

# **Hybrid modeling of Alfvénic turbulence and related wave-particle interactions in the solar wind**

Dr. Yana Maneva/NASA Goddard Space Flight Center/Catholic University of America

The multi-species fast solar wind plasma is known to be very tenuous, anisotropic and highly turbulent. The strong deviations from thermo-dynamical equilibrium at a given place in the interplanetary space can be attributed to the present spectra of acoustic and electromagnetic fluctuations, which propagate there. The interaction between the waves and particles and the relation between the wave activities and the plasma heating are regulated via multiple plasma micro-instabilities. In this study we model the preferential heating and acceleration of minor ions in the fast solar wind via parametric instabilities, Landau damping, cyclotron resonance and non-resonant wave-particle interaction in low-beta plasma conditions, typical for the solar wind streams near the Sun. We discuss the results from 1.5D and 2.5D hybrid simulations, where the electrons are considered to be charge and current neutralizing isothermal fluid and the ions are treated fully kinetically within the PIC approach. We track the evolution of initially isotropic ion velocity distribution functions and discuss the appearance of non-thermal effects like generation of ion beams, differential streaming and temperature anisotropies. The results are compared to different solar wind observations and provide relevant predictions for the future Solar Probe Plus and Solar Orbiter missions.