Deflection of the neutral H population from Baranov Wall based on Ulysses H^+ PUI observastions

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We present compelling evidence that the upwind direction of the secondary population of neutral interstellar hydrogen, coming up from charge exchange within the so-called Baranov Wall between the bow shock and heliopause, is deflected with respect to the canonical upwind direction inferred from interstellar helium by $\sim -20^\circ$ in ecliptic longitude and $\sim +10^\circ$ in ecliptic latitude. This conclusion is based on time-dependent 3D simulations of the distribution of neutral interstellar hydrogen in the inner heliosphere aimed at reproducing a neutral H gradient inferred from observations of H^+ pickup ions. The measurements were performed by SWICS during a ~ 1 year interval in 1997 and 1998, when Ulysses was cruising in equatorial latitudes at ~ 5 AU from the Sun. The distribution function of pickup ions was averaged over the observations interval and, based on the canonical theory of PUI transport in the supersonic solar wind, the density gradient of the seed interstellar H density was inferred. The simulations were performed using the Warsaw 3D, time- dependent model of interstellar hydrogen distribution in the inner heliosphere. The ionization rates (charge exchange, EUV and electron impact) and the radiation pressure were all derived from available observations. The net H density was calculated as a sum of two populations predicted by the Moscow kinetic-continuum model of the heliosphere, with the interstellar boundary conditions adopted after Izmodenov et al. (Ap.J. Lett. 594, L59, 2003). In our calculations we assumed that the upwind direction of the primary H population was that of helium, and varied that of the secondary population on a mesh of longitudes and latitudes. We discovered that the best agreement of the simulations with the data is obtained for the upwind direction of the secondary population $\sim 234^\circ$ longitude and $\sim 14^\circ$ latitude. Further improvement is obtained when the Doppler effect from the solar Lyman-alpha line profile on the gas distribution is included in the simulations. The most probable physical reason of the deflection of the secondary population of H atoms is the distortion of the global heliosphere by interstellar magnetic field (ISMF). Possible implications of our results on the magnitude and direction of ISMF will be discussed.