Examination of the EUV Intensity in the Open Magnetic Field Regions Associated with Coronal Holes

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Coronal holes can be identified as the regions with magnetic field lines extending far away from the Sun, or the darkest regions in EUV/X-ray images with predominantly unipolar magnetic fields. A comparison between the locations of our determined regions with open magnetic field lines (OMF) and regions with low EUV intensity (LIR) reveals that only 12% of the OMF regions coincide with the LIRs. The aim of this study is to investigate the conditions leading to the different brightnesses of OMF regions, and to provide a means to predict whether an OMF region would be bright or dark. Examining the statistical distribution profiles of the magnetic field expansion factor ($f_s$) and Atmospheric Imaging Assembly 193 Å intensity ($I_{193}$) reveals that both profiles are approximately log-normal. The analysis of the spatial and temporal distributions of $f_s$ and $I_{193}$ indicates that the bright OMF regions often are inside or next to regions with closed field lines, including quiet-Sun regions and regions with strong magnetic fields. Examining the relationship between $I_{193}$ and $f_s$ reveals a weak positive correlation between log $I_{193}$ and log $f_s$, with a correlation coefficient $= 0.39$. As a first-order approximation, the positive relationship is determined to be log $I_{193} = 0.62 \log f_s + 1.51$ based on the principle of the whitening/dewhitenning transformation. This linear relationship is demonstrated to increase the consistency between the OMF regions and LIRs from 12% to 23%.