December 1974 B74-10232

NASA TECH BRIEF

NASA Headquarters

Compact Source of Soft X-Rays

The problem:

Proportional counters used in the investigation of soft X-rays in space must be calibrated prior to launch. Such calibration, however, requires a small, lightweight source of soft X-rays which can be used in the field.

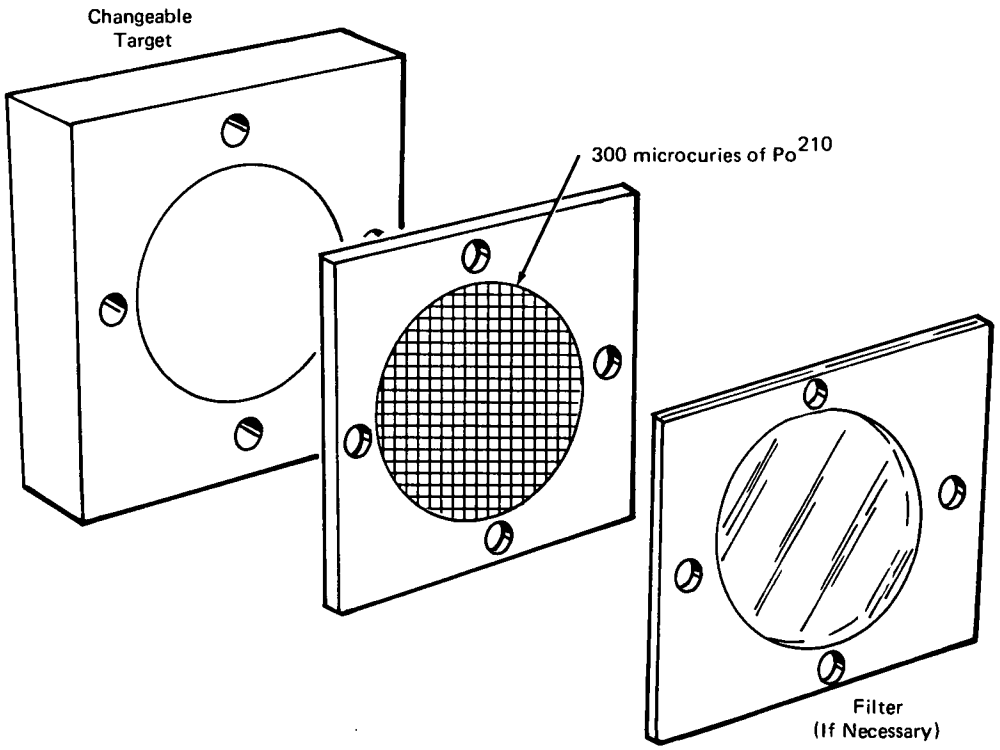
The solution:

A compact, lightweight source of soft X-rays has been constructed (see figure) which uses alpha particles to fluoresce light elements such as boron, carbon, and magnesium. The X-ray wavelengths are varied by changing the target. Output intensities range from 100 to 1000 photons per second when 300 microcuries of Po^{210} is used.

How it's done:

The figure illustrates the soft X-ray source configuration. A small alpha particle source [diameter of 0.6 cm (1/4 in.)], 300 microcuries of Po^{210} is placed at the center of a milled frame with its side facing the target. Alpha particles impinge upon the target surface and induce emission of characteristic X-rays over a broad angular range. An absorbing filter may be used outside the alpha source if it is desired to use complex targets containing several elements. Such filtering suppresses spectral lines that are not being measured.

It is possible that the output of fluorescent X-rays can be increased significantly by lowering the energy of the alpha particles. Typically, the range of alpha



(continued overleaf)

particles penetrating the target material is much larger than the mean free path (for absorption) of the outgoing fluorescent radiation, i.e., X-rays generated deep within the target do not have sufficient energy to reach the surface. Thus, full-energy emission of alpha particles results in too great a loss of X-rays. A thin absorber (screen) placed over the alpha source results in more efficient energy use and increases X-ray yields.

Notes:

1. This technique supplies a broad range of monoenergetic X-rays whose energy can be adjusted very easily. The source is small, lightweight, and requires no auxiliary equipment or power. Strength of X-rays produced is constant, well-known, and useful for absolute calibration.
2. With an X-ray proportional counter, this source has been used to measure the thickness of materials, such as stretched polypropylene, parylene, and teflon, on the basis of their X-ray transmission properties.
3. Requests for further information may be directed to:
   Technology Utilization Officer
   NASA Headquarters
   Code KT
   Washington, D. C. 20546
   Reference: TSP74-10232

Source: P. Gorenstein and B. Harris of
American Science and Engineering, Inc.
under contract to
NASA Headquarters
(HQN-10732)