ON THE RELATION BETWEEN FILAMENTS (PROMINENCES) AND Hα LOOPS*

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Abstract. The relation between occurrence of Hα loops and filaments is discussed on the occasion of the observation of a new type of transient loops during a flare associated filament activation. Considering all known types of loop systems crossing neutral lines it is concluded that concurrent existence of stable filaments and Hα loops is incompatible.

1. Introduction

It is concluded from comparisons of magnetograms and Hα filtergrams that Hα filaments are lying between regions of opposite magnetic polarity and thus occupy a ‘neutral line’ or ‘neutral band’ of quasi zero longitudinal magnetic field. That suggests that filaments are approximately perpendicular to magnetic field loops which are supposed to connect the opposite field regions. Kippenhahn and Schlüter (1957) assumed that the dense prominence material is supported against gravity by these magnetic loops in that way that it rests in a dip at the top of the loops. There is, however, no direct observational evidence for the existence of perpendicular loops inside or around quiescent prominences; on the contrary, the majority of Hα fine structures observed around and in filaments (Smith, 1968; Foukal, 1971) as well as the magnetic field measurements in prominences (Ioshpa, 1968; Rust, 1971) are strongly indicative of a main field component along the filament axis.

On the other hand, Hα loops (or arches) crossing the neutral line do occur. The most conspicuous type are the flare loop prominences (LPS) which develop in the post-maximum phase of a large two-strand flare. As a rule, no filament is present on the neutral line in that case; if a filament existed before flare occurrence it was erupted at flare onset. In a few cases only, a faint, thin trace along the neutral line was observed simultaneously with an LPS (an example was presented by Rust, 1971). These traces could have been either a remnant of the erupted filament or the first trace of the reappearing filament but certainly not proper filaments. LPS are generally believed to follow – and therefore to represent – magnetic field loops. The same applies for the Arch Filament Systems (AFS) (Bruzek, 1969; Frazier, 1971) which represent emerging flux loops and are not associated with filaments, either.

These observations show that magnetic loops do exist between regions of opposite polarity but, so far, they were not observed in association with proper filaments or prominences. In the following the first observations (to the author’s knowledge) of strong Hα loops connected with a filament are reported.

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2. Filament Associated Loops

A particular type of Hα loops connected with a filament was observed July 1, 1970 with the Domeless Coudé Refractor at the German Anacapri Observatory. The phenomenon was flare associated and appears to be a hitherto unknown special type of filament activation. A 1B flare occurred on both sides of a small filament (already visible in the morning) and on its prolongation. Reported flare data are: start 1058 UT, maximum 1105 UT, end 1145 UT, position 20N 11W; the situation just before flare onset is shown in Figure 1. The filament was already activated at flare maximum.

![Figure 1](image)

At 1115 UT it was observed to be made up in part of (or to be superposed by) a number of bundles of arches or loops. After 1120 UT another series of dark arches connecting different parts of the flare appeared at the end of the filament close to the sunspots (Figure 2). A comparison of the off-band photographs taken at Hα ±0.5 Å shows that material is descending near either end of the loops and slightly rising in their center (see the composite drawing in Figure 3). All loops run at an angle much smaller than 90 degrees relative to the axis of the filament (presumably the neutral line) the angle being largest in the center of the filament (∼45°) and smallest at its