Nonstationary Poission Distributions of Solar X-ray Flare Waiting Times

Moon, Yong-Jae [1], Choe, Gwangson [2], Yun, Hong Sik [3], and Park, Young-Deuk [1]

[1]Bohyunsan Optical Astronomy Observatory, Korea Astronomy Observatory

[2]Princeton Plasma Physics Laboratory, USA

[3]Astronomy Program, SEES, Seoul National University

With the use of GOES soft X-ray data taken during the last solar maximum period (1989-1991) the observed waiting-time (time interval) distribution of successive flare pairs has been compared with nonstationary (time-dependent) Poission distributions. For this purpose we have introduced fraction of events which is a time segment during which the observed waiting time distribution follows a constant Poission distribution. By taking the fraction of events as a free parameter, its numerical value has been determined by means of Kolmogorov-Smirnov statistical test. To assess presently competing two models for the power law distribution of peak fluxes of soft X-ray flares, "continuous storage and random release model" by Rosner and Vaiana(1978) and "avalanche model" by Lu and Hamilton (1991), we have made a Spearman rank-order correlation analysis between peak fluxes of flares occurred in individual active regions and their waiting times. Some of the important findings emerged from the present study are as follows:
(1) the observed waiting-time distribution is well represented by a nonstationary Poisson probability function with a time varying mean flaring rate. (2) The fraction of events is found to about 3 days (with a significance level of Q=0.999), suggesting that 3 days may be regarded as a time unit for testing a flare prediction method based on Poission statistics. (3) the Spearman rank-order correlation analysis shows that there exists no systematic correlation between peak fluxes of flares and their waiting times, implying that the solar corona is in a self-organized critical state.