A Statistical Study of Solar X-ray Flares

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We have examined statistical characteristics of solar X-ray flares stronger than M1 class occurred during the solar maximum period (1989-1991). Candidates of homologous flares having waiting times (flaring time interval) less than one day have been searched by identifying flaring sites and taking into account the solar rotation effect. Then it is found that the number distribution of homologous flares counted per unit time interval follows an exponential function, which is described by Poisson probability function given by $P(t) = m\exp(-mt)$, supporting Rosner and Viana (1978)' s assumption for flare statistics that flares occur as a Poisson process in time. This fact implies that flares could be recognized as local relaxation events in a cellular automation (e.g., avalanche) subject to random stressing at a constant mean rate. It is also noted that the waiting time distribution of all flares is somewhat different from that expected from Poisson statistics, which might have something to do with either coherent processes in flare occurrence such as sympathetic flares or entirely independent physical origins. By evaluating the autocorrelation function of the observed solar flares together with that generated by randomly distributed hypothetical flares, we have derived an angular correlation function which is found to be well represented by exponential function for angular separations among solar flares on the disk. We will discuss the physical implication of our results from the view point of flaring mechanism.