RESULTS FROM OSO-IV: THE LONG TERM BEHAVIOR OF X-RAY EMITTING REGIONS

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Abstract. A grazing incidence X-ray telescope on board the OSO-IV spacecraft obtained images of the Sun in the 2.5 to 12 Å waveband nearly continuously from 27 October 1967 to 12 May 1968. The instrument had sufficient spatial resolution (one and four arc minutes) and temporal resolution (5 to 20 min) to estimate the spatial characteristics of X-ray emitting regions and to monitor the temporal behavior of individual active regions. Variations in the absence of flares of as much as a factor of 10 in the X-ray output of individual regions were observed, with typical durations ranging from several hours to several days. The X-ray time variations are related to observations at optical and radio wavelengths. The results are interpreted under the assumption that the X-ray time variations are caused by temperature changes in the coronal portions of active regions. The contribution of radiative losses to the energy budget of the coronal active region is estimated.

1. Introduction

The OSO-IV satellite was successfully launched into Earth orbit on 18 October 1967. AS&E's grazing incidence X-ray telescope on board the spacecraft obtained solar images in the 2.5 to 12 Å waveband, nearly continuously from 27 October 1967 to 12 May 1968 when the satellite tape recorder failed. Intermittent data were received thereafter.

The OSO-IV X-ray telescope had sufficient spatial resolution (one and four arc minutes) to locate and identify the sources of solar soft X-ray emission. The temporal resolution (5 to 20 min) of the instrument was sufficient to resolve the time variations in X-ray flux (except during impulsive flares), and the duration was sufficient to monitor active regions for periods on the order of their lifetimes. Because of its spatial resolution, the instrument could measure the X-ray emission from a particular active region even while the majority of the total solar X-ray flux was being produced by other regions. Consequently, the X-ray telescope was able to follow the temporal behavior of individual active regions for several solar rotations.

The analysis of the OSO-IV telescope data has followed three major lines: (1) the angular resolution characteristics of the instrument have been used to determine the spatial dimensions of X-ray emitting regions; (2) time histories of the X-ray activity of individual, selected active regions have been studied in order to determine the temporal characteristics of these regions; and (3) the data has been compared with observations made at radio and optical wavelengths. The results of this analysis follow a brief description of the instrumentation and our experimental procedure.

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Fig. 1. AS&E pointed X-ray telescope experiment.