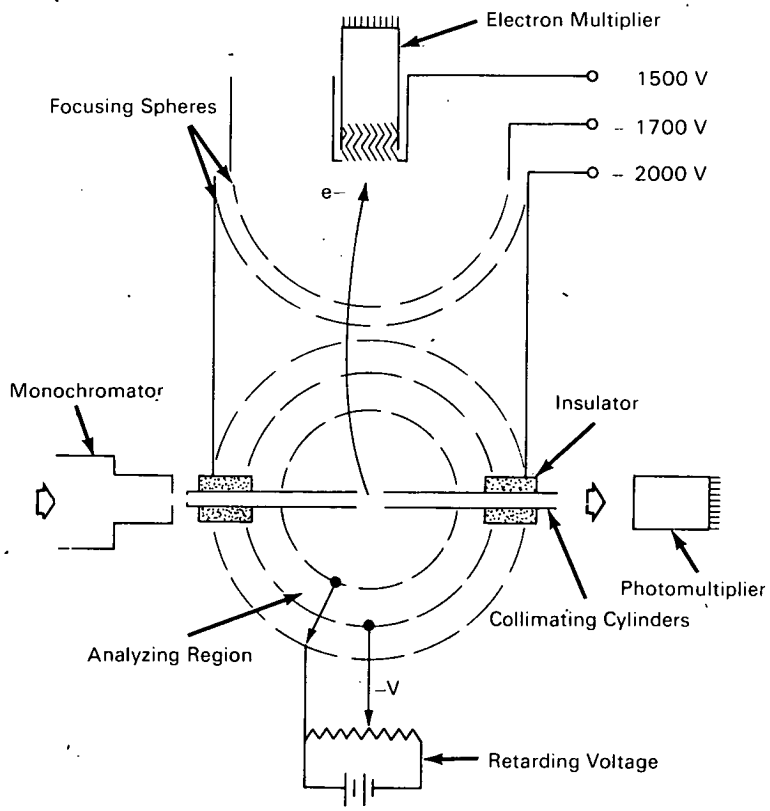
June 1970 Brief 70-10138

NASA TECH BRIEF

Electron Energy Analyzer



Electron Energy Analyzer

The problem:

To develop an electrostatic deflection analyzer of improved sensitivity for measuring low energy electron energy distributions.

The solution:

A device consisting of three spherically concentric grids designed to allow the production of electrons within a small volume at the center of the inner sphere. By applying a retarding potential between the middle and inner spheres, the energies of the electrons can be measured.

How it's done:

The principle of operation of the analyzer is illustrated in the figure. Monochromatic radiation is channeled by a hollow metal tube which is open at the center of the inner sphere. The gas under study

(continued overleaf)

permeates the entire apparatus, permitting the production of photoelectrons along the length of the light beam. Electrons are free to escape only in the small gap between the hollow cylinders, traveling in straight lines in the field-free region of the inner sphere. On entering the annulus between the inner and middle spheres their energies are analyzed by applying a retarding potential between these two spheres. A third outer sphere is used to prevent field penetrations from the electron multiplier from upsetting the energy resolution of the analyzer. Energetic electrons which are not retarded escape through the three grids and are focused onto the first dynode of the electron multiplier. A complete scan of the retarding potential will provide an output from the multiplier which will show a series of steps. Each step will represent the retardation of a specific energy group of the photoelectrons which in turn represents an ionization potential of the gas.

This device can be used to determine ionization potentials of gases and to determine specific absorption processes which occur when solar radiation is incident on a planetary atmosphere. The transfer of this device for use in industry could occur in a production line assembly where the purity of gases is monitored. Energies of the photoelectrons are unique to each gas, permitting specific gases to be identified.

Notes:

1. This device is one of the few in existence which can use a vacuum monochromator to produce the photoelectrons.
2. Although greater sensitivity can be achieved with the spherical grid analyzer, there is some sacrifice in energy resolution.
3. This information should be of interest to developers of instrumentation for physical electronics research and to research personnel in the television industry.
4. Requests for further information may be directed to:
   Technology Utilization Officer
   Headquarters
   National Aeronautics
   and Space Administration
   Washington, D.C. 20546
   Reference: TSP70-10138

Patent status:

No patent action is contemplated by NASA.

Source: Dr. James A. R. Samson of
GCA Corporation
under contract to
NASA Headquarters
(HQN-10373)