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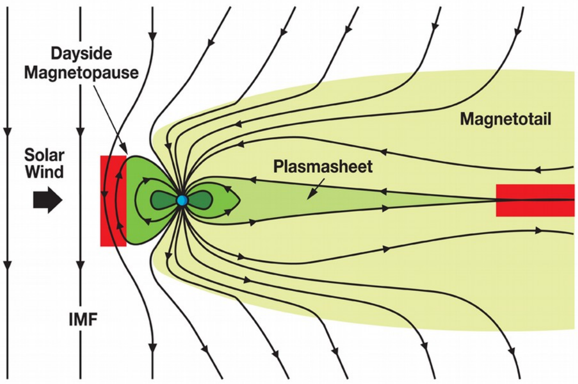
DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

(State the objective of the project, describe the research to be carried out, and present reasons for choosing the research topic - max. 1 page)

Turbulence and Magnetic Reconnection in Earth's Space Environment

Magnetic fields play an important role in the neighborhood of the Earth in space, leading to the reconnection of magnetic field lines, which is responsible for the redistribution of kinetic and magnetic energy in the Universe. Reconnection generated by turbulence is a complex phenomenon that remains a challenge for contemporary science. The solar wind is a stream of charged particles (mainly ions and electrons) flowing from the Sun with the embedded interplanetary magnetic field (IMF); this plasma of solar origin fills-up the Solar System, including the magnetosheath with the magnetopause, plasmasheet, and magnetotail in the terrestrial magnetosphere.



The solar wind can be considered a natural laboratory for investigating this problem. To grasp the mechanisms responsible for this complicated behavior of plasma in the solar wind and the magnetosphere, we need to investigate the experimental data on much smaller scales than those characteristic for the theoretical description of plasma in fluid mechanics. Therefore, the aim of the project is analysis of turbulence and reconnection on kinetic scales based on the measurements acquired from the various space missions. To examine magnetic reconnection on ion and even much smaller electron scales, we will consider the plethora of past and currently operating space missions in the magnetosphere, where typical time scales are shorter than those in the heliosheath, including NASA/ESA missions such as *WIND*, *THEMIS*, *Cluster*, and especially *Magnetospheric Multiscale* (*MMS)*, with the unprecedented millisecond time resolution. This will illustrate that when ions decouple from electrons electron physics should dominate. In addition, we will profit from the experimental data on small scales provided by the *Voyager* deep space spacecraft in the entire heliosphere and beyond the heliopause, the ultimate boundary separating the heliosphere from the very local interstellar plasma. We will use statistical classical analysis and more advanced modern nonlinear methods based on numerical simulations, including multi-fractal modeling that can reveal the mechanisms of reconnection in space plasmas. We expect that the results obtained during the realization of this project will be essential not only for the standard magnetohydrodynamical approach but for a kinetic theory of reconnection and also for the general theory of turbulence.