



Solar Wind Properties During the Current Solar Minimum: Ulysses Observations

Rudolf von Steiger (1) and Thomas H. Zurbuchen (2,1)

(1) International Space Science Institute, Bern, Switzerland (vsteiger@issibern.ch, +41 (0)31 631 4897), (2) Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, 2455 Hayward St, Ann Arbor MI 40109-2143, USA

During its nearly 19 year mission, Ulysses pioneered novel measurements of the three-dimensional heliosphere and particularly first in situ observations of solar wind from polar coronal holes (PCHs). It is thus possible to compare observations in the current, peculiar solar minimum with those obtained in 1994-95. It has been reported earlier that, during the current minimum, there is a $\sim 15\%$ reduction of the heliospheric magnetic field (Smith and Balogh, 2008), and $\sim 17\%$ and $\sim 14\%$ reduction in density and temperature, respectively (McComas et al., 2008), as compared to the previous minimum. But the PCH-associated solar wind streams show long-term variability not only in dynamic, but also in compositional signatures. From 1995 to 2008, the C and O freeze-in temperatures measured in high-latitude solar wind have decreased by $\sim 15\%$ and are now around 0.86 MK and 1.0 MK, respectively. Si and Fe ionization states also exhibit a substantial cooling with a reduction of 0.2 and 0.3 charge states, respectively. Thus it appears that the PCH of cycle 23 are cooler overall than those of cycle 22. It is more difficult to assess whether there are significant changes of the elemental composition of the solar wind, as exhibited through the First Ionization Potential fractionation effect, which seems to have remained at $f = 1.8 \pm 0.3$ during both sets of polar passages, i.e., enhanced to the photospheric composition ($f = 1$). If this can be confirmed the streams from PCH would truly be the “ground state” of the solar wind. These observations provide a unique test for theories of the solar wind and its composition. We will present results from this data analysis and also provide a discussion of their scientific implications.