Abstract of PhD thesis: Numerical simulations of two-fluid waves in the partially ionized solar atmosphere

The following doctoral thesis is dedicated to numerical simulations of two-fluid waves in the partially ionised solar atmosphere. The problem of the chromosphere and solar corona's heating remains unresolved in heliophysics despite 70 years of research. Another solar physics' problem is understanding of mechanisms responsible for generation and acceleration of the solar wind, which reaches 400 km/s if it comes to the slow wind and 500-800 km/s as for the fast wind.

A numerical code JOANNA has been used to conduct the simulations, which allows for solving two-fluid equations in the solar atmosphere. The two-fluid model implies the plasma's division into two fluids consisting of ions (protons) and electrons along with neutrals (hydrogen atoms). This kind of approximation makes it possible to take into consideration essential mechanisms affecting the chromosphere's temperature, i.e. ion-neutral collisions. Waves caused by diverse factors have been examined in order to precisely analyse heating mechanisms and origination of plasma outflows in the partially ionised atmosphere. Waves deriving from a single pulse, harmonic oscillator and processes related to granulation have been inspected. Its value is crucial as it affects the waves' frequency while the two-fluid model has proved to be the best in the description of short-period waves.

The research has confirmed the key role of the two-fluid effects in the chromosphere by highlighting their value in both heating processes of this layer and plasma outflows' generation.