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ANALYSIS FROM THE UNIVERSITY OF CHICAGO
CHARGED PARTICLE EXPERIMENT ON THE OGO-5
SPACECRAFT Final Report (Chicago Univ.)
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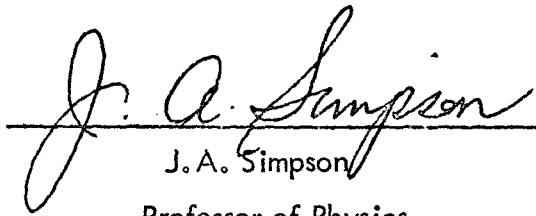
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Final Report On

NASA Contract NAS 5-9366

Data Processing and Analysis from the
University of Chicago Charged Particle Experiment
on the OGO-5 Spacecraft

25 May 1973

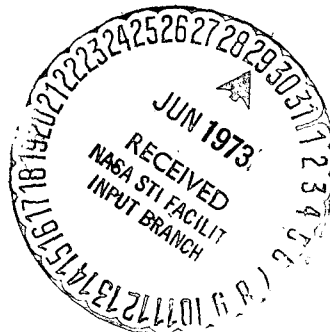


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Final Report on Contract NAS5-9366
Data Processing and Analysis of Data from the
University of Chicago Charged Particle Experiment
on the OGO 5 Spacecraft

25 May 1973

Abstract: This final report summarizes the data processing and analysis performed under the subject contract with the National Aeronautics and Space Administration and reports the principal scientific results obtained from the analysis. A bibliography of Conference Reports, and Publication based on these results is appended.

Data Processing and Analysis: All available data from launch through day 196 of 1972 has been delivered by the Goddard Space Flight Center of the National Aeronautics and Space Administration to the University of Chicago. This data coverage was near 100% except for the period from day 267 of 1971 through day 155 of 1972 when no data was telemetered.

All raw data received at the University of Chicago has been processed and given at least a preliminary analysis, except for the period from day 178 (1200 GMT) through 179 (1500 GMT) of 1972. This data is of poor quality and would require more effort to process than it would return in new information.

As noted in earlier reports, the rate channels in the University of Chicago instrument become noisy near the end of 1970 and were not useful for analysis purposes thereafter. The pulse height channels have, however, been verified to be returning good data up to the time of spacecraft turn-off, and have been used for all analysis purposes since 1970, together with the rate channels from the IMP 4/5 University of Chicago experiments.

All data received from the experiment have been submitted to the National Space Sciences Data Center of the Goddard Space Flight Center. This data was submitted in a reduced form agreed upon by that Center, and was accompanied by complete instrument - description and instrument - performance documentation.

Although all data processing work has been completed on the information from this spacecraft, we anticipate a continuation of the analysis program over the next 1 - 2 years, to be funded from alternate sources.

A list of publications based on results from the OGO-5 experiment can be found on page 5, and a list of papers presented at conferences on page 4. This bibliography is an indication of the scientific importance of our instrument. We have also attached copies of the publications at the end of the report. At the present time two more articles are in preparation to be submitted to journals for publication, and one paper will be presented at the 13th International Cosmic Ray Conference to be held in Denver in August 1973.

A brief description of the main scientific results follows:

(a) Composition of the Earth's radiation belts.

The instrument on OGO-5 provided the first identification of carbon and oxygen nuclei trapped in the geomagnetic field. The measurement of the abundance ratio of carbon to oxygen nuclei is consistent only with an extraterrestrial origin for these nuclei. The results on C and O nuclei also set a new value for the observed high energy limit of trapping.

(b) Composition of heavy nuclei accelerated in solar flares.

The University of Chicago instrument on OGO-5 measured the relative abundance of nuclei accelerated in solar flares from carbon to the iron group. When compared with solar photospheric and coronal abundances, the measurements show an overabundance of solar flare nuclei, which increases with increasing atomic number. A variability in the enhancement was found from flare to flare. Since the galactic cosmic rays display a similar overabundance, our results may be relevant to the more general problem of the origin of cosmic rays. A model was presented to explain the observed preferential acceleration of heavy nuclei in flares.

(c) Composition and energy spectra of heavy nuclei during quiet times.

With data from the OGO-5 satellite, the energy spectra of C and O nuclei during quiet times have been found to behave as the H and He spectra during quiet times at low energies. This behavior is characterized by a drastic change in slope, and the origin of these low energy nuclei has been undecided for a number of years. By analysing the relative abundances of the elements at these low energies, and by following their flux variations as a function of time, we have been able to determine that these low energy nuclei are of galactic origin, rather than being solar. This determination has important consequences in the study of galactic cosmic rays and of their modulation in the heliosphere.

Conference Proceedings based on results from the University of Chicago
experiment on the OGO-5 satellite (as of 1 April 1973)

- A. Mogro-Campero and J. A. Simpson, Enrichment of Very Heavy Nuclei in the Composition of Solar Accelerated Particles, Special session paper presented at the 12th Int. Conf. on Cosmic Rays, Hobart Australia, 1971
- J. A. Simpson and A. Mogro-Campero, Enrichment of Very Heavy Nuclei Accelerated in Solar Flares, paper C5.2 presented at the San Juan, Puerto Rico meeting of the American Physical Society, Division of Cosmic Physics (1-4 Dec., 1971).
- A. Mogro-Campero and J. A. Simpson, Overabundance of Very Heavy Nuclei Accelerated in Solar Flares, paper presented at the meeting of the American Astronomical Society, Solar Physics Division, University of Maryland (4-6 April, 1972).
- B. G. Cartwright and A. Mogro-Campero, The Preferential Acceleration of Heavy Nuclei in Solar Flares, paper presented at the Conference on High Energy Phenomena on the Sun, Goddard Space Flight Center, September, 1972.

Publications based on results from the University of Chicago experiment on
the OGO-5 satellite (as of 1 April 1973)

- A. Mogro-Campero and J. A. Simpson, Identification and Relative Abundance of C, N, and O Nuclei Trapped in the Geomagnetic Field, Phys. Rev. Lett. 25, 1631 (1970).
- A. Mogro-Campero, Geomagnetically Trapped Carbon, Nitrogen and Oxygen Nuclei J. Geophys. Res., 77, 2799 (1972).
- A. Mogro-Campero and J. A. Simpson, Enrichment of Very Heavy Nuclei in the Composition of Solar Accelerated Particles, Ap. J. (Letters), 171, L5 (1972).
- A. Mogro-Campero and J. A. Simpson, The Abundances of Solar Accelerated Nuclei from Carbon to Iron, Ap. J. (Letters) 177, L37 (1972).
- B. G. Cartwright and A. Mogro-Campero, The Preferential Acceleration of Heavy Nuclei in Solar Flares, Ap. J. (Letters), 177, L43 (1972).
- B. G. Cartwright and A. Mogro-Campero, A Mechanism for the Abundance Enhancements of Heavy Nuclei in Solar Flare Particle Events, accepted for Publication in the Conference Proceedings on High-Energy Phenomena on the Sun (1973).