

or wherever pure mathematicians do their cogitating. Fleming cites his own field, the calculus of variations, which is concerned with determining the maxima and minima of certain kinds of processes. It's an "old, old subject," and it appeared to be all but dead until aerospace activity burgeoned. The need for optimal control methods in aerospace systems revitalized the calculus of variations.

The future is likely to see mathematicians grappling more and more with the real world, which after all is where mathematicians started back in ancient Babylonia, and the resulting stimulus will be mutual. "It's a healthy time," says Anderson. □

## Hole in ionosphere by Saturn 5

Old space hands felt a nostalgic pang on May 14, 1973, when the last of the titanic Saturn 5 rockets took off on its pillar of flame, carrying the Skylab workshop into orbit around the earth. It is thus somehow fitting that, in addition to all the noise and spectacle of its kind, this final super-booster now appears to have made its mark with an extra flourish: a huge temporary "hole" in the ionosphere, some 1,200 miles across, within which about 99 percent of the existing free electrons were virtually swept out of circulation.

In the upper portion of the ionosphere, known as the F layer, solar radiation causes about .1 percent of the existing single atoms of oxygen to dissociate, or break down, into positively charged oxygen ions and free (negatively charged) electrons. As the Skylab Saturn 5 climbed through the F layer on its way to orbital altitude, the powerful engines of its second stage left a huge, rapidly expanding exhaust cloud of water vapor and hydrogen, which combined with the non-dissociated oxygen to form positively charged OH and water ions. In minutes, according to Michael Mendillo of Boston University, Gerald Hawkins of the Smithsonian Astrophysical Observatory and John Klobuchar of the Air Force Cambridge Research Laboratories in the Jan. 31 *SCIENCE*, this sudden spawning of positive ions simply combined with the negative electrons, producing "a dramatic ionospheric phenomenon, unique in magnitude and in spatial and temporal extent." So graphic was the effect that it was monitored from the Sagamore Hill Radio Observatory in Massachusetts, as well as Illinois and Labrador.

Previous Saturn 5's produced no comparable effects, the researchers point out, because second stages fired at lower altitudes. □

## 40 top young scientists selected

For the last three summers Keith Gover of Detroit has studied silkworms. At 17, his teachers agree, he's an expert. And, thanks to his dedication to his goal, he's successfully bred hybrid moths.

Gover and 39 other high-school students with the same spark of enthusiasm for research have been selected the nation's most scientifically talented high-school seniors. All of them are in the running for a \$10,000, four-year scholarship, plus \$57,500 more in other scholarships and awards, to be awarded next month.

All 40 will be honored with an expense-paid trip to Washington (Feb. 26 through March 3) to attend the Science Talent Institute, where their projects, displayed for the public, will be judged.

This year's crop of finalists, 30 boys and 10 girls, were chosen from 14,321 contestants, of whom 1,118 completed their entries by writing a report on their independent science research projects, submitting personal data and teacher recommendations. The trip winners are 15 to 18 years old and come from 35 cities in 19 states. Emphasis in selecting winners is placed on creative research.

Projects this year cover a wide range of science and engineering fields—genetics, computer mathematics, physics, biochemistry, nematology, electrical engineering, zoological taxonomy, microbiology, paleontology, entomology and wildlife ecology. A contestant from New Orleans studied the protein levels in crayfish during the intermolt cycle, concluding that crayfish absorb protein from the cuticle and store it in the blood for later use in the formation of a new shell. A young scientist who studied the lipoproteins in rat plasma for his project designed and installed a computer program for his high school's swim team in his spare time.

A Boston student became a camera bug after setting up a darkroom at home to supplement drawings for his science project, and another built a laboratory onto the side of his bedroom to do his research. A student from Los Angeles prepared a complete field guide to tiger beetles, found along mud flats in Southern California and almost impossible to identify by sex and breed. A Florida student, after spending two years studying airfoils in model gliders, concluded that if his airfoil really worked on full scale transport planes it could reduce stalling and make air travel safer.

Twenty-four of this year's contestants spent last summer employed as lab technicians or attending science workshops at state universities. Most of them did their research at home, on

their own, consulting faculty members only routinely. Thirty percent of the students' parents are professional scientists, and 30 of the 40 students are in the top 10 percent of their class.

The Science Talent Search is sponsored jointly by Westinghouse Electric Corp. and Science Service, Inc., publisher of *SCIENCE NEWS*. Science Service administers and Westinghouse provides financial support for the searches through the Westinghouse Educational Foundation.

The top 40 are:

**CALIFORNIA:** Meiling L. Fang, Alhambra H.S., Alhambra; Daniel R. Marshak, La Jolla H.S., La Jolla; Julia A. Craig, Leigh H.S., San Jose; Derrick T. Kikuchi, San Marcos H.S., Santa Barbara; Christopher D. Nagano, Santa Monica H.S., Santa Monica.

**FLORIDA:** Lorraine A. Pillus, Cocoa H.S., Cocoa; Kathy R. Albe, Coral Gables Sr. H.S., Coral Gables; Richard J. Foch, Astronaut H.S., Titusville.

**GEORGIA:** Charles E. McKemie, Griffin H.S., Griffin.

**HAWAII:** Wendell T. W. Ching, Aiea H.S., Aiea; Scott O. Zeitlin, Kalani H.S., Honolulu.

**ILLINOIS:** Joel I. Dubin and Evan D. Kharasch, Niles Twp. West H.S., Skokie.

**IOWA:** Robert A. Light, Bettendorf H.S., Bettendorf.

**LOUISIANA:** Donald V. Brignac, Litcher H.S., Litcher; H. Britton Sanderford, St. John Vianney Preparatory School, New Orleans.

**MARYLAND:** Jon S. Marans, Springbrook H.S., Silver Spring.

**MASSACHUSETTS:** Anthony R. Maranto, Phillips Academy, Andover; Christopher G. Howard, Wachusett Reg. H.S., Holden; Joyce D. Rounds, Taunton H.S., Taunton.

**MICHIGAN:** Keith B. Gover, Redford Union H.S., Detroit.

**MISSOURI:** Julie A. Logan, Palmyra H.S., Palmyra.

**NEW JERSEY:** Alan S. Geller, Ridgewood H.S., Ridgewood.

**NEW YORK:** Howard H. Heller and Terry A. Jacobson, Benjamin N. Cardozo H.S., Bayside; Arthur D. Lander, John Dewey H.S., Brooklyn; Kenneth R. Aupperle, Half Hollow Hills H.S., Dix Hills; Stephanie L. Sakson, John Glenn H.S., Huntington; Lisa R. Edelstein, Jamaica H.S., Jamaica; Craig F. Miller and Byron B. Siu, Bronx H.S. of Science, N.Y.; Paul A. Zeitz, Stuyvesant H.S., N.Y.; Philip Garcia, Trinity School, N.Y.

**OKLAHOMA:** Kevin L. Behar, Ponca City Sr. H.S., Ponca City.

**OREGON:** Gary A. Stipe, Sunset H.S., Beaverton.

**PENNSYLVANIA:** Charlene G. Sanders, Lower Merion H.S., Ardmore; Richard M. Busch, Warwick Sr. H.S., Lititz.

**VIRGINIA:** Tom B. Mattson, Abingdon H.S., Abingdon.

**WASHINGTON:** Robert M. Claudson, Hanford H.S., Richland.

**WISCONSIN:** Debra S. Erdmann, Wausau West H.S., Wausau. □