

Infrequent Occurrence of Significant Linear Polarization in H-alpha Solar Flares

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We performed statistical and event studies of linear polarization in the H-alpha line during solar flares. The statistical study revealed that, among 71 H-alpha flares analyzed, including 64 GOES flares, only one event shows significant linear polarization signals. Such an infrequent occurrence of significant linear polarization in solar flares is consistent with the result by Bianda et al. (2005), who studied 30 flares and found no polarization signals. In the event showing the significant polarization, the maximum degree of linear polarization was $1.16 \pm 0.06\%$, and the average direction of the polarization deviated by -142.5 ± 6.0 degrees from the solar north. The observed polarization degrees and the directions are consistent with the preceding reports. These strong linear polarization signals did not appear at major flare ribbons, nor did they correlate with either hard or soft X-ray emissions temporally or spatially. Instead they appeared at a minor flare kernel, which corresponds to one of the footpoints of a coronal loop. The active region caused coronal dimming after the soft X-ray peak. The observed flare show no direct evidence that the linear polarization is produced by high energy particles, which are often considered to generate the polarization. On the other hand, our study suggests the possibility that coronal mass ejections, which have been often observed in flares showing linear polarization signals, play an important role for exciting linear polarization at H-alpha flare kernels.

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