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(M)HD Modelling

30 min. invited talk

MHD Modeling of the Heliosphere

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An adaptive, 3-D, time-dependent model of the plasma flow in the distant solar wind (SW) and in the inner heliosheath will be presented. This model is based on the MHD treatment of plasma flow and either fully kinetic or multi-fluid approach to describe the transport of neutral atoms. The importance of the choice of appropriate boundary conditions in the SW and in the local interstellar medium (LISM) will be discussed in the context of the appropriate validation of numerical results. Numerical simulations will be compared with spacecraft data (ACE, IBEX, Ulysses, and Voyager). It will be demonstrated that the IBEX ribbon location on the sky map strongly depends on the choice of the interstellar magnetic field (ISMF) direction. In particular, the unperturbed ISMF vector should belong to the hydrogen deflection plane (HDP) for the calculated ribbon to be consistent with the IBEX observations. We will analyze the development of corotating interaction regions and their propagation into the inner heliosheath. A new, based on Ulysses measurements, solar cycle model will be presented. The issues will be discussed related to the interpretation of spacecraft measurements that are intrinsically transient by their nature. In particular, the asymmetries in the SW-LISM interaction, a peculiar behavior of the SW velocity in the inner heliosheath derived from the Voyager 1 measurements, and global time-dependent processes occurring in the outer heliosheath will be considered.