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On the role of plasma jets with anomalous dynamic pressure in the flow balance and transport

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’Plasma jets’ are regularly detected in the magnetosheath (MSH) with preference of occurrence behind the bow shock (BS). The typical duration of the jets is up to several tens of seconds. They appear intermittently, exhibiting as their main feature an increase in the dynamic pressure of 2-3 times above solar wind (SW) pressure. Jets are seen also in the boundary layers and even outside the BS. Some of the jets carry the momentum excess during MSH transition towards a state of smaller dynamic pressure, or they appear as the result of transient MSH reactions on SW disturbances, e.g. like a discontinuity. Transient jets are followed by decelerated flows having speeds near or below the Alfvén velocity. The typical jets velocity approaches the sound velocity in the MSH. Supersonic jets are found in the mantle. Presumably they are caused by the Laval-nozzle effect. Such intermittent/ transient flow concentrations are opposite to the predictions of gasdynamics and MHD for the transformation of SW kinetic energy into thermal energy at the BS since in the jets the dynamic pressure is rising instead of falling. In the presence of postshock jets the flux in the middle of MSH tends towards the SW one, which is in contrast to the predictions. Averaging of the flux along spacecraft orbits in time gives a flow deficit of 20-40% with respect to the gasdynamic model. But averaging in space, taking into account the jet motion across the spacecraft at average MSH speed, lets the data and models converge. Being statistically confirmed, it suggests that the jets must be considered in the flow balance of the MSH. It is proposed that the magnetic stress balance is satisfied in the sub-Alfvénic/Alfvénic flows behind the jets, unlike the super-Alfvénic flows in front. Thus the interacting flow-obstacle system should have lower potential energy after the jets have been emitted (this reminds one to a peculiar maser-like transition from the

meta-stable to a stable state). The high-dynamic pressure jets seem to skew the magnetopause, being able to cut off a piece of the magnetopause boundary layer or drive secondary reconnection at the deformed magnetopause.We proceed in the case and statistical study of the jets taking advantage of Polar, Geotail, Interball-1 and Cluster data and their comparison with the gasdynamic, MHD and kinetic predictions. E.g. filamentation of nonlinear Alfven waves and Alfvenic collapse are promissing mechanisms for the jet generation. The jets occur to be nonlinear structures detected for decades. But understanding of their properties and origin could essentially modify the approach to the SW- magnetosphere interaction and should also shed light on heliospheric and astrophysical plasma streamlinings. This work was supported by INTAS grant 03-50-4872 and ISSI.