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Application of genetic algorithm and support vector machine for probing nanoflare parameters

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Abstract

Nanoflares are the small impulsive sudden energy releases, due to the explosion of solar background. Thus, determination of their energies and distributions is important. Recent observations and simulation models have shown that the frequency of their energies follows power-law. According to Parker hypothesis, if these exponents are greater than critical value 2, the contributions of nanoflares to the heating of solar corona is more significan. Here, the extreme ultra-violet (EUV) emission radiances of corona observed by STEREO/EUVI taken on 11 and 12 Jun 2007 are analyzed. To simulate the EUV irradiance, a simple nanoflare model with three key parameters (the flare rate, the flare duration time, and the exponent of the power- law) is applied. Based on genetic algorithm, the lengths of data points are reduced. The resultant light curves are fed to the Support Vector Machine (SVM) classifier. The produced light curves of quiet and active regions of the solar corona are classified and the set of power- law exponent, the flare duration time and the flare rate parameters are obtained. The flare duration time is estimated about 80 minutes. The power-low exponents range about 2.5-2.7.

Keywords: nanoflare, genetic algorithm, support vector machine

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