ON THE LOCATION OF THE FOOT-POINTS OF SUB-ARC-SECOND MAGNETIC STRUCTURES IN THE QUIET SUN PHOTOSPHERE

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OBSERVATIONS: We present the results of our study of a long sequence of high spatial resolution filtergrams obtained with the Universal Birefringent filter (UBF) at the Vacuum Tower Telescope of the National Solar Observatory, Sacramento Peak on July 14, 1987. The UBF has a band pass of 0.25A and was set sequentially in the following wavelengths, and filtergrams were obtained at each of the settings.

5172.698A 5173.098A
5172.898A 5173.498A and 5174.698A (continuum).

The image scale was 10 arc sec mm^{-1} and the region of study was a quiet region on the sun of area 145" x 210" around the centre of the solar disc. Through a beam splitter, light was fed to a Ca+K line filter with a band pass of 0.6A which operated simultaneously with every exposure of the UBF. The seeing was excellent and in most part of the frames the sub-arc second bright points (henceforth denoted as BPs) are seen with good clarity in the Ca^{+} K and Mg b filtergrams, both in the interior of the network as well as at the boundaries. Enough evidence exists (Sivaraman and Livingston 1982) to show that the BPs are cospatial with the sub-arc second magnetic points that represent the thin flux tubes and so we have used the BPs as a proxy for the magnetic points in this study.

ANALYSIS: Our aim is to find out where are the foot-points of these magnetic structures located with reference to the photospheric granulation. We chose the best frames from the sequence and made enlarged transparencies on low contrast films. Using these transparencies, we identified all the BPs in the K filtergrams (which occur both in the interior of the network and on the boundaries) and established these BPs in the Mg b core picture by coaligning the K and Mg b pictures with an accuracy better than 0.5 arc sec. We then coaligned the Mg b core and the continuum pictures via the Mg b wing pictures that served as a reliable intermediate stage to

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confirm the correctness of the identification of the BPs and the network boundaries. Whereas the network boundaries served as a good overall reference, the actual alignment was done using the finer features on the boundaries and the BPs.

RESULTS: We did the visual correlation for nine frames covering a total of 1800 BPs. Of these, 77.8% are located in the dark intergranular lanes of the photospheric granulation and 14.4% are on the very periphery of the bright granules and the rest in the granules themselves.

Mehltretter (1974) and Muller (1983) used a 16A pass band K filter and showed that the network BPs (called facular points by them) occur in the dark intergranular lanes. Such a filter could have shown only the network and the most intense bright points sitting on the network boundaries but not those in the cell interiors. The latter in general are not as bright as the ones in the cell boundaries and so tend to be missed when a large band pass is used for observing them. Title et al (1987) observed an emerging flux region with their tunable filter and found that the sub-arc sec magnetic features seen in the map of Fe I 5250A line correlated with regions of downdrafts. Comparison with the continum pictures confirmed that these coincide with the intergranular lanes.

Our results illustrate the state of affairs in the quiet regions of the sun and the use of the UBF filter enabled us to have a large sample of the BPs both in the cell interior as well as in the cell boundaries.

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