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MHD Simulation of several Current Sheets Creation for a Set of elementary Flares

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The new approach is developed for simulation of energy accumulation in corona before a set of flares. By numerical solving of the 3D MHD equations system it is shown several current sheets appearance before such set of flares. Each of sheets can produce an elementary flare. Several current sheet creation influence on the general field configuration above the active region can be essential. X-points positions found in the potential magnetic field can strongly differ from positions of created current sheets. For the MHD simulation of flare situation in the corona all conditions are taken from observed magnetic field distributions on the photosphere. SOHO MDI maps are used. For initial conditions setting the method of numerical Laplace equation solving with inclined derivative as the boundary condition is developed. The initial magnetic field above the active region is potential one. It is calculated before new magnetic flux emergence. To stabilize the numerical instabilities a number of numerical methods are developed and programming realized in the PERESVET code. The finite-difference scheme for MHD equations is absolutely implicit, and it is conservative relative to the magnetic flux. Also new method of approximation of MHD equations by finite-difference scheme is developed. According to this approximation behavior of div**B** in the time evolution is described by diffusion equation. Calculations for active regions with different sizes show, that for finding of the real magnetic field in the corona it is necessary to perform simulations in a large region with the size 4×10^{10} cm. MHD simulations show that several current sheets are appeared during the evolution, and their number is changed in time. The current sheets are created as in already existing singular lines of the potential field, as in the singular lines appeared due to emergency

of new magnetic field. The magnetic field near the X-points emerged from-under the photosphere is much larger, then magnetic field near the already existing X-points situated higher. So these CS must produce more powerful flares. The sheets appeared near the emerged X-points are almost vertical ones. So the flares in these sheets can produce CME, because the $\mathbf{j} \times \mathbf{B}$ force, which accelerates plasma in the sheet, is directed away from the Sun. The typical time of magnetic energy accumulation for a flare is several tens hours. During this time the magnetic North and South fluxes through an active region increase in $10^{21} - 10^{22}$ Mx.