The solar atmosphere, i.e. the medium above the visible surface, can be classically described as a stack of layers which are magnetically structured and gravitationally stratified and characterize by a number of diverse physical phenomena, making the Sun a highly interesting natural plasma physics laboratory. The lowest solar atmospheric layer is called the photosphere with its temperature of 5600 K, and characteristic granulation pattern. Right above, it is located the chromosphere which is about 1500 km thick. The temperature surprisingly rises in this layer until higher up in the corona it reaches a magnitude of about 1-3 MK. The corona extends to about 2-3 solar radii and it passes smoothly in the solar wind which is the stream of solar particles, reaching the Earth and beyond. Apparently, as a result of their low temperatures the photosphere and chromosphere consist of a number of atoms, while the corona is essentially fully ionized, containing electrically charged particles such as proton and electrons. So, the chromosphere marks the transition between very different neighboring layers.

The treatment of energy flow from deeper and colder solar layers and the heating of the outer and hotter regions is the main problem of solar physics, and it is still in its infancy-understanding. Solar observations reveal that a diversity of waves propagate throughout the solar atmosphere. Most of these waves seem to be generated by solar granulation, and they were recently found to be capable to heat the outer solar atmospheric regions and generate the solar wind; it was showed recently that: (a) energy of these waves is deposited in the form of heat which is sufficient to balance energy and momentum losses and to sustain an essentially stationary solar atmosphere and (b) plasma outflows are efficiently generated by solar granulation. However, the developed models require urgent improvements on more realistic cases with the addition of electrons, ionization and recombination, which are expected to emphasize atmospheric heating and the solar wind generation.

The intellectual merit of the proposed project is its unique capability to solve the important longstanding problem of the heating of the solar atmosphere and the solar wind generation. Our proposed studies will establish the role played by granulation and excited by it different waves in the heating of the solar atmosphere. To achieve this goal, comprehensive studies of the solar granulation-generated waves, their propagation and dissipation in the solar atmosphere and the associated plasma outflows will be performed by using our numerical JOANNA code. The proposed research will be used to explain a wide range of activities occurring in the solar atmosphere, develop a theoretical basis for interpretation of the current and future solar observations, and identify the principal energy sources for heating the chromosphere and corona. Thus, the suggested science is timely, certainly far at the forefront of the current academic research in the field of heliophysics, extremely important, and of the highest scientific level. The contemporarity of the proposal, the novelty of the approach, and the capacity of the group members ensure that the obtained results will be published in the high-quality journals. It is our hope that the *proposed studies will finally unravel the mystery of the heating problem of the solar atmosphere and the solar wind origin!*

The proposed project will have a broad impact since the obtained results will be widely disseminated by various venues, including our project website, journal publications, and special sessions at major conferences. All demonstrations and preprints will be made available at the project website for other interested researchers to download. We shall enhance graduate and undergraduate education by involving PhD, graduate and undergraduate students in this project, and incorporating the research accomplishments of this project into existing graduate and undergraduate courses in astrophysics and solar physics. We shall also produce demonstrations featuring results from the proposed research for our public outreach activities. This will help us to disseminate some of our results to many students and large public groups who attend to our public talks each year.