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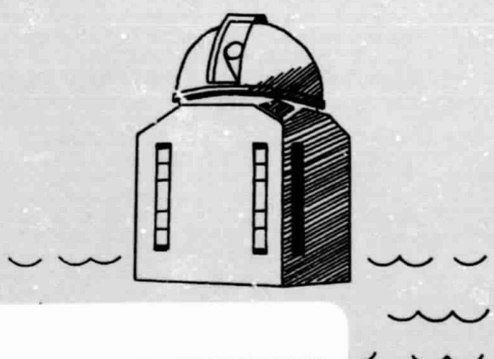

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A NOTE ON CHROMOSPHERIC FINE STRUCTURE AT ACTIVE REGION POLARITY BOUNDARIES.

By

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H-α photographs show a variety of dark structures along zero-longitudinal-field lines in active regions. At least one form is apparent only in high-resolution photographs. We wish to point out this form here. For comparison, we will list first two better known forms.

1) Active region filament: These filaments lie along lines of zero longitudinal field. The fine structure of such a filament is parallel to the gross structure of the filament. There is an appreciable component of magnetic field along the filament. Such filaments are described, for instance, by FOUKAL (1971). A few examples are labeled "1" in Figure 1. Field and filament are parallel to the magnetic boundary.

2) Arches: Figures 2 and 4 show active region arches (labeled "2"). In appearance and size they are similar to AFS arches, such as discussed by BRUZEK (1967), ROBERTS (1970), and WEART (1970). However, instead of overlying bright plage (as AFS arches do) they connect plage regions. Their similarity in appearance to AFS arches and the fact that material often flows along the arches suggest that they, too, lie along the magnetic field lines. In this case, both field and arches are perpendicular to the boundary between opposite polarity regions. These arches appear to have lifetimes greater than the one hour characteristic of AFS arches but in some cases less than 24 hours; this matter and other properties of such arches merit further study. Arches

typically are of the order of 15,000 km long.

3) Field Transition Arches: On lower resolution photographs (Figure 3) these features (labeled "3") look like rather crooked filaments separating bright plages of opposite polarity. High resolution photographs, however, show that the fine structure in these filaments is in fact cross filament and cross boundary (Figure 4). That is, the actual structural form consists of a long series of parallel, closely spaced dark threads joining regions of opposite polarity. As in the preceding class, field and structure are perpendicular to the magnetic boundary. However, these threads are much smaller than the arches. They are of the order of 4000 km or less in length. On the large scale, the feature can last weeks. We do not yet know the time scale for the individual threads, but it is clearly much shorter.

There are, of course, gradations between the various classes. Figure 4, for example, shows features intermediate in size and position between the last two classes. Then, too, the angle between the filament structure and polarity boundary can be between the two extreme angles of 0° (first class) and 90° (the other two classes). For instance, near the "3" in Figure 4, this angle is closer to 45°.

We have noted the following points about where these features occur:

1) The active region filaments lie on boundaries between regions of weaker fields, while the cross-boundary

structures (the second and third classes above) occur at boundaries between regions of stronger field (ZIRIN, 1970).

2) The arches often appear roughly radiating from sunspots.

3) The field transition arches are found only where opposite polarity regions of strong field are closely adjacent; bright plage can be found adjacent to both sides of the feature.

4) Often a single boundary will have field transition arches where the fields are strongest and regular filaments where the fields are weaker; the transverse structure will change to a shear structure.

The forms themselves are transmutable. Boundaries spanned by parallel arches can become field transition filament regions, indicating that the width of the region of horizontal field decreases. In some cases, field transition filaments are eventually replaced by regular filaments; there is one case on film where the reverse occurred. Changes such as these are not the rule, but they are interesting. They could be caused by motion of the opposite polarity regions relative to each other or by the emergence of new flux in the vicinity of the boundary.

These boundary regions will be investigated more closely as more high-resolution movies are made. Information on lifetimes, structure, and evolution of the boundary features should give us greater knowledge of the structure, growth, and evolution of the magnetic field in active regions.

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FIGURE CAPTIONS

Figure 1 - Active region filaments (labeled "1"): filament and magnetic field are both parallel to the boundary between opposite polarities. (October 24, 1969). All photographs in this article are from Big Bear Solar Observatory.

Figure 2 - Arches (labeled "2"): These features are parallel to the magnetic field and perpendicular to the polarity boundary. (October 26, 1969).

Figure 3 - Field transition arches (labeled "3") under conditions of low resolution look like a single irregular active region filament. (September 9, 1970).

Figure 4 - With higher resolution the true structure of the field transition arches ("3") becomes visible. The features are parallel to the magnetic field and connect regions of opposite polarity. Also visible are some arches ("2"). (September 9, 1970).

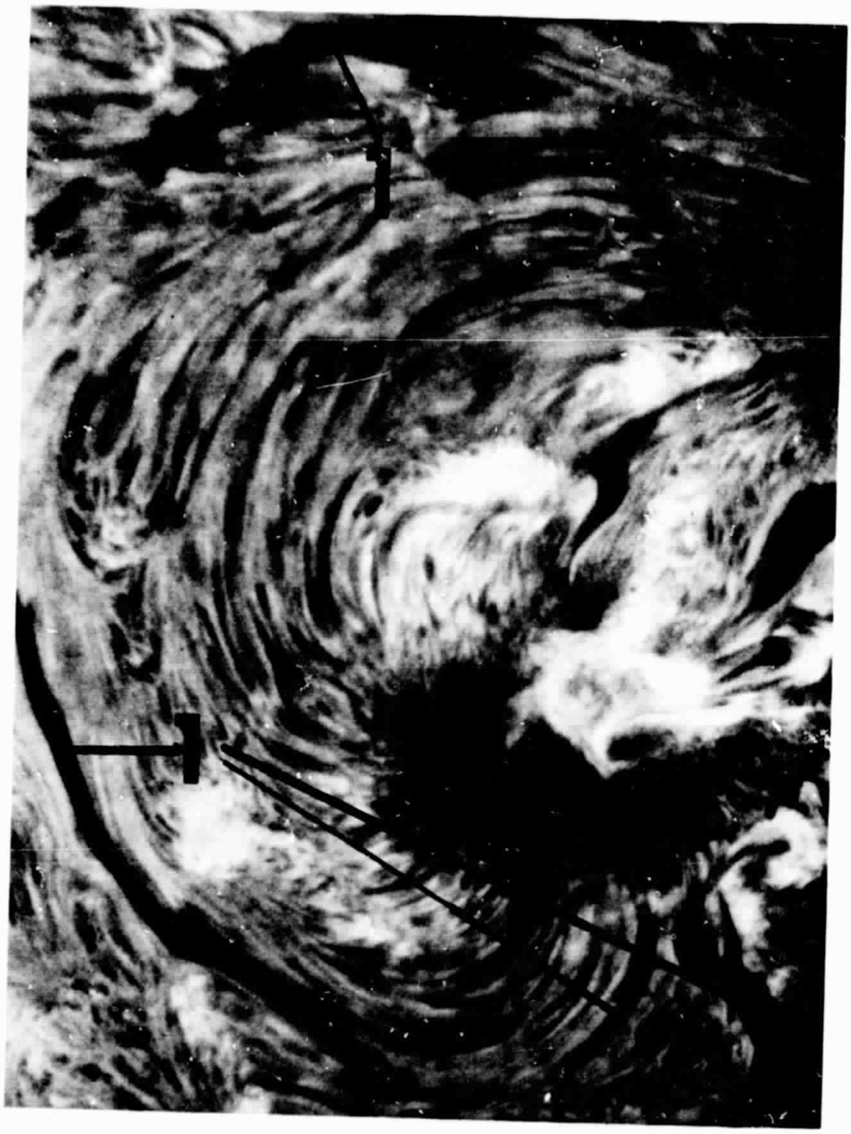

Figure 1

Figure 2

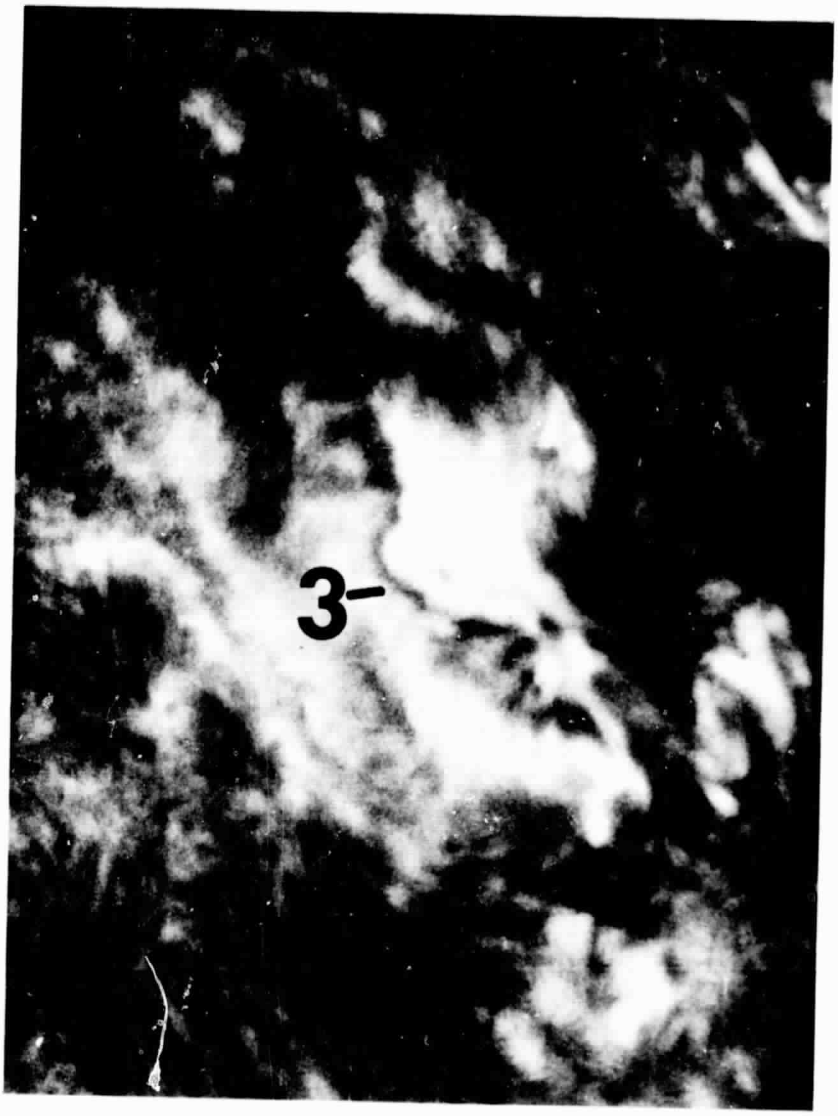

Figure 3

Figure 4