ator parts were built and in position by mid-1966, but there was trouble with three major items: the 40-MeV linear accelerator, which injects electrons, the rf amplifier and a large choke, which is part of the ac magnet power supply.

Electrons went all the way around the ring for the first time in October. After all major components were commissioned in December, electrons were accelerated to 4.5 GeV with very little difficulty, according to A. W. Merrison, director of the laboratory.

Now NINA has been turned off, while Daresbury people try to improve her performance. Full rf power is expected this spring, and then attempts will be made to reach NINA's design intensity.

New X-Ray Telescope is Sensitive, Light and Cheap

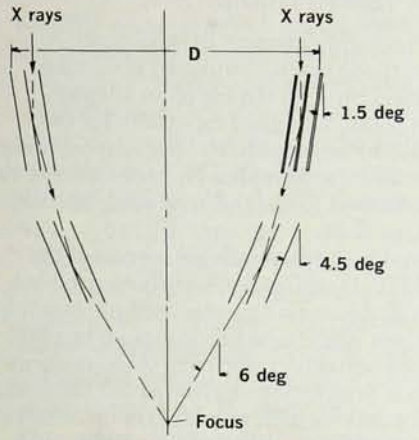
A simple, inexpensive x-ray telescope with a large gathering area has been developed by Robert Novick and Frederick Kantor at the Columbia University Radiation Laboratory; they expect its effective sensitivity to be 100 to 1000 times greater than that of previous detectors. In addition to collecting celestial x-rays, the technique might also be applied to focus thermal and subthermal neutrons and to improve the study of mu-mesic atoms.

Since the first x-ray source beyond the sun was discovered four years ago, about two dozen more have been detected. Future development of the field requires the use of improved detecting devices.

An ideal x-ray telescope would have high sensitivity to detect weak sources and good angular resolution to separate independent sources that are close together; it could also be used to measure intensity and polarization as functions of energy. Previous x-ray telescopes utilized complex surface shapes that produced a high-resolution image but with a relatively small effective collecting area. Since many x-ray astronomical studies do not require good resolution, Novick and Kantor have built an x-ray collecting system with large effective area and modest angular resolution, which is

relatively inexpensive and lightweight. The device achieves high sensitivity by focusing the radiation onto a relatively small detector with a correspondingly small intrinsic background count; in addition, its small size permits efficient shielding from the residual cosmic-ray background.

Like other central-focus x-ray gatherers, the Columbia telescope uses specular reflection of x rays at grazing incidence from a polished surface. Other experimenters produce the reflecting surface by polishing and figuring of suitable metallic surfaces. Novick and Kantor make exceptionally smooth surfaces by evaporating a uniform gold film onto flat annealed glass strips; such a surface produces about 50% specular reflection through a total angle of about 1 deg for 5-keV x rays. They mount several such reflectors in modules with free space between adjacent glass strips and with the surfaces parallel to each other. The x radiation incident on such a module is deflected through an angle equal to twice the grazing angle, but the deflected rays are still parallel to each other. Many such modules are grouped in a circle and are arranged so that the deflected rays are incident on a small common area that corresponds to the focal spot of the lens. Two such arrays of modules are cascaded to reduce the focal length of the system and to insure proper off-axis focusing. In this system the focal spot is about equal to the area of each of the modules.



MODULAR X-RAY COLLECTOR
has *f*-number of approximately 5.

To demonstrate the workability of this modular x-ray gathering system, two prototypes were built. Each consists of two single rings of modules with input area of about 5 cm² for each module (see figure). The two rings are arranged concentrically and are displaced both radially and axially to permit successive passage of x rays through them; each x ray is reflected twice for a total bend of about 6 deg. This results in an *f* number of approximately 5.

The first complete telescope, which will contain four concentric nested rings of modules, will probably be launched by rocket this summer. Novick and Kantor expect that by extending the nesting arrangement further, they can build telescopes with collecting areas of more than 1 m² that can produce intensification ratios of several thousand to one.

They hope first to extend the observations of the newly discovered x-ray stars and, in particular, to search for extragalactic x-ray sources. Later they plan to make spectral studies and high-sensitivity sky surveys.

. . . *also of Interest: Space and Accelerators*

A synchronous weather-watching satellite, planned by Verner Suomi and Robert Parent of the University of Wisconsin, moved into position over the equator south of Hawaii in December, the first of five planned to follow cloud and air-mass motion. . . . When the moon occulted Pioneer VII in mid-January, space scientists planned to look at variation in radio signals from the spacecraft to check existence of a lunar atmosphere. An atmosphere would refract signals at 50 MHz differently than at 400 MHz. The experiment would also measure "roughness" of the lunar disc, thus improving lunar occultation measurements of quasars. . . . John Hagen of Pennsylvania State University proposes that NASA orbit a huge radio telescope 8000 km above the earth. The antenna, 300 meters long, would detect signals at 1, 3 and 9 MHz. . . . Three Emperor tandem Van de Graaffs are approaching completion at Minnesota, Chalk River and Heidelberg. A new order for one has come from Munich—the university and the technical institute. □