Observational Characteristics of Flare-productive delta-type sunspots

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The human activity outside the earth atmosphere will become increasingly common in the future as satellites and space stations will come into more widespread practical use. To guarantee human beings to work safely and effectively in the space, the forecast for the occurrence of strong flares which release high-energy particles and strong electromagnetic radiations is indispensable. To forecast the strong flares we need to know the flare enegy build-up and triggering mechanism. For the study of the flare energy build-up process, it is essential to investigate which type of magnetic field configuration in a suspot region produces strong flares, and how it is formed.

It has long been recognized that many strongest flares are produced in delta-type sunspots. Sammis and Zirin (1998) found that 50 of 64 regions for which X1 or larger flares occurred were delta-spot regions. Shi and Wang (1994 Solar Physics 149, 105-118) describes that 96 percent of 149 X-class flares reported from 1988 to 1992 appear in active regions with delta-sunspots. On the other hand, however, Shi and Wang (1994) also found that only 23 percent of 282 delta-sunspots produced X-class flares. It is essential, therefore, to study how the delta- type sunspots form and to examine which type of formation process and which type of additional characteristic ofdelta-sunspots lead to strong flare activity (Kurokawa 1989 Space Science Rev. 51, 49; Kurokawa et al. 2002 Astrophys. J. 572, 598-608).

In this talk we introduce some typical processes of delta-type sunspot formations, the essential characteristics of strong flare-productivity and discuss which additional factor leads to a strong flare occurrence in the delta-sunspot region by reviewing previous observational works.