

THE MECHANISM OF ENERGY RELEASE AND FIELD-ALIGNED CURRENT GENERATION DURING SUBSTORMS AND SOLAR FLARE

I.M. Podgorny, *A.I. Podgorny

Institute for Astronomy RAN, Moscow, Russia,

*Lebedev Institute of Physics RAN, Moscow, Russia,

The explosive energy release at a current sheet reconstruction is considered as a mechanism of substorms and solar flares production. The model of field-aligned current generation during the energy release is proposed. Field-aligned currents are produced due to the Hall electric field generation. During the substorm the Hall electric field is directed Earthward. This electric field is projected along the magnetic field lines to the ionosphere. Many observational data show that energy storage for a solar flare occurs in the coronal current sheet above an active region. The numerical 3D MHD simulation demonstrates possibility of energy storage in the current sheet in the vicinity of a neutral magnetic line. The current system is responsible for energy transfer to the ionosphere at substorms and in the chromosphere at solar flares. Upward and downward field-aligned currents are closed in ionosphere (chromosphere) by the Pedersen current. West electrojet is the Hall current, which is located between two opposite directed sheets of field-aligned currents. During fast reconnection the upward field-aligned current displacement to the pole takes place. This displacement is responsible for moving an aurora arc to the pole. The similar field aligned current displacement produces moving apart the bright ribbons during a solar flares. During current sheet decay plasma is accelerated earthward and injected in the magnetosphere. Current sheet creation and decay, field-aligned current generation and other phenomena observed at substorms and solar flares are demonstrated. The MHD calculations have been carried out for compressible resistive plasma with PERESVET code.