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太陽表面磁極の統計的性質
Statistical properties of magnetic patches on the solar surface

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We investigate statistical properties of magnetic patches on the solar surface, especially velocity and lifetime, by means of auto-tracking algorithm in this study.

The solar surface is covered with the convection and the magnetic field, which are important not only as the energy source of the coronal heating problem but also as the actual example of magneto-convection system on the stellar surface. Despite its importance, the comprehensive description of their properties is difficult because of thier complexity and the frequency of their interactions and high frequency of occurrence.

We investigate statistical properties by using our patch tracking method for two sets of line-of-sight magnetograms in quiet regions, one not of which has higher time resolution of nearly 1 minute and the other has long observational period of nearly 140 hours, and out patch tracking method. Both data sets are obtained by the Solar Optical Telescope (SOT) onboard Hinode satellite. We track ˜3200 and ˜40000 patches as sums of both polarities for each data sets, respectively.

Various relationships are investigated. The distribution of proper velocity of patch structures is investigated. We find that the frequency peak is concentrated around 1.0×10^5 cm s^{-1} and the median value is 8.0×10^4 cm s-1. We also find that the velocity has a slight negative correlation with flux content of patches and the relation is expressed with a power-law form. The power-law index is derived as -0.23. WAddition to the apparent velocity, we investigate the frequency distribution of patch lifetime as well. By comparing the results of the high- cadence data data set and the long-duration one, we find the common steep power-law distribution. The power-law index obtained in our analysis is ˜-2.5. On the other hand, there is a maximum value in the lifetime around 100 minutes, which is substantially enough shorter than the observational duration.

We will discuss the turbulent diffusion coefficient on the solar surface and stability the stability of patch structures on the solar surface from these results in the presentation.

キーワード: 太陽, 光球, 磁場, 磁気対流, 自動判別
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