Observational constraints on ion acceleration by waves in coronal holes

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Abstract

The relationships between the deduced parameters of the coronal emission line of Mg X at 625 Å (with a formation temperature of about 1 MK) as observed by SUMER and the underlying magnetic field as measured by NSO/Kitt Peak have been investigated. It has been found that the line widths deduced from the Mg X line in different equatorial coronal holes show a clear trend to increase with the increasing underlying magnetic field strength (signed). Evidence for preferential heating and acceleration of heavy ions very near the Sun had previously been found in observations with UVCS and SUMER aboard SOHO. This suggests that dissipation of high-frequency Alfvén waves in coronal funnels may be a prime candidate for the heating of the magnetically open corona. Following this reasoning, our result seem to indicate that the wave-mechanical energy flux correlates with the strength of the magnetic field in coronal holes. Moreover, the spectroscopically obtainable quantity $v\sqrt{I}$ (with the intensity scaling like $I \sim n_e^2$), which is used here as a proxy for the coronal mass flux of the nascent fast solar wind, also reveals a clear positive correlation with the magnetic field strength. If this estimation of the mass flux (and its ratio between different holes) can be trusted, we could interpret our results as evidence that the mass flux is directly associated with the net magnetic flux density in a coronal hole.