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A global magnetohydrodynamics coronal model

The sharp rise in the plasma temperature in the solar atmosphere from about 5700 Kelvin at the base of the photosphere to a few million degrees Kelvin in the corona and the origin of the solar wind remain the most long-standing problems in space physics. Magnetohydrodynamics (MHD) waves are widely proposed as a potential mechanism for the observed heating in the two-fluid plasma, which is understood to be caused by convective motion beneath the sun's surface that shakes the magnetic field lines extending outward to the upper solar atmosphere. These waves, along with other processes such as jets, spicules, can transport energy, mass, and momentum across the solar atmosphere by converting kinetic energy to thermal energy via dissipative mechanisms like ion and neutral collisions. The project "A Global MHD Coronal Model" aims to model the upper solar atmosphere layers by using the existing cutting-edge multi-fluid chromospheric models. This project employed the Joint Analytical Numerical Approach (JOANNA) code for the local modeling and COolfluid COroNA UNsTructured (COCONUT) for global modeling of the solar atmosphere. The local aspect of the study entails numerical simulation of two-fluid plasma in the solar chromosphere concerning the dissipation of MHD waves resulting from impulsive perturbation and solar granulation. The model provides insight into wave propagation, their dissipation, and the subsequent roles in plasma heating and accompanying plasma outflows. The global aspect of the model incorporates new energy source and sink terms into the energy equation of the multi-fluid MHD within the framework of the polytropic COCONUT model to understand the dynamics of the solar atmosphere. Finally, the presented models add new perspectives to our knowledge of plasma heating, outflows, and their dynamics in the upper solar atmosphere.

Uprzejmie zapraszam wszystkich pracowników, doktorantów i studentów Instytutu Fizyki.

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