

M07a **Hemispheric Sign Rule of Helicity and Electric Current Distribution in Solar Active Regions**

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Current helicity in solar active regions (area integral of $J_z B_z$) statistically shows the so-called hemispheric sign rule (HSR); regions in the northern (southern) hemisphere tend to have negative (positive) helicity, respectively. Therefore we can define “normal” and “abnormal” electric currents according to whether they follow (normal) or violate (abnormal) the HSR. To quantify this picture, we introduce the parameter R_{J_z} as the ratio of the “abnormal” current to the total current; $R_{J_z} = 0$ ($R_{J_z} = 1$) means that all the currents in an active region are normal (abnormal), respectively. R_{J_z} can be defined in positive and negative polarities separately, but we found that the values of R_{J_z} in the two polarities tend to behave nearly synchronously, indicating that the electric currents are basically closed within an active region, or the currents basically flow along the field lines.

If we make a butterfly diagram of R_{J_z} , we see that active regions with $R_{J_z} > 0.5$ which violate the HSR tend to appear in activity minima or at the periphery of the butterfly wings.

We then used the R_{J_z} parameter to study the evolution of current systems in the flare-productive active regions NOAA AR 11158 and 11283. Using vector magnetograms obtained with SDO/HMI, we found that the large flares tend to take place in the intervals of gradual increase in R_{J_z} , namely the growth of abnormal currents.