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The magnetic fine structure of coronal holes

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Coronal holes are regions with a significantly reduced emissivity in lines corresponding to coronal temperatures. An intriguing observation is that the emission from chromospheric and transition region lines formed at temperatures below $6\ 10^5 K$ is not significantly reduced in coronal holes. A key quantity for the understanding of this phenomenon is the magnetic field. We use data from SOHO/MDI to reconstruct the magnetic field in coronal holes and the nearby quiet Sun. We distinguish between open and closed field lines, with the closed field lines being assumed to represent magnetic loops. High and long closed loops are extremely rare, whereas short and low-lying loops are almost as abundant in coronal holes as in the quiet Sun. As a consequence the emissivity in hot coronal lines is strongly reduced in coronal holes because the hot plasma is assumed to be stored in long coronal loops.

We investigate the small scale plasma flow with the help of Doppler-shift maps as observed by SUMER with the small-scale structures of the 3D magnetic field. The combined data set is analysed with respect to the small-scale flows of coronal matter, which means that the Ne VIII Doppler-shift used as tracer of the plasma flow is investigated in close connection with the ambient magnetic field. The Doppler-shift patterns are found to be clearly linked with the field topology. We find that the plasma is almost at rest in the small closed field regions but depicts a significant blueshift (outflow) in open field regions. The results of this phenomenological correlative study are discussed with the intention to understand how the magnetic field determines mass supply to the extended CH, and with respect to the role played by the field in guiding plasma flows at all scales resolved.