3rd National Congress on Physical Sciences, 29 Sep. – 2 Oct. 2016, Sofia
Section: Theoretical Physics

WKB Approach for the Solar Corona Heating and Launching of Solar Wind by Alfvén Waves – Concept of Self-Induced Opacity

Todor M. Mishonov, **Albert M. Varonov**

Faculty of Physics, St. Kliment Ohridski University of Sofia,
5 J. Bourchier Blvd., 1164 Sofia, Bulgaria

Abstract. Static distributions of temperature and wind velocity at the transition region are calculated within the framework of magnetohydrodynamics (MHD) of completely ionized hydrogen plasma. The numerical solution of the derived equations gives the width of the transition layer between the chromosphere and the corona as a self-induced opacity of high-frequency Alfvén waves (AW). The domain wall is direct consequence of the self-consistent MHD treatment of AW propagation treated in WKB approximation. The low-frequency MHD waves coming from the Sun are strongly reflected by the narrow transition layer, while the high-frequency waves are absorbed – that is why we predict considerable spectral density of the AW in the photosphere. The numerical method allows consideration of incoming AW with arbitrary spectral density. At higher boundary of the corona we apply absorbing boundary condition (ABC). The idea that Alfvén waves might heat the solar corona belongs to Alfvén, we simply solved the corresponding MHD equations; the WKB approach gives for the first time the possibility to obtain hundred times plasma temperature increase. The approach allows to take into account influence of gravitation, bremsstrahlung, and transversal to the magnetic field components of the wave-vector. The comparison of the solution to the experiment is crucial for revealing the heating mechanism of solar corona and launching of solar wind.