SPACE SCIENCES

Light flashes and Van Allen belts

During the final Skylab mission early in 1974, astronaut William Pogue twice donned a pair of light-tight goggles and retired to his sleeping compartment to make controlled observations of the light flashes that were reported by previous Apollo and Skylab crews. The flashes are generally attributed to interactions between energetic heavy particles in space and the nerves of the eye. Now a team of University of Houston and National Aeronautics and Space Administration researchers believes that Pogue's findings may indicate "a previously unobserved . . . flux of multiply charged nuclei" in earth's inner Van Allen radiation belt.

The rate, or flux, of flashes reported by Pogue shows a distinct correlation with the calculated local cosmic ray flux, which varied with Skylab's changing latitude, according to L. S. Pinsky, W. Z. Osborne, R. A. Hoffman and J. V. Bailey in the May 30 SCIENCE. But a far more pronounced correlation exists, they report, with the space station's passage through the South Atlantic Anomaly, a region where a local variation in earth's magnetic field causes the planet's trapped radiation belts to dip closer to the surface. Here, particularly during the second of Pogue's two sessions, an on-board dosimeter measured a high peak in particle flux that coincided remarkably with the flash rate.

"Either the flashes were caused by heavier [atomic number of 2 or more] secondaries from proton interactions in the surrounding matter," the authors maintain, "or they were caused by an as yet unobserved heavy component of the inner belt trapped radiation, whose flux one would *a priori* expect to be approximately proportional to that of the trapped protons." The former possibility is ruled out, they say, since even the maximum proton intensity known at Skylab altitudes "fails to produce the maximum observed flash rate by a factor of 5 to 10."

For trapped heavy particles in the inner belt to produce the observed flash rate would require about one such particle per 1,000 trapped protons, the researchers calculate, which is "consistent with the upper limits currently available from direct measurements." This is not proof of such a particle population, they point out, but "it is one possible solution."

Light flashes and surgery

Controlled observations of light flashes in space during this summer's Apollo-Soyuz rendezvous mission will be part of a research effort aimed at developing earthly treatments for such conditions as cerebral palsy, Parkinson's disease and certain kinds of seizures.

In the experiment, which will not involve the Soviet Soyuz cosmonauts, two astronauts will count flashes through closed eyes and light-tight masks, while the third will monitor and control instruments designed to measure the level of dark adaptation and energetic particle fluxes. From these data, a team headed by Thomas J. Budinger of the University of California's Lawrence Berkeley Laboratory hopes to establish the "flux, trajectory and stopping power" of all particles capable of producing a perceivable flash.

Since the discovery of the connection between the flashes and energetic charged particles, Budinger and his colleagues have been working on the possibility of "particle radiotherapy," in which a stream of such particles would be aimed to selectively destroy cancerous cells or specific regions of the brain. Researchers at LBL have already begun exploratory studies with heavy ions for the treatment of pituitary diseases and certain body tumors. Particle radiotherapy, Budinger says, may well offer the possibility of painless neurosurgery.

EARTH SCIENCES

Oldest fossil marsupials

Fossil bones discovered more than a century ago in Tasmania and relegated to obscurity because they were thought to be of a modern animal now turn out to be the remains of the oldest known fossil marsupials from Australia. The bones, first discovered in 1866, were located recently in the holdings of the British Museum. Preliminary examination left no doubt that they represented a new taxon of marsupials and indicated they were of the Tertiary age. This led to reexamination of the geology of the travertine deposit in which they were found. Potassium-argon dating of the rocks overlying the deposit gives a minimum age of 22.5 million years. Thus the deposit is considered to be late Oligocene or older.

"The evidence we present that a diverse fauna of diprotodon marsupials existed in Australia in late Oligocene time is of considerable importance," R. H. Tedford of the American Museum of Natural History and four Australian colleagues report in the May 8 NATURE. "This evidence gives tangible support to the hypothesis that marsupials have been residents of the Australian continent since the early Tertiary at least."

Highly conducting lower crust

Studies by two Canadian scientists of geomagnetic variations recorded at 10 stations across the east-central United States have surprisingly revealed that the lower crust of the earth beneath this region is highly conducting. The finding raises questions, R. N. Edwards of the University of Toronto and J. P. Greenhouse of the University of Waterloo write in the May 16 SCIENCE: How can the conductivity of crystalline rock at a depth of 15 kilometers be two to three orders of magnitude greater than that at the earth's surface? One explanation is that the rocks of the lower crust are unusually water-rich. Perhaps this could mean that the rocks are segments of former oceanic crust that have retained their water-rich character, the scientists hypothesize. This would support a previously advanced idea that conductivity anomalies found today in areas of no obvious tectonic activity may mark very ancient zones of subduction of oceanic plate beneath continental plate.

Tornadoes and electricity

Various theories proposing that tornadoes are produced by electrical energy have been advanced from time to time. A group from the National Severe Storms Laboratory in Oklahoma now casts cold water on that idea. The meteorological teams observed 18 tornadoes at close range, using radar to locate them, cars to get close to them, and motion picture film to document them. The observations, report R. P. Davies-Jones and J. H. Golden in the JOURNAL OF GEOPHYSICAL RESEARCH (80:1614), " reveal that electrical activity near or within the funnel is far too infrequent to lend credence to electrical theories of tornado genesis and maintenance."

Warning on hurricanes

The hurricane season officially begins June 1, and the National Weather Service's warning to U.S. coastal residents is more urgent this year because of the growth of population along vulnerable coasts and the shrinking proportion of people in those areas who have experienced—and thus learned to respect—even moderate hurricanes. "Much as we would like to," says NWS Director George P. Cressman, "there is no way we can predict in advance whether the coming season will be relatively quiet, like the past few years, or incredibly destructive, like 1954 and 1955. Our message is: 'Be ready.' "