A SINGLE LOOP OF 21 JANUARY 1974 FLARE

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Abstract. A single loop associated with a flare of 21 January 1974 was studied with NRL spectroheliograms in order to understand the phenomenon of 'evaporation'. The loop seen in the emission lines of Fe xv reached its maximum brightness 15 min after the onset. The loop is different from a flare loop because of the time sequence in which it appeared and is different from a post-flare loop prominence system because of its morphology. The electron density in the loop increases gradually to $4 \times 10^{10} \text{ cm}^{-3}$. The material of the loop is thought to be supplied from the lower atmosphere of the chromosphere or the photosphere. The loop is an associated phenomenon of the main flare event distinguished by a longer rise time (15 min) and a lower peak temperature ($2 \times 10^9 \text{ K}$).

1. Introduction

A series of spectroheliograms of the 21 January 1974 flare has been obtained from the very beginning of the event with the NRL instruments on Skylab. The main characteristics of the event seen on the spectroheliograms (Brueckner, 1976) are as follows: (i) two strong Doppler broadened emission features appear at the very beginning at 23:16 UT, (ii) a high temperature kernel appears only at one side, (iii) the Fe xxiii and Fe xxiv emission kernels also appear only at one side, (iv) a single loop appears at 23:22 UT and reaches maximum brightness at 23:35 UT in the emission lines of Fe xv 243.78 Å and Fe xvi 251.07 Å (Figures 1 and 2).

The single loop which appeared several minutes after the onset of the flare is studied here. The loop is neither a flare loop nor a post-flare loop prominence system as described by Bruzek (1964). If it were a flare loop, a bright single loop should be seen from the onset. But in this event the brightenings appear at both foot points of the flare arch, and the single loop is seen later. The single loop also is morphologically different from postflare loops. The loops of a loop prominence system typically form a rather regular system of parallel loops connecting the strands of a two-ribbon flare, and grow discontinuously by the formation of progressively higher loops. Material is observed to descend from the tops of the loops into the chromosphere. The single loop studied here grows from one end of the loop like a surge, and the material is probably supplied from the chromosphere or photosphere. The electron density in the loop is derived from the intensity ratio of density-sensitive lines of Fe xv. The

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Fig. 1. A sequence of spectroheliograms obtained with the NRL S082A experiment on Skylab. The brightening of the loop discussed in this paper began at approximately 23:22 UT 21 January 1974. The position of the loop is indicated between arrows in the images of Fe XV and Fe XVI. The small bright flare kernel is located on the right-hand side of the loop (see Figures 2 and 6).

Fig. 2. Sketch of the flare arch observed in He II, the single loop AC, and the high temperature kernel B. A and Bo are foot points of the flare arch. The positions of Bo and B are different.

electron density in the loop gradually increases with time. Upflows in the transition region at a foot of the flare arch were observed, and the upflows are though to supply the material in the loop.

2. Observation and Reduction

A description of the NRL S082A experiment on Skylab and the procedure for intensity calibration of the spectroheliograms is given by Packer et al. (1976). The