

## Ulysses Near-Ecliptic Observations of Differential Flow Between Protons and Alphas in the Solar Wind

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"The evolution of differential streaming between protons and alpha particles in the solar wind was observed with the solar wind plasma experiment on the Ulysses spacecraft over the solar range of 1.15 to 5.40 AU between Nov. 18, 1990 and May 5, 1992. The correlation of the difference in ion speeds,  $\Delta V = |V_\alpha| - |V_p|$ , with the proton speed  $V_p$ , observed by other spacecraft at solar distances  $\leq 1$  AU disappeared at  $\sim 2$  AU. At solar distances  $\geq 2.85$  AU, the largest values of both  $V_{\alpha p} = |V_{\alpha p}| = |V_\alpha - V_p|$  and  $|\Delta V|$  were found in the interaction regions on the leading edges of high-speed streams. The differential streaming was typically enhanced just downstream of strong forward and reverse shocks and large negative values of  $\Delta V$  were frequently encountered in the interaction regions. A correlation between  $V_{\alpha p}$  and the ratio  $\tau_c/\tau_c$  of expansion time to Coulomb collision time was observed at all distances, but it is suggested that at the larger values of  $\tau_c/\tau_c$  the observed correlation may arise from enhanced production of differential streaming by processes that also increase the entropy of the solar wind protons.

1. 1993 Spring Meeting
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