HIGH RESOLUTION OBSERVATIONS OF FIBRIL CHANGES IN A SMALL FLARE

DONALD F. NEIDIG

Air Force Geophysics Laboratory, Sacramento Peak Observatory*, Sunspot, NM 88349 U.S.A.

(Received 4 August; in revised form 26 October, 1978)

Abstract. Changes in the fibril geometry associated with a subflare are tracked in detail in both time and space. The fibril morphology at the location of the subflare is a spiral configuration surrounding a sunspot. Despite the rotation of this sunspot, which tends to tighten the spiral structure, a relaxation toward a more nearly radial structure is associated with the occurrence of the subflare. The relaxation is confined to those fibrils which connect the poles of the optical flare emission, and in addition, tends to reflect the different time evolutions of different parts of the subflare. Comparison of the changes in the fibril geometry with the soft X-ray burst indicates that the reorganization of the fibril structures lags the energy release in the subflare by more than one hour.

1. Introduction

The reorganization of fibril structures following flares, presumably associated with the relaxation of force-free magnetic fields, has been reported in a number of cases (e.g. Tanaka and Nakagawa, 1973; Bruzek, 1975; Tanaka, 1976). Tanaka and Nakagawa (1973) derived equations for approximating the force-free field energies in terms of fibril geometry and found sufficient energy (>10^{32} erg) associated with the relaxation observed in a 3B flare to account for the energy released. Using the same equations Neidig et al. (1978) obtained energy changes of 8 \times 10^{31} erg for a 2N flare and 10^{30} erg for a subflare. The latter subflare (14 September, 15:30 UT) is the subject of the study here, where the associated changes in the fibril geometry are studied in detail in both time and space. The subflare consisted of two adjacent emission patches with different evolutions in time. This condition provided an ideal test for the localization of the relaxation process, as observed in the subsequent changes in fibril structures. Another subflare, also showing fibril changes, was observed at the same location on 13 September, 14:55 UT. The latter event, however, did not exhibit the two-component structure and therefore will not be considered here.

2. Description of the Active Region

The basic configuration of McMath 14943 is evident from the filtergrams presented herein. The spiral configuration in the chromospheric superpenumbra associated with the large preceding sunspot is of particular interest in connection with the

* Operated by the Association of Universities for Research in Astronomy, Inc., under contract with the National Science Foundation.