. Because cosmic-ray protons also fluoresce sodium iodide, active shielding was used to discriminate against the cosmic-ray background. Both the sodium iodide and the shield material fluoresce on proton impingement, but only the sodium iodide fluoresces on gamma. Coincident response of separate scintillation detectors then indicates cosmic-ray protons; the background is thus subtracted.

Radioactive potassium, thorium, and uranium were detected directly by the spectral signature of their natural gamma radiation.

Many other elements interact with cosmic-ray protons in a process series culminating in gamma radiation spectra characteristic of the elements. Mapped in this way were oxygen, sodium, magnesium, aluminum, silicon, potassium, iron, titanium — all of the major rock-forming elements, and some minor ones including trace elements such as the rare earths.

Both X-ray and gamma-ray techniques are useful in near-vacuum conditions such as on the Moon and Mercury, but atmospheric absorption precludes the use of X-rays on planets which have atmospheres.

Radioactive potassium, thorium, and uranium are important indicators in examining differentiation. Since potassium is volatile and thorium and uranium are refractory, the depletion ratio of potassium with respect to thorium and uranium is a function of the temperature reached and maintained in the differentiation process.

Because the distribution of silicon is almost constant over the lunar surface, the distributions of aluminum and magnesium can be derived in terms of the abundance ratios of these elements to silicon. Thus normalized to silicon, the aluminum-to-magnesium ratio was found to be largest in high-altitude terrain, as expected in a differentiated body. A significant finding was the striking agreement between the abundance-ratio distribution and the independently mapped radar-altimeter topography. Indeed the data, derived primarily from the X-ray experiments, are suffieiently detailed to support fairly high resolution (5-to 10-km) mapping of various topographic features, soley on the basis of compositional variations. As an illustration, Dr. Trombka showed a map of the crater Picard in the Mare Crisium basin. The crater is clearly delineated by the differing composition of its floor with respect to the surrounding mare. it is even possible to trace relatively delicate features such as the debris fans surrounding impact craters.

The Apollo gamma-ray data also have yielded important information on the

## OCCULTATION EXPEDITIONS PLANNED

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

| Date | UT Time | Place | Vis Mag | Pcnt Sunlit | Cusp Angle | Min Aper |
|---|---|---|---|---|---|---|
| 03-04-80 | 05:47 | Greenville, SC | 2.9 | 95 | 13S | 5 cm |
| 03-05-80 | 04:18 | Providence, RI | 5.8 | 90 | 9S | 10 cm |
| 03-10-80 | 08:25 | Largo, MD | 8.5 | 46 | 10S | 20 cm |
| 03-21-80 | 17:08 | Richmond, VA | 1.1 | 32 | 10S | 5 cm |
| 03-23-80 | 00:35 | Thornburg, VA | 6.9 | 45 | 1N | 5 cm |

## NCA WELCOMES NEW MEMBERS

Craig Jones and Family
1818 Metzerott Road, #34
Adelphi, MD 20783

Ronald E. Jones and Family
5731 Harriett Court, #132
Alexandria, VA 22311

Robert T. McIntyre, Jr.
1006 Polly Street, SE
Vienna, VA 22180

## SCIENCE FAIR TIME AGAIN

The annual area science fairs will be held in Washington and the contiguous counties, beginning with the Northern Virginia Science and Engineering Fair on Saturday and Sunday, March 22 and 23.

Since 1958 National C pital Astronomers has awarded junior memberships (including *Sky and Telescope*) for outstanding astronomy-related projects in these events. For these awards, NCA provides independent judges who are to be guided by criteria which may differ from those of the county judges. Here is an opportunity to offer encouragement, perhaps substantial, to tomorrow's scientists. Contact John Lohman, 820-4194 if you would like to participate in this program.

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Moon's formative history. Three particularly radioactive spots were observed along the edges of Oceanus Procellarum supporting the hypothesis that it may have been the site of a major impact event. The concentrations of radioactive elements may indicate upwelling of molten material heated by the impact.

The gamma-ray data also show the Moon to be strongly depleted of volatile materials, at least in the equatorial regions studied by the Apollo missions.

The returning Apollo 16 spacecraft made a chance observation of a gamma-ray burst — a poorly understood phenomenon. About 12 such bursts are observed each year, apparently distributed isotropically. Their energy profile resembles that of a solar flare, but is more energetic by a factor of about $10^{10}$, assuming galactic sources. They may result from flares in very intense magnetic fields such as may occur on white dwarf stars.

Dr. Trombka expressed his opinion that the high cost of future space exploration may best be met through international cooperative ventures. X-ray and gamma-ray remote-sensing missions to the Moon's polar regions, to Mercury, and to comets and asteroids are possibilities being contemplated. jkc, rhm

## EXCERPTS FROM THE IAU CIRCULARS

1. 1979 August 26 — Ubertini, Bazzano, La Padula, and Polcaro, Laboratorio di Astrofisica Spaziale, Frascati; and Manchanda, Tata Institute of Fundamental Research, Bombay, discovered a line emission feature between 64 and 76 keV in the spectrum of the Crab Nebula. The detection was made with a balloon-borne Xe-multiwire proportional counter.

2. December 11 — Analysis of the observations of the occultation of SAO 115946 by (3) Juno has indicated that the observation at Central Michigan University was spurious. Observations were made from 11 sites by astronomers from Lowell Observatory, Massachusetts Institute of Technology, Jet Propulsion Laboratory, the University of Maryland, California Institute of Technology, the University of Southern California, and the University of Hawaii. The size of the best-fitting elliptical profile is 291 x 243 km. No secondary occultations were seen.

3. January 25 — A. W. Harris, Jet Propulsion Laboratory, found the rotation period of 1980 AA to be 2.7 hours, the second shortest known for a minor planet. The photometric observations were made with the 1.5-m reflector at Mt. Wilson.

4. February 5 — Brown, Mallama, and McCracken, Goddard Space Flight Center, obtained spectra of Comet Bradfield (1979 l) showing emission from CN, $C_2$, $C_3$, OH, NH, and CH. rnb

## FOR SALE

Early Questar, original design; serial number 108. 2 Oculars plus illuminated ocular, heavy-duty Majestic tripod, camera cradle, camera extensions and adaptors for Cannon and Pentax, solar filters for scope and finder, other miscellany. Mint condition. $1800 or best offer. Alan Flum, 3400 Shepherd Street, Chevy Chase, Maryland 20015, 652-4609.

Two 2-inch diameter steel shafts with matching pillow blocks, 24 inches and 36 inches in length, machined for perfect fit with bearings. Each is threaded on one end to accept pipe flange. Suitable for large equatorial mount. $135. Ron Cohen, H: 476-9521, O: (703) 860-6947 (Reston, Virginia).

## WANTED

Massive mount suitable for holding a 6-inch f/8 Newtonian with assorted guide scopes very stably. It should have slow-motions on both axes and a drive in right ascension. Pedestal desired but not required. Boris Starosta, evenings, 652-0981.

* STAR DUST WASHINGTON, D.C.

Published eleven times yearly for NATIONAL CAPITAL ASTRONOMERS, INCORPORATED, a non-profit, public-service organization promoting interest and education in astronomy and related sciences. President, Mary Ellen Simon. *STAR DUST:* Robert H. McCracken, 5120 Newport Avenue, Washington, DC 20016. Deadline: 15th of preceding month.

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