Filament observations at the SSRT

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Two-dimensional solar images, obtained at the Siberian solar radio telescope (SSRT, 5.7 GHz), frequently show low-contrast filament-shape features. Brightness temperature of radio filaments can be both lower (dark filaments) and higher (bright filaments) than that of a quiet Sun. Dark and bright filaments are sometimes observed as a common feature located in the region of strongly structured weak magnetic field. In this case, bright filaments constituting a system of bright fibrilles are arranged along dark filament boundaries. Both the location and size of dark and bright radio filaments (and fibrilles) fit the H-alpha observations well. The length to width ratio of a dark filament varies from a few unities to several tens. In the latter case, the filament can extend from one limb to the other.

For instance, the solar image taken at the SSRT on October 25-28, 1997, distinctly shows a dark filament in the norther hemisphere, which extends from the east to west limb. This dark filament is fringed by bright fibrilles of width 20-40 arcsec. The western end of the dark filament penetrates a small active region (AR). Superposition of radio images and magnetograms reveals that the dark radio filament corresponds to the photospheric inversion line. Bright fibrilles are arranged on both sides of this line. The depression region that separates them varies within 0.5-1.5 arcmin. The brightness temperature of the dark filament in the example under discussion is 8-10 thousand K. The brightness temperature of bright fibrilles, in turn, was 22 thousand K on October 25 and 26. On October 27 and 28, their brightness equalled that of a quiet Sun. Until October 28, the system of fibrilles in the eastern part of the disk showed a substantially different brightness in its different parts. The temperature of the bright features was as high as 52 thousand K while on October 28 the temperature of all features which by then had formed a closed structure 3-4 arcmin in size, was vir- tually the same and reached 30 thousand K.

Structural changes of the radio filament under investigation correlate with those of the corresponding X-ray image. A disconti- nuity appeared in the central part of the filament on October 25, coinciding with the appearance of X-ray loops across the filament. At the same time, the bright fibrilles fringing the central dark filament decreased in brightness. Different parts of the system of bright fibrilles undergo brightness variations from day to day. Note that at the same time the dark filament, located in the southern hemisphere, does not undergo any substantial changes in its structure. An analysis of images obtained at the NRO radio telescope shows that not all depression regions observed at 5.7 GHz frequency are clearly seen at 17 GHz frequency. These include some low-latitude H-alpha filaments. In some instances, 5.7 GHz images show some dis- cernible high-latitude filaments on the limb with the temperature of 7-10 thousand K, associated with H-alpha prominences. At the same time, low-latitude radio filaments on the limb appear as regions with the temperature characteristic for bright radio filaments. Fur- thermore, their height above the limb is small.

All of the above-mentioned observational peculiarities imply the following. The low contrast of some filaments at 17 GHz can be due to the fact that their brightness temperature is somewhat higher (of order 10 thousand K), i.e. it approaches

the brightness tempera- ture of a quiet Sun at 17 GHz frequency. At 5.7 GHz frequency, the brightness frequency of a quiet Sun is 16-17 thousand K; therefore, these filaments are seen with a sufficient contrast.